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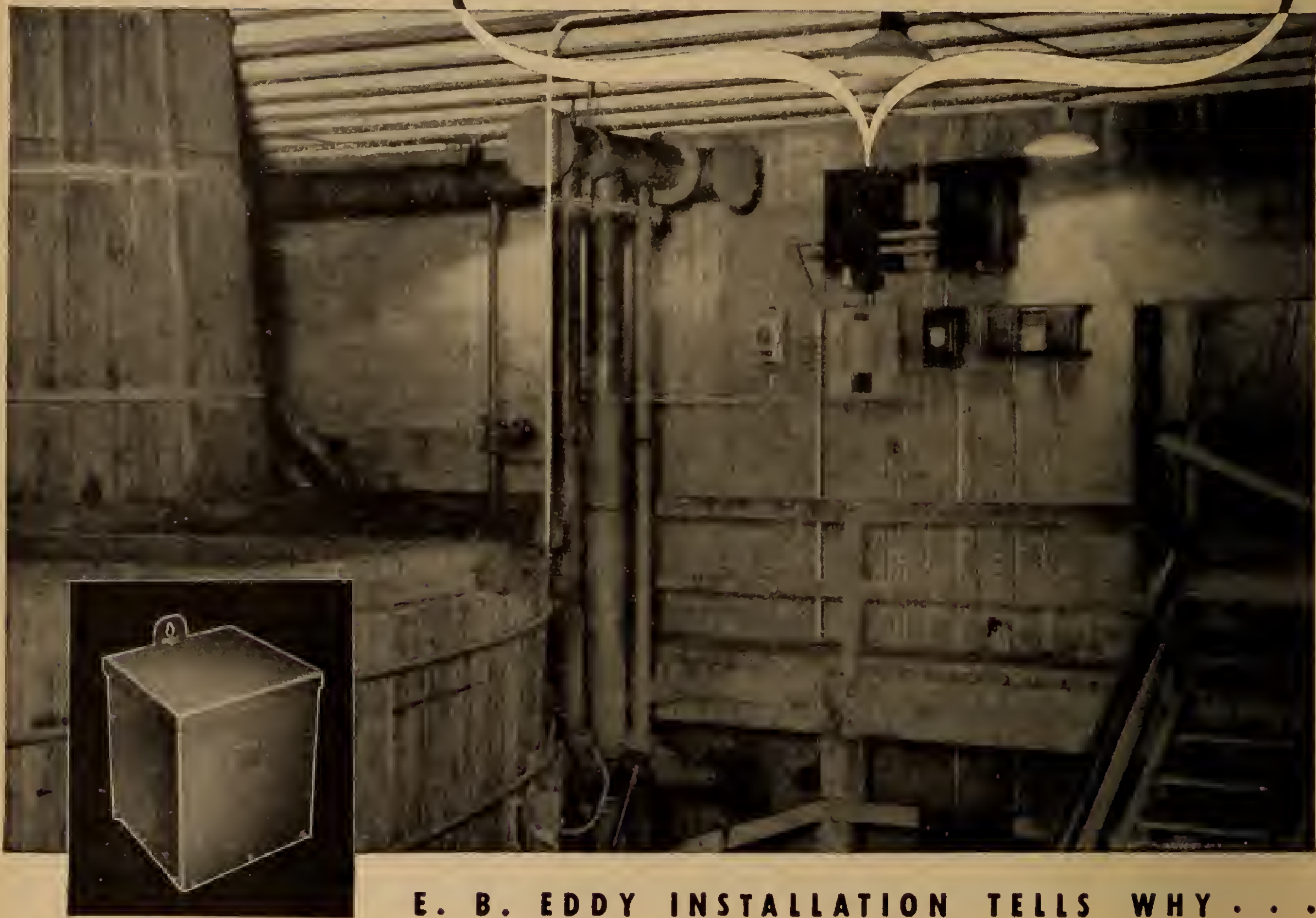
# WHY Westinghouse DRY TYPE "E" DISTRIBUTION TRANSFORMERS



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# THE STABILIZATION

# OF

# SUSPENSION BRIDGES

*by*

F. P. Shearwood, Hon.M.E.I.C.

*Montreal*

The following discussion is an effort to visualize the action of suspension bridges and their unique behaviour as compared with all other types of bridges, when subjected to wind force. To modify these differences a change in the stiffening system is here proposed. Mr. Shearwood, for many years chief engineer of the Dominion Bridge Co. Ltd., Montreal, describes one method for attaining this end.

Few other types of bridge construction have called forth so much admiration for their beauty and graceful lines as have suspension bridges. These have an ancient history and are the only known type of bridge which can, economically and even successfully, be utilized for exceptionally long spans. But, as at present designed, they are often too limber and have a tendency to oscillate under even moderate winds. For these reasons they have been used only sparingly when in competition with other types of bridge construction.

With the constantly increasing demand for unobstructed highways involving spans of great length, the suspension type of bridge offers the only apparent solution. It is also probable that this type of bridge would be more used for spans of medium length, and even for railways, if the objectionable features of excessive deflection and undulation could be appreciably reduced.

It is with these ideas in mind that a modification in the stiffening construction is here suggested and presented for discussion and criticism. The suggested modification is to substitute diagonals for the vertical hangers and stiffening truss of the conventional type (Fig. 1); these, with the cable and stiff bottom chord would constitute a complete truss (Fig. 2), adequate to resist longitudinal forces from wind and to distribute partial loading. An article published in the *Engineering News Record* of October 24, 1941, by the staff of Modjeski and Masters, discussed the use of such diagonal hangers and the testing of a small model which showed remarkable advantages in the dampening of vibrations.

Most of the reported failures and troubles with suspension bridges have been due to wind blowing diagonally on the bridge, and to the fact that the resulting disturbing and disastrous movements were vertical oscillations and vibrations. Vertical live loads on these bridges, even on those with shallow stiffening trusses, have not been reported as producing dangerous or disturbing movements. These facts indicate that it is a longitudinal force that has caused the trouble.

Published reports on the extensive tests and investigations made in connection with the Tacoma bridge failure, indicate that these were largely conducted with a view to determining the resultant forces of the wind and their effect on a suspension bridge of the conventional design; i.e., on one with suspended stiffening trusses or plate girders. The effect of deflections of the cables on the bridge as a whole has been given scant attention, whereas it should be realized that every movement of the cables from their normal curvature causes a vertical deflection in the floor of the bridge and is probably the main cause of the oscillation.

All the external forces (wind and vertical loading) are duplicated for most bridges, not only for those of the suspension type, yet these other types have exhibited no similar undesirable tendencies. A comparison of the conventional suspension bridge design with that of the ordinary truss bridge should, therefore, indicate in what way they differ, and whether such differences are likely to account for the undesirable behaviour of the suspension bridge.

The outstanding difference between the suspension and other types of bridges lies in the provision for supporting and resisting external forces. In the suspension type it lies in the funicular lay of the cable, while in other types it lies in the elastic resistance of the structure.

The curve of the cable is acutely susceptible to variations of loading and, therefore, trusses are hung to the cables through which the moving loads are distributed over distances varying with the stiffness of these trusses. The trusses are also susceptible to variation in cable curvature, especially when it is deformed by other than vertical forces, e.g., by longitudinal forces or other movements.

Longitudinal force is chiefly derived from the longitudinal component of a diagonal wind force. This force acting on the suspended structure will swing it about the cables but if it is longitudinally connected to the cables, it will pull the cables towards one end, thereby sagging this end and straightening the other which in turn lowers and raises the suspended structure.

The resulting deflection of the trusses is an easy reversed curve between their extreme ends and, therefore, the elastic resistance to this bending of the trusses is small. The vertical loads on the trusses being equal, a seesaw action is liable to occur, and this may be aggravated by synchronizing with the gusts of wind.

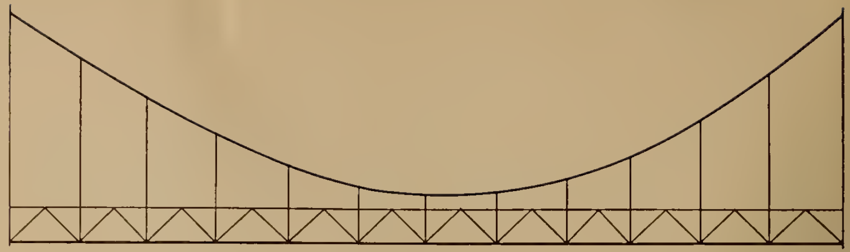


Fig. 1.

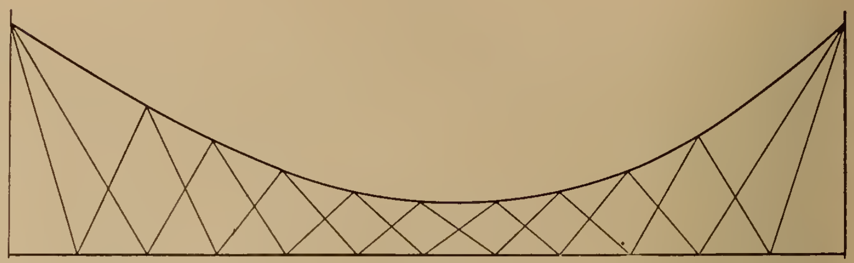


Fig. 2.

Since it is primarily the wind force acting against the members in the plane of the floor which causes the initial movement in a suspension bridge, it is probable that it is this movement, aided by the spring-like action of the cables, which starts undulations in the cables and produces the see-saw action of the whole structure that may lead to disturbing and sometimes disastrous results.

During strong gales, the wind, blowing in gusts, frequently varies slightly in both horizontal and vertical directions. This influence will often exert an uplifting pressure on the floor at one end of a bridge. In a suspension bridge this upward pressure will relieve the pull of the hangers on the cable there and allow the cable at that end to straighten out. The stiffening truss is then ineffective, since it cannot be the means of preventing deflection of the cable while at the same time causing this deflection.

This straightening of the cable at one end must be compensated for by increased sag at the other end, and also by a longitudinal movement of the whole structure. All of these complex adjustments tend to induce mixed disturbing oscillations of the bridge floor.

Modern suspension bridges have generally been designed with their stiffening trusses attached to the cables directly by means of vertical hangers. Some of the earlier ones, such as the Brooklyn Bridge, were also provided with diagonal ties, extending from the tower tops to adjacent floor panel points. These diagonals do brace the floor and prevent it from swinging longitudinally on the cables, but the distri-

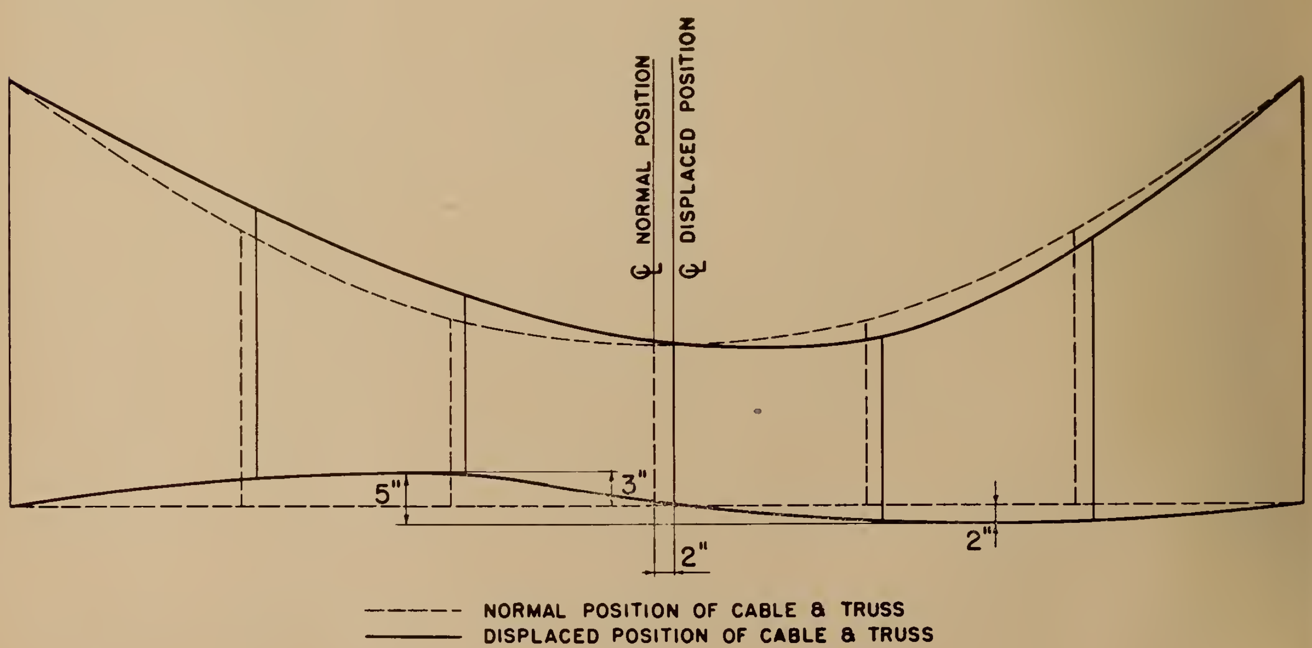



Fig. 3.

bution of stress between the diagonals and vertical hangers is very indeterminate and hence any analysis is unsatisfactory.

In some suspension bridges which showed a tendency to oscillate, ties have been installed, leading from the cables at some distance from the towers to the ends of the stiffening trusses or girders. These ties restrain the cables from straightening out their normal sags at the one end, but are ineffective in preventing the simultaneous increase of sag at the other end. They will reduce the general deflections of the cables and so help to dampen the oscillations of the bridge. In order to be effective, these ties must be fairly tight, and consequently they affect the distribution of loading and the stresses in the already indeterminate stiffening trusses.

In most suspension bridges the suspended weight is braced longitudinally only by means of some auxiliary connection to the cables at the centre of the span. Any induced resistance to longitudinally applied forces will then cause longitudinal movement of the span which, in turn, straightens out the cables on the windward end and sags them on the leeward end. This action deflects the truss into an S-shape, similar to that reported in the case of the Tacoma bridge failure (see Fig. 3). Wind, acting on a plate girder from any direction, except when blowing at right angles, will slide along the smooth surface of the web plate to meet the obstruction of the numerous stiffeners and so build up a severe longitudinal force, which normally must be resisted by the cables.

Longitudinal forces applied to the suspended structure must be resisted at their reaction points, i.e., at the tower tops. In a design which provides only the cables at the tower tops, the inclination of the cables at each tower must vary enough to give the required longitudinal reaction. This variation alters the symmetrical sag of the cables and therefore deflects the trusses and the floor of the suspended structure.

All of these movements and strains indicate that longitudinal forces and their consequent effect on the curvature of the cables, are potentially capable of producing the undulations in the floor which have caused troubles and disasters in suspension bridges. It is, therefore, reduction in the wind force, or increase in the resistance to its effect, that is desired.

Reduction in resistance to wind force has been extensively investigated and means for accomplishing it have been suggested. These will only reduce the deflections, but will not alter their character.

The increase in resistance to the distortion of the cable's curvature, which will alter the character of the movements, can be accomplished by changing the vertical hangers to diagonals, so as to form a complete truss system. This will carry most of the imposed force to its reaction points by direct stress, instead of by cross bending in subsidiary members combined with funicular cable distortion, as is achieved by the suspension truss system.

An example to show or verify the cause of undulations in a suspension bridge is experience with a comparatively short span (600 ft.), unloaded back stays, fairly high ratio of dead to live loads and stiffening girders well over conventional depth (6 ft.). This span developed vertical undulations amounting to over eleven inches in strong winds (probably 50 mph.) when blowing diagonally, and no noticeable vertical vibrations when blowing normally to the bridge. There were no complaints about vibrations when carrying heavy truck loads.

No other type of bridge of about that span would oscillate as this did and, therefore, one suspects the reason for the difference to be the unstable path from the applied load at the deck to its reaction points at the tower tops. This path is by the cable, the curved loaded panel points of which are held indirectly in only one direction by the suspended trusses, which themselves are hung to the member they should stiffen.

While the diagonal system will resist the longitudinal forces more efficiently, it must also distribute uneven and concentrated loadings without producing excessive local deflections in the floor.

The arrangement of the web members of the proposed system will be of the Warren truss type, as shown in Fig. 2. This is the type suggested for replacing the conventional stiffening truss design, shown in Fig. 1. For uniform loading the stresses in all the diagonals of Fig. 2 are tension, and nearly equal in each member of a pair meeting at a common panel point, but a concentrated load will tend to produce a reversal in all those diagonals located between the load and either pier, which are inclined from bottom to top away from the pier.

Owing to the lengths of many of the diagonal hangers and also for the sake of economy, as well as for simplicity of detail design, it is almost imperative to make the diagonals of strands, ropes or rods, i.e., purely tension members. If all the members in the proposed system could resist the stresses developed under all conditions of loading, it would form a more rigid structure than a suspended truss system, because of its greater average depth.

Assuming that the lower chord has no bending value, the diagonal system will function as a complete truss for all positions of the moving load, until the live load compression stress in some diagonal exceeds the dead load tension stress in it. The excess stress will then distort the curve of the cable and deflect the floor of the bridge until the components of the cable meeting at that point, balance the extra stress.

Considering the small amount of extra live load required to reverse the dead load stress in the diagonals, a very slight increase in the section of the lower chord would give it enough bending value to transfer the excess live load to the adjacent panel points and so prevent any excessive local deflection of the floor.

If the slight curvature in the cables between panel points be initially neglected, the stresses for a diagonally braced span, as shown in Fig. 2, can be closely calculated for uniform loading, because the reactions at the towers are determinate in amount and very nearly so in direction.

Moving loads will cause deflections of the cable at each panel point and so alter the component from the cable to be taken by the diagonals. Any increase from this cause is considered to be comparatively small and safe to neglect, especially as it tends to decrease the possibility of reversing the dead load tension in the diagonals.

The exact elastic stresses in all the members of such a system are indeterminate, but the maximum stress in any member when subjected to the most severe loading can be readily approximated. Therefore, if all reasonable assumptions of loading are considered, the safety of the bridge and its component parts will be assured.

The maximum stress in the cables occurs when the total design load is being carried; therefore, this maximum stress in the cables will not be exceeded if the cables are

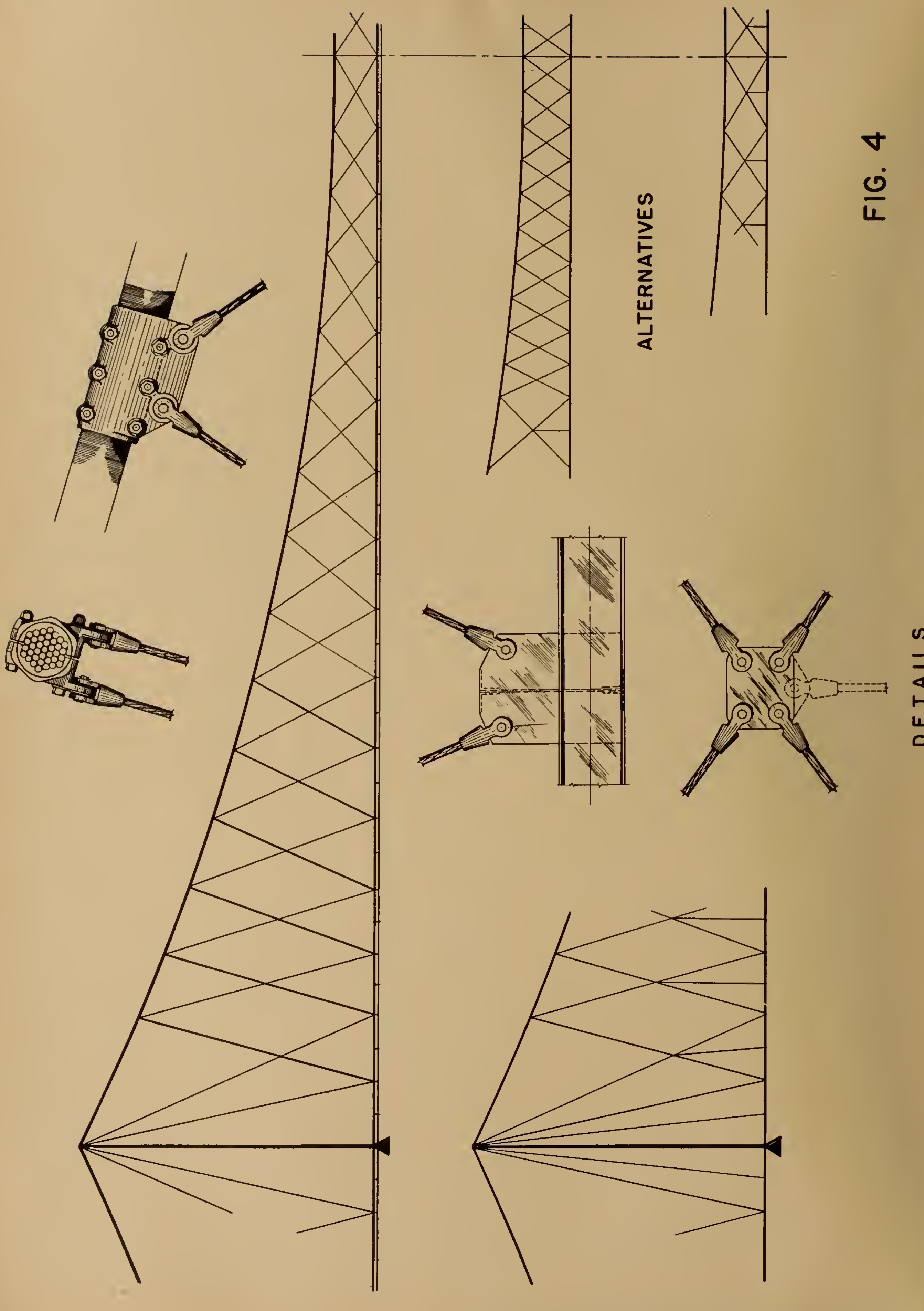



FIG. 4

incorporated into a truss system for the distribution of partial loadings.

The direct stress in the lower chord will be the sum of the components from each pair of diagonals. Since the inclinations of each pair are nearly equal, the result will be small for uniform loading; for moving loads these components will be influenced by the varying amount of continuity of stress in the cables at the towers.

The design of the lower chords will also be made to provide resistance to cross bending from intermediate panel loads and from the distribution of possible excess live loading; further, it will provide for the direct stress when it is acting as the chord of the lateral bracing system.

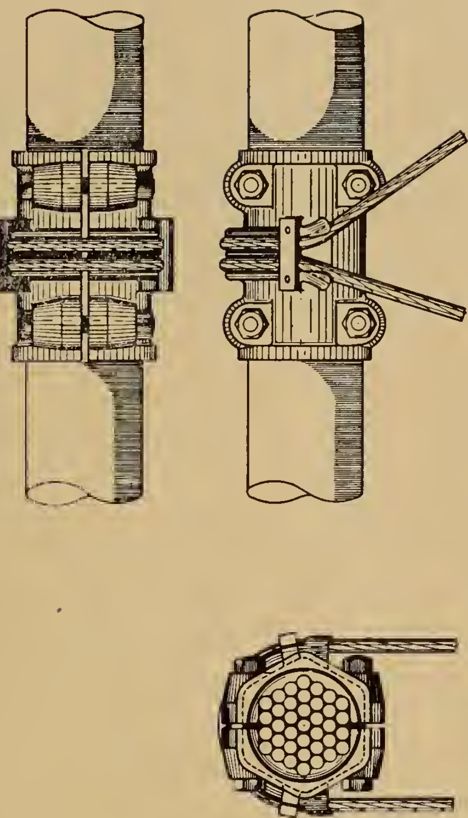
The maximum stress in any diagonal inclined from bottom to top towards its nearest pier cannot exceed that due to the maximum panel load, because of the lack of compressive value in the other diagonal meeting at that point, while the stress in the other diagonals, for non-uniform loading, must be less than that due to a full panel load.

Some of the advantages to be gained by using the proposed stiffening system, as compared with that in Fig. 1 are:

1. Longitudinal movement of the deck is prevented by complete trussing between the deck and the cables.
2. Complete trussing between the cable and the bottom chord greatly reduces local distortion of the cable from its normal curvature, resulting in reduced vertical deflections of the floor.
3. It provides the maximum possible depth of stiffening system and utilizes the great strength of the cable as a part of the system.
4. A more direct and stiffer path for distributing the shears to the cable and towers is provided.
5. The saving in the dead weight of the suspended truss is considerable.
6. It results in a slight reduction in the maximum cable stress.
7. It offers less exposure to the wind, due to the absence, or reduction in size, of conventional stiffening trusses.
8. It is in itself a basically complete truss and does not require additional members to stiffen it.

Some of the disadvantages are:

1. The greater variations of stress in the hangers.



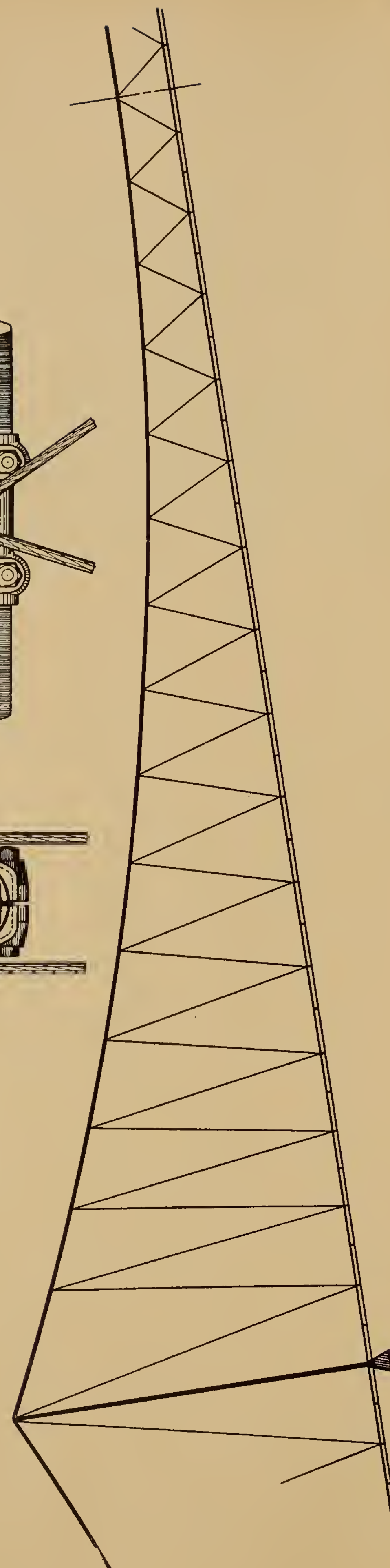


Fig. 5.

2. The greater shear between the cable bands and the cable, requiring higher adhesion of the bands to the cable.

To sum up:

1. It is the longitudinal component of the wind force that causes undesirable movements in existing suspension bridges.
2. The component force swings the suspended structure and so deforms the curvature of the cable, thereby causing undulations in the floor, and a torsional movement in it if the cable deformations become out of step with each other.
3. These movements can be reduced by providing more co-operative action among all the main members of the structure and by more definite bracing of the panel points of the cables, as provided by the diagonal system of hangers, which gives a complete trussing system between the final reaction points.
4. The type of deflection experienced in suspension bridges does not occur in other types. It is, therefore, probable that this is due to their different means of resistance, i.e., to funicular change and elastic deflections.
5. If most of the resistance to deflections from moving loads (wind and live loads) could be changed from distortion of the cable curve to an elastic deflection of a truss, the undulations and vibrating motions could be eliminated, or at least reduced.
6. The proposed diagonal system of hangers will function elastically as a complete truss for the greater part of the moving and wind loads. The excess from extreme conditions of loading will seldom occur and will generally be very small. If or when they do occur, only the excess must be counteracted by the funicular resistance of the cable, and only this excess will cause a corresponding local deflection in the floor, similar to that in the conventional type of bridge.
7. The great supporting power of the catenary cable curve and the stiffening qualities of a truss are efficiently utilized in the proposed diagonal system.

Figs. 4 and 5 are simply sketches indicating the application of this suggested trussing to an 1,100 ft. bridge, similar in dimension to the Island of Orleans bridge near Quebec. Only a few typical details are shown.

This paper was suggested by the study and observation of small four-foot models of suspension bridges with both vertical and diagonal systems of hangers. The models were made of string, cord and light chains, and they served to demonstrate visually many of the causes of oscillation, as well as to suggest the possible means of preventing it. The models also provided a visual demonstration of the distribution of stress, suggesting the idea of prestressing some of the diagonals to avoid reversal.

The suggested change in the stiffening system is discussed here in mere outline. There are many topics relating to the subject which have not been touched upon, e.g., the complicated problem of the amount of continuity at the tower tops for various conditions of loading. There are many others which will reveal themselves, but it is trusted that sufficient reasons have been here presented to show that the basic principle of the diagonal system of hangers is not only possible, but probably far more economical and stable than the system of vertical hangers.

In the preparation of the arguments set forth here, a great measure of assistance has been extended to the writer by the designing department of the Dominion Bridge Company, Ltd., Montreal. Grateful thanks are due for such aid, especially that accorded by the Chief Engineer of the Company, Mr. D. B. Armstrong, and also to Dr. Ammann and Dr. P. L. Pratley, M.E.I.C., for their most useful comments on a preliminary draft of this paper. √

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# Industrial Electric Motors Re-rated

The Canadian Electrical Manufacturers' Association Motor and Generator Section recently announced new standards for re-rating industrial type electric motors. This is considered to be revolutionary since most industrial induction motors on the Canadian market today have been built according to basic frame size-horsepower relationships established almost 25 years ago. Because of the long service life of electric motors it has been difficult to take advantage of the technological advances made during this time.

The new standard covers the re-rating of squirrel cage, polyphase, 60-cycle, 2, 4, 6 and 8 pole induction motors in designs A and B, and rated 1 to 30 horsepower open type and 1 to 25 horsepower totally enclosed.

Basically the new design will allow more horsepower for each frame size. For example, in the old standard a motor with frame size 254 delivered 5 horsepower at 1,800 r.p.m. In the new setup the same frame size, designated 254U, will deliver 7½ horsepower at 1,800 r.p.m., an increase of 50 per cent. Similar increases are noted for each frame size.

Comparisons of the new and old frame assignments are shown in Table I. The old 200 and 220 series have been replaced by the 180 and 210 series respectively. Where the new re-rated motors have the same frame designation as the previous design the suffix letter "U" has been introduced to indicate larger shaft extension dimensions. Shaft sizes have been increased to maintain approximately the same size relationship to horsepower ratings.

**Table 1—Comparison of the New and Old Standard Frame Sizes for Open Squirrel-cage Induction Motors at 1,800 rpm.**

| *H.P.* | *New* | *Old* |
|---|---|---|
| 1 | 182 | 203 |
| 1½ | 184 | 204 |
| 2 | 184 | 224 |
| 3 | 213 | 225 |
| 5 | 215 | 254 |
| 7½ | 254U | 284 |
| 10 | 256U | 324 |
| 15 | 284U | 326 |
| 20 | 286U | 364 |
| 25 | 324U | 364 |
| 30 | 326U | 365 |

To ensure maximum interchangeability, the totally-enclosed, fan-cooled ratings have been assigned the same horsepower-frame relationship as the open type ratings up to and including 20 horsepower. Above 20 horsepower it is necessary to use larger frame sizes than for the open ratings in order to maintain the same standards of temperature rise, torque, etc.

July 1, 1954, is the tentative availability date set for frames 182 and 184. The remaining series are expected to be made available at five-month intervals.

A similar re-rating program has been adopted by U.S. manufacturers.


**Fig. 1. Diesel road freight locomotive, 3,200 hp.**

# Economics of the Diesel-Electric Locomotive in Railway Service

*by*

W. P. Moffat

*Transportation Engineer, Canadian National Railways*

*A paper presented before the Montreal Branch of The Engineering Institute of Canada, November 12, 1953*

In this paper the author compares the characteristics and performance of steam and diesel locomotives, and discusses the economic significance of the diesel in various classes of rail service.

Pointing out that with each additional diesel unit acquired it becomes increasingly difficult to obtain a high level of utilization, he observes that the Law of Diminishing Returns is applicable to this problem.

He concludes that while the diesel may ultimately lose its supremacy to the gas turbine or some other type of locomotive, the advantages of any new type will not justify scrapping the diesels for a long time to come.

The diesel-electric locomotive is described alternatively as a diesel engine with an electric transmission system, or as an electric locomotive carrying its own power plant. Whichever definition is preferred, common usage today has made it simply 'the diesel locomotive', and it is in such terms that it will be referred to here.

It is not intended to explore here the various mechanical and electrical intricacies of the diesel locomotive. The purpose, rather, is to discuss the fundamental differences between diesel and steam locomotives, and the economic significance of these differences in the various classes of railway service.

'Economics' is a word that is liable to a variety of interpretations, and its use in the title of an address might not normally be considered good psychology on the part of the author. Actually, the "economics" are vital with respect to dieselization, and it is in the "economics of the situation" that the railways have sought, and are seeking, the answer to the question "How far and how fast shall we dieselize ?"

Reduced to simple terms, the problem may be stated as follows: To what extent should we replace steam locomotives, which we own (regardless of how much depreciation we have accrued thereon), by diesel locomotives which have a lower operating cost, but each unit of which requires a capital expenditure of from $100,000 to $250,000 depending on size and type, and a further expenditure to provide servicing and maintenance facilities ? The answer must rest on how quickly we expect the operating savings of the diesel to amortize its capital cost.

It is proposed to deal with this question separately in relation to each of the various types of railway service, that is, through freight service, passenger service, yard switching service, and wayfreight service, and to indicate in general how the fundamental differences between diesel and steam locomotives affect the answer in each case. Before doing so, it seems that a description of the characteristics of the two types of locomotives, which are important when comparing their cost of operation, would be in order.

### The Steam Locomotive

The characteristics of the steam locomotive, which indicate its usefulness in transportation service, are: (1) Maximum tractive effort. (2) Weight on drivers. (3) Horsepower. (4) Maximum axle load. (5) Total weight. The same factors are applicable in the case of the diesel locomotive, but a sixth factor is sometimes important, namely, continuous tractive effort and short time ratings allowed in excess thereof. Maximum tractive effort of a locomotive determines the tonnage the locomotive can haul over a given grade, without any regard to speed.

Maximum tractive effort of a locomotive may be determined by horsepower, or by the coefficient of adhesion between wheel and rail, whichever is the limiting factor. Weight on drivers is important, because adhesion is based on this weight. Horsepower, to the extent that it can be utilized, determines speed. Maximum axle load is the criterion which determines whether the locomotive will be permitted to operate over any given piece of track with a given weight of rail. Total weight of the locomotives is usually the criterion which indicates whether the locomotive will be permitted to operate over any given bridge.

A Northern type steam locomotive has a 4-8-4 wheel arrangement, that is, 4 wheels in the leading truck, 8 driving wheels and 4 wheels in the trailing truck. The maximum tractive effort of this locomotive is 57,000 lb., its weight on drivers 246,000 lb., its maximum horsepower at the rim of the driving wheels approximately 2,600, and its maximum axle load 61,500 lb. Total weight is 400,000 lb., or 678,000 lb. including tender.

### The Diesel Locomotive

Figure 1 shows a 3,200 hp. diesel road freight locomotive, consisting of two 1,600 hp. units. This locomotive has a maximum tractive effort limited by adhesion, depending on rail conditions, to 25 or 30 per cent of its weight on drivers, which (unless the locomotive is specially ballasted), in this case is 480,000 lb. Thus the maximum tractive effort at 25 per cent adhesion would be 120,000 lb. The horsepower, normally stated as 3,200, is measured at the input side of the generator. It is exclusive of horsepower required for auxiliaries, that is, it is horsepower for traction purposes. At the rim of the driving wheels the horsepower amounts to about 2,600.

The weight is nearly equally distributed on all four axles, so that the maximum axle load is about 60,000 lb. It will be noted that, in contrast to the steam locomotive, all the weight is on driving axles. The continuous rating of this particular locomotive is 105,000 lb. It is generally conceded that, while the locomotive can, on starting, effectively exert a tractive force equivalent to 25 or 30 per cent of its weight on drivers, the maximum percentage adhesion that can be regularly counted upon in ascending a grade of any length is 19 per cent. In the case of this locomotive, 19 per cent adhesion amounts to 91,200 lb. which is well below the continuous rating.

Thus, the maximum tractive effort of this locomotive on grades is limited by adhesion rather than horsepower. This is generally true of diesel units now manufactured. It can be stated that the manufacturers, by increasing the continuous ratings, have eliminated to a great extent the possibility of burning out traction motors through overloading, since the factor of adhesion can be

**Fig. 2. Diesel yard switcher locomotive.**

expected to prevent the overload condition being reached for any significant time. Road passenger units are similar in appearance to road freight units.

### Comparisons

There are, of course, many other types of steam and diesel locomotives. The Northern type is the most modern steam locomotive in use on the Canadian National, our last purchases having been made in 1944. There are heavier locomotives than the Northern in use, for instance, the Texas type, with a maximum tractive effort, when booster equipped, of 89,100 lb. Other types range from the Santa Fe, with a 2-10-2 wheel arrangement and a tractive effort of 65,000 lb., to the lowly Moguls and 10-Wheelers with tractive efforts as low as 20,700 lb.

On the diesel side, there are two other general types, the yard switcher and the road switcher. Figure 2 illustrates an 800 hp. yard switcher, and Fig. 3 a 1,200 hp. road switcher. The latter, as the name implies, is suitable for operation both on the main line and in yard service. The diesel switchers now in use on the Canadian National vary from 380 hp.—three of which are in service in Newfoundland—to 1,200 hp., while the road switchers vary from 380 hp. to 1,500 and 1,600 hp.

To return to the comparison of the Northern type steam locomotive and the 3,000 or 3,200 hp. diesel, Fig. 4 shows a comparison of the tractive effort and horsepower curves. It will be noted that the diesel has a relatively constant horsepower throughout the speed range, whereas the steam locomotive horsepower gradually increases to a maximum, which is not reached until the speed is 35 to 40 miles per hour. These curves are significant in comparing the capabilities of the locomotive in different services. The greater tractive effort of the diesel at low speeds means that, in this particular comparison, it can handle almost twice the tonnage of the steam locomotive up any given grade.

In passenger service, or high speed freight service, the comparison is quite different. Here it is found that, with trains of equal weight, there is very little difference in the running time of a 3,000 hp. diesel and a Northern type—the diesel having greater tractive effort at lower speeds, and thus being able to accelerate faster up to about 30 miles an hour, while the steam locomotive has a slight edge at higher speeds. Thus, while a 3,000 or 3,200 hp. diesel locomotive in heavy freight service will perform the work of almost two steam locomotives of the Northern type, in passenger service the comparison is approximately one for one, without in either case, taking into account the greater mechanical availability of the diesel locomotive.

### Diesels are Slower

While on the subject of comparative tractive effort curves, it will be of interest to point out the reason why diesel locomotives in freight service are often found to be slow, in comparison to steam locomotives. It will be seen from the shape of these curves that if the two-unit diesel is just able to equal the running time of the Northern type steam locomotive with a train of equal weight, the diesel is bound to be slower when loaded down to the extent that its greater tractive effort at low speeds will permit.

The availability of a locomotive is defined as the percentage of time that it is available for use in transportation service. Diesel locomotives in road service should average about 85 per cent availability, while in switching service the percentage should be 90 or over. Steam locomotives, on the other hand, rarely have an availability greater than 65 per cent, and usually it is somewhat lower.

The greater mechanical availability of the diesel locomotive is important, not only because it reduces the number of locomotives required, but because it permits the use of diesel locomotives on much longer runs than is, or was, possible with steam locomotives. For instance, diesel locomotives on the Canadian National have regularly been handling freight trains between Montreal and Halifax, Montreal and Winnipeg, Toronto and Winnipeg, and Winnipeg and Jasper. This characteristic of the diesel locomotive is important in helping to obtain the maximum utilization of this type of power, a factor that is most significant economically.

Fig. 3. Diesel road switcher, 1,200 hp.

### Fuel Costs

The principal items affecting the comparison of diesel and steam locomotive operating costs are fuel costs (including such associated costs as water and lubrication), repair costs, and enginehouse expenses. In through freight service a saving in crew wages is also made whenever average train load is increased through dieselization.

With respect to fuel costs, care must be taken to make a true comparison, and also to see that all applicable costs are included, such as the cost of distribution and handling. When all costs are included it is found that the fuel and associated costs of diesel locomotives in freight service generally vary from ⅓ to ½ of steam fuel costs, with the probable average being about two-fifths. The lower fuel cost of the diesel locomotive arises chiefly from two factors, the greater thermal efficiency of the diesel locomotive and the low distribution costs of diesel oil compared with coal.

The above comparison refers to a coal burning steam locomotive. Fuel costs of oil burning steam locomotives, of which the Canadian National has over 300 operating in Western Canada and about 40 in Newfoundland, have varied between 65 to 90 per cent of coal costs, depending on distance from coal mines. However, recent changes in subvention rates have somewhat reduced the difference between oil and coal costs in Western Canada. In any event, the fuel savings of the diesel, as compared with steam locomotives, are less when the comparison is made with oil burning steam locomotives.

#### Repairs and Servicing

The comparison of repair costs of steam and diesel locomotives also requires care. With the average age of steam locomotives now in excess of 30 years, it is a safe assumption that steam locomotive repair costs, on an out-of-pocket basis, have reached their peak, at least in terms of a stable dollar. In fact, the life of a steam locomotive can probably be prolonged almost indefinitely at a repair cost not much in excess of the present, since it is a fact that many steam locomotives today have been practically rebuilt.

On the other hand, diesels now in service are relatively new, and cannot be expected to reach their peak repair costs for some years yet. Another factor is that when replacing steam locomotives with diesels, there is a significant proportion of steam locomotive repair cost in the form of overhead which will not be affected by scrapping steam locomotives unless complete locomotive shops are disposed of. Thus, the comparison to be made is that of an average future maintenance cost of the diesel locomotive at current prices, against the present out-of-pocket maintenance cost of the steam locomotive, excluding overhead items.

Such a comparison involves a judgment or estimate of the future trends in diesel maintenance costs. It also depends on the type of steam locomotive with which the comparison is made. Experience of other railroads owning diesel equipment which has been in service somewhat longer than our own is of some help in forming a judgment as to what the future diesel costs will be. As a result of studies of this matter, it is expected that repair costs of diesel locomotives will be on the average approximately 25 per cent less than those of steam locomotives.

Enginehouse expenses, which represent costs of servicing locomotives as distinct from maintaining or repairing them, are somewhat more difficult to compare. The diesel locomotive inherently has a great advantage over the steam locomotive in this respect, since it requires much less attention by enginehouse staffs and less frequent visits to the enginehouse. The difficulty in arriving at cost comparisons in this case is to obtain the true effect on enginehouse manhours. Operating one particular train with diesel power may not have any effect at all on enginehouse staffs and manhours paid for. However, on the whole, it is considered that diesel enginehouse expenses should be only about 30 per cent of steam enginehouse costs.

Crew wage savings in freight service are dependent on increasing the length of trains. In many cases, diesel operations has made this possible, the inherent advantage of the diesel in this respect being that additional units can be added to the locomotive without adding to the crew. However, there is a limit to what can be achieved along these lines. For one thing there is a practical limit to the length of freight trains; also there are many instances where the frequency of service is a governing factor. The savings to be achieved in crew wages vary so much from one application to another that it is difficult to assess any sort of significant average.

#### Savings Per Operating Ton Mile

To summarize the situation with regard to through freight operating costs, it may be stated that fuel savings constitute the most important item. These account on the average for more than three times the savings in repair costs and enginehouse expenses, while crew wage savings may or may not be important, depending on the extent to which train load is increased.

Total savings to be attributed to diesels can vary from 30c to $1.00 per 1,000 gross ton miles, depending on such factors as grades and curves, type of steam locomotives used, relative prices of fuel and length of haul on coal used in steam locomotives. A rough average would be 40c per 1,000 gross ton miles, but with such a wide variation it would be dangerous to apply the average to any specific case.

Having determined the operating savings per 1,000 gross ton miles to be expected from diesel operation, the next problem is to ascertain how many gross ton miles each diesel purchased is likely to handle. In cases where the diesels are to be assigned to regularly operated manifest freight trains, it is relatively simple to estimate the gross ton miles to be handled. Where the diesels are assigned to extra freight service, which, of course, fluctuates with the volume of traffic to be handled, the problem is more complex.

#### Law of Diminishing Returns

It will be evident that operating savings and return on invested capital from diesel locomotives are largely dependent on the gross ton miles handled. In other words, the busier a diesel locomotive is kept, the sooner its capital cost will be amortized by savings. The use of diesel locomotives on long manifest freight runs, such as Montreal-Halifax, and Montreal-Winnipeg, results in a high level of utilization. However, good utilization can also be obtained in the initial stages of dieselization on shorter runs in heavy density territory where the diesels are assigned to both manifest and extra freight trains.

A good example is the Montreal-Toronto run where, in the year 1949, six 1,500 hp. units handled the remarkable total of 1.6 billion gross ton miles, an average of 737,000 gross ton miles per unit per day. We naturally did not expect to equal this performance with every diesel unit purchased. In fact it was foreseen that with each additional diesel acquired, it would become increasingly difficult to obtain a high level of utilization.

This means that the law of diminishing returns is applicable to the utilization of motive power on a selective basis. This is true in all types of railway service, but the determination of how this law operates constitutes a more complex problem in through freight service than in other services. The reason for this is that the number of trains or train miles operated can be adjusted according to the type of locomotive available and the traffic offering to a much greater extent in through freight service than in other services.

Two basic steps are required to answer the question as to how many gross ton miles might be handled by each additional diesel operating between two specific points. One is to determine the maximum possible gross ton miles per locomotive, that

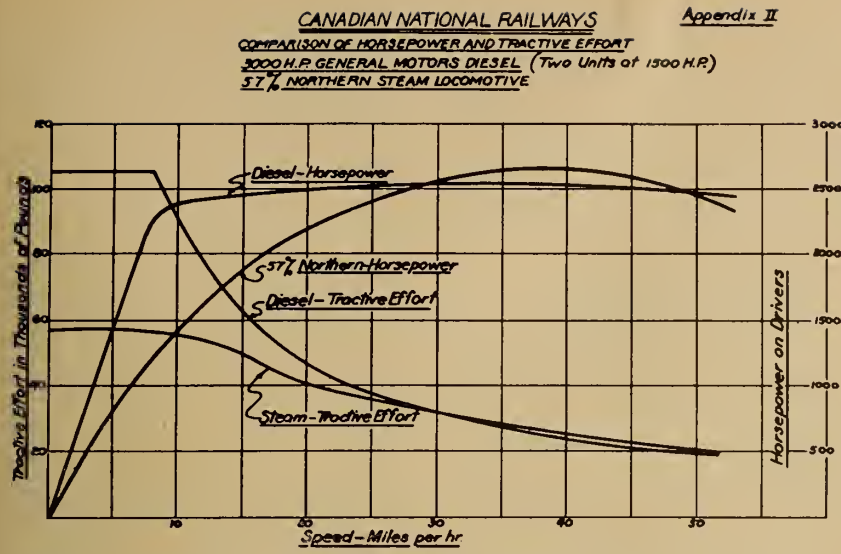


**Fig. 4. Comparison of tractive effort — diesel and steam locomotives.**

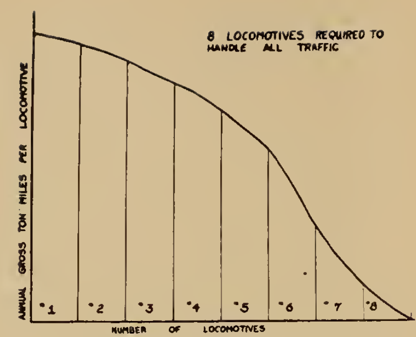


**Fig. 5. Maximum annual gross ton miles per locomotive.**

is, if only one diesel locomotive was assigned to the particular service in question, how many gross ton miles could it handle ? The second step is to determine how much less than the maximum gross ton miles each successive locomotive can be expected to handle.

#### Factors Determining Maximum Haul

The factors which determine the maximum possible gross ton miles per locomotive are: (1) Density of traffic. (2) Length of the run. (3) Average speed. (4) Average train load. (5) Average time taken by the locomotive to and from shop or roundhouse at each end of run, including time at shop, and (6) time spent at intermediate terminals. The second half of the problem, that of discovering how the law of diminishing returns behaves, almost defies precise calculation. If traffic was uniform from month to month throughout the year and the only fluctuations were daily or weekly fluctuations, it can be demonstrated that the law of diminishing returns would follow a curve similar to an inverted parabola.

Because of the fluctuations in traffic, however, the actual curve is shaped somewhat like that shown in Fig. 5. Here the upper part of the curve follows closely that of the inverted parabola, but departs from this form at the lower end. The shape of the curve for different runs varies according to conditions, but the factor which has the greatest influence in establishing the shape of the curve is the ratio of peak traffic to minimum traffic. This is understandable if it is considered that in dealing in monthly fluctuations of traffic, the upper part of the curve consists of the sum of 12 inverted parabolas; the next portion, 11 inverted parabolas and so on.

#### Five Year C.N.R. Program

By applying to this curve the operating savings per gross ton mile, a similar curve showing total operating savings to be expected from each successive diesel is obtained. To indicate the number of diesel units to be purchased, it is then only necessary to decide what minimum return on invested capital can be accepted.

In this discussion no mention has been made of the capital cost of steam locomotives.

Under current conditions the capital value of a steam locomotive consists only of the price that it will bring in the scrap market, since steam locomotives are no longer being manufactured on this continent. The scrap value of a steam locomotive is, of course, negligible in comparison with the purchase price of a diesel and, therefore, can be neglected in comparing operating and capital costs of the two types of power.

In the initial stages of through freight dieselization operating savings are sometimes quite spectacular, being sufficient in some cases to amortize the capital cost of diesels in two or three years. As more diesels are acquired, however, the savings per locomotive and return on investment decline, as has been demonstrated in the previous discussion. The five-year dieselization program of the Canadian National is based on these principles. This program was described in the Company's 1951 Annual Report in the following words:

> Following the completion of a comprehensive study, approval in principle has been given to a five-year program of partial dieselization directed towards those freight, passenger, and yard services where relatively intensive utilization of locomotives can be obtained, and advantage taken of the greater availability and lower operating costs of this type of power.

The Canadian National now has 194 diesel units of 1,500 or 1,600 hp. operating in through freight service, and currently over 35 per cent of the total gross ton miles are handled by diesel. Diesel locomotive utilization, while it has descended somewhat from the previously mentioned pinnacle reached in the Montreal-Toronto service during 1949, has generally lived up to expectations.

#### Diesels in Passenger Service

Public interest is naturally centred more on passenger service than freight service, and the question is often asked why the railways of Canada have not acquired more diesels for passenger service. The answer is that operating savings of diesels in passenger service are much less than in freight service. There are four principal reasons for this: (1) As demonstrated in the discussion of tractive effort curves, it takes more diesel horsepower to provide equivalent service to a steam locomotive in passenger service than in freight service. This tends to increase operating costs and reduce operating savings, and at the same time, increases diesel capital costs, reducing further the return on investment.

(2) While selective dieselization of passenger service will enable diesel locomotives to operate very high mileages (which of course, would tend to increase operating savings), this is more than offset by the fact that a passenger train consumes much less fuel per mile than a freight train. Thus fuel savings are less per diesel locomotive purchased than in freight service, despite the higher mileage.

(3) There is little or no opportunity for diesels to effect a saving in train miles, as there is in freight service.

(4) Capital costs of the diesels are increased by the necessity of providing a means of heating the train.

#### Yard Switching

Turning now to the use of diesels in yard switching services, it would perhaps have been more chronologically correct to commence this paper with a discussion of diesel yard switchers, since their introduction in railway service preceded that of the road units. The inherent advantages of the diesel switcher in yard service, such as high mechanical availability and lower operating cost than the steam switcher, have been recognized for many years.

There are many freight yards across the country where advantage can be taken of the high availability of the diesel switcher by assigning it to round-the-clock service. The intensive utilization thus obtained results in operating savings which yield a return on investment almost comparable with the more favourable applications in through freight service, but there is a greater percentage difference between steam and diesel fuel costs. Whereas a ratio of diesel to steam fuel costs of about two to five was indicated in through freight service, the ratio in switching service is less than one to four.

This is explained by the low fuel consumption of the diesel when idling and the greater proportion of idling time in switching service. At the end of last month the Canadian National had on hand 217 diesel switchers of various sizes. Most of these are used in round-the-clock assignments. The law of diminishing returns is beginning to take effect, and diesel switchers acquired in the future will be confined mostly to 16-hour or two-shifts per day operation.

#### Branch Lines

Wayfreight or branch line services offer a further field for dieselization. In this case, the anticipated return on investment is generally more favourable than in passenger service, but not so favourable as in through freight or yard switching service. The total fuel consumption per locomotive-mile is greater than in yard service, but the relatively high percentage of idling time makes for a ratio of diesel to steam fuel costs per mile of about one to four. The operating savings and return on investment from wayfreight dieselization is limited, however, by the mileage per locomotive which can be obtained. A locomotive in wayfreight service is generally confined to a single daylight run each 24 hours and perhaps only 5 or 6 days per week.

There are many instances, however, where further utilization in yard service or freight service can be obtained before the next day's wayfreight run, and in these cases operating savings and return on investment will be increased accordingly. The relatively low mileage per locomotive, which is characteristic of wayfreight service, also tends to increase the differential between steam and diesel locomotive repair costs. The reason is that diesel locomotive repair costs are more directly proportional to mileage than those of steam locomotives, which contain an appreciable element of cost assignable to time rather than mileage.

#### Dieselization of Territories

There remains one more subject about which a few observations may be appropriate. I refer to the complete dieselization of territories. Fundamentally, once it is accepted that the law of diminishing returns is applicable to this question of dieselization, it follows that in every territory where there is any appreciable fluctuation of traffic, a point must be reached where the purchase of the next diesel unit will not bring sufficient savings to yield a satisfactory return on investment.

This does not mean that complete dieselization of the territory is never justified, but it does mean that, in order to justify it, one of two conditions must apply. Either the additional savings possible through elimination of steam locomotive servicing and maintenance facilities must be sufficient to offset the low return on investment provided by the last few diesels required to complete the dieselization, or the project must be viewed from an earlier stage of dieselization, when the higher returns obtained from units acquired early in the program can be averaged out with the lower returns obtained in later stages.

The latter alternative is not basically correct in economics, but in individual cases it may be a rationalization forced by circumstances. For instance, although Management may realize that a higher return on investment can be obtained by partial, rather than complete dieselization of a certain territory, the complete dieselization of the territory may be desirable for policy reasons. If, in this case, the complete dieselization project, started from an early stage, provides on the whole an adequate return, management may decide that the expenditure of the additional capital to complete dieselization is justified.

#### Replacement Not Imminent

In conclusion, it may be said that the diesel locomotive represents one of the most important technological advances in railway history, although this fact is obscured by the present relatively unsatisfactory net income position of the Canadian railways. This unsatisfactory condition is not due to inadequate returns on the investment which has been made in diesel locomotives, but stems from the fact that railway revenues per unit of service have not kept pace with increases in wage rates and prices generally.

This is a statement of fact, the end result of many factors. The background for it is tied in with the complicated and controversial questions of the railway freight rate structure, freight rate increases and the loss of traffic to competing forms of transport. It is possible that the diesel locomotive will lose its present supremacy in the motive power field to the gas-turbine or some other type of locomotive. It will be surprising indeed, however, if the advantages of any new type of power are sufficient to justify scrapping the diesel locomotive for some time in the future. √

# The Engineer and Natural Resources

*by*

The Honourable Robert H. Winters, M.E.I.C.
*Minister of Public Works of Canada*
*Ottawa*

**This is an address delivered by invitation at the fall meeting of the American Society of Mechanical Engineers at Rochester, N.Y., on October 6, 1953. It is good evidence of the increasing interest in things Canadian in the United States and an excellent example of the kind of publicity Canada has long needed. What Mr. Winters has to say in the latter part of his address should help to convince even the most conservative that engineers have a role in society much wider than, and on the whole as important as, mere contributions of technical ability.**

At the time the invitation to speak to you at your Fall Meeting reached me I was in a peculiar position. It was less than a month to the date of our Canadian general election—the third successive one in which I was a candidate. The invitation took cognizance of that situation, and very understandingly stated that "even if some very strange things do occur and your party is not returned, we would still like to have you take on this speaking engagement." However, under such circumstances my position would have been unenviable, to say the least.

I would have found it difficult, I'm afraid, to speak with conviction on the subject of "The Engineer and Natural Resources" while occupying the role of an ex-Minister of Resources whose policies had been rejected by the electors. To anyone in public life there's nothing as reassuring as a renewed mandate from the electors. I've often felt that there are times when business executives would feel more comfortable if they had such an endorsation from their employees. However, although the election didn't bring about many changes, I have been involved in one since then, and as a result I am here tonight not as Minister of Resources and Development, but in my new capacity as Minister of Public Works.

No matter what position I hold, I am always glad to be in the presence of professional engineers. Although I have deviated some distance from the full-time practice of the engineering principles which involve the application of say, Bessel functions or Fournier series, I have been fortunate in my political life to have been associated with departments of government which rely greatly upon the special skills of the professional engineer.

In the Department of Resources and Development the traditional civil, electrical and mining divisions of the engineering profession were represented directly in the administrative and technical branches. So too, were the more specialized divisions of forestry and soils engineering. In my new post, for the functions of the Department of Public Works lay special emphasis on mechanical engineering and architecture, I know I am going to enjoy my continued association with the work of the various phases of our profession.

Historically, the growth and development of our two countries has been somewhat similar, except in the matter of pace. Exploration and discovery touched our shores and the earliest settlements were established at about the same time. The greater hazards of North Atlantic voyages and the rigors of the northern climate were probably the main reasons why the influx of immigrants was more rapid along the shores of New England and southward. For this was a fact long before political differences set the stage for the revolution that culminated in the Declaration of Independence.

When you think of it, I suppose there is no single group of specially trained people, that has been so long and so closely associated with the growth of our two nations from colonial days to our present equal status of sovereign, free nationhood, as has the group of professional engineers.

By their very natures, both our lands have been at the same time an invitation and a challenge to the engineer. At first, the need was to tackle the most obvious problems—the means for travel and for transportation in the wild, new land. There was space to be conquered and a landscape to be adapted to human needs. Canals were required to permit full utilization of natural waterways for river and lake transport. Railways were built so that steam locomotives, those early giants of mechanical engineering genius, could carry passengers and freight across the plains and over the mountains to make secure the precarious hold that wagon train pioneers had wrested from a difficult country and hostile natives.

Prospectors for gold and silver, and farmer settlers, each required the services of someone possessing one or another type of engineering skill. As problems were solved the pattern of progress spread. More population required increasingly more of the basic necessities of life, which themselves were multiplied by the growingly complex form of life in this western civilization. The engineer was the designer and oftentimes the builder of the equipment that is the basis of our physical well-being. He was in the forefront of every progressive step in our technological advance. Without the engineer, life as we know it today would be impossible.

The role of the engineer has been, and basically still is, integrated with the development and utilization of natural resources. Thomas Tredgold's classic definition still holds good today, as it did a century and a quarter ago when he said, "Engineering is the art of directing the great sources of power in Nature for the use and convenience of man."

It is when we consider the engineer in relation to the natural resources of our two countries that we begin to notice the trend away from similarity. I have mentioned the difference in the rate of growth and development in our countries. This is a fact that has been highlighted by the publication of the Paley Report. Among other significant statements about the potential and proven reserves of natural resources in the United States, the document contains the opinion that some time during the 1940's total production was less than total consumption, and that since that time the gap has continued to widen. This means that the United States is becoming dependent to some degree upon other countries for supplies of certain raw materials to keep its industrial machine running. Substitutes for some commodities have been found, but the sobering, thought-provoking knowledge that so many of our natural resources are not inexhaustible makes us pause and take stock of our own position in Canada.

Canada's standard of living is near enough to yours in the United States so that for practical purposes it can be said that our own use of raw materials, both in kind and volume, is about the same as the American per capita rate. But our rate of disappearance is greater in some cases, because we produce and export, for example, about 80 per cent of the world's nickel, half of its platinum and two-thirds of its asbestos. We rank second in zinc and gold production among the nations of the world, third in silver and fourth in copper. Canada also supplies about 30 per cent of world exports of wood pulp and 80 per cent of newsprint exports. We are a nation of barely 15 million people, but we produce and export surpluses from our rich storehouse of natural resources to such an extent that we are the third trading nation in the world.

Back of this record of development and utilization of natural resources is the engineer. It is his knowledge, skill and genius for solving problems that has helped us attain our present position of economic buoyancy. It was the engineer, or the application of engineering principles, that enabled Canada to be with you a veritable arsenal for democracy during World War II, and so quickly to manage the reconversion from newly established peace-time industry to a program of defence preparedness when Korea appeared to hold the threat of yet another world conflict. The extreme urgency of war-time needs of certain strategic materials was ample justification for venturing outside the bounds of strictly economic exploration and development. New discoveries were made that have since proven to be profitable commercial enterprises. The upsurge of development of one kind of natural resource stimulated, and in many cases made feasible, the development of another. The net result has been an expanding program, with projects established in every part of the country from Newfoundland to British Columbia, and from the International Boundary, north to the fringes, and even beyond the lines, of permanent settlement.

While all of these developments are significant in terms of their contributions to labour and industrial payrolls, and for the acquisition of new, strategic materials, some of them are notably spectacular. The Quebec-Labrador iron ore development which includes a 358-mile railway stretching between two sizable communities of workers' homes at Seven Islands, on the north shore of the St. Lawrence River, and Knob Lake, at the mine site, is a project comparable to the building of the Transcontinental. Last month, while enroute to northern Ungava, I flew the length of this railway grade and viewed it from a low elevation. I was greatly impressed by the manner in which a multitude of difficult engineering problems had been overcome in this stupendous undertaking. In 1946 Canada produced only about one and a half million tons of iron ore. We have great proven deposits which are already yielding several times that amount and which, as a result of spectacular engineering achievements, may be producing some 30,000,000 tons a year before very long.

Discovery of new oil fields in Alberta in 1947 led to large scale explorations and development there. This search and development has spread to other provinces and to the Northwest Territories and the Yukon. Where less than 10 years ago we were producing barely 10 per cent of our domestic needs of crude petroleum, Canadian oil wells are now supplying fully one-third of our present, greatly increased requirements. There are good prospects that within a few years after engineers have overcome transportation problems, we will be producing sufficient oil to meet all our home demands, and in fact, may be in a position to become an exporter of crude petroleum.

The huge aluminum undertaking at Kitimat in the north coastal mountains of British Columbia is an engineering feat that defies comparison for the size and daring of the plan to direct a "great source of power in Nature for the use and convenience of man". Reversing the direction of flow of a 200-mile circle of large lakes and connecting rivers; tunneling 10-miles through solid rock to carry the water to a great power-generating plant built entirely within the mountain, and then stringing 50-miles of transmission lines over the most hazardous, heart-breaking mountain terrain imaginable to serve the aluminum plant on the deep-sea harbour location at Kitimat, is all part of the price for being able eventually to produce at this plant alone 500,000 metric tons of aluminum a year. When completed, the total annual production capacity of Arvida, in the Province of Quebec, and Kitimat in British Columbia, will be more than the current output of aluminum in the United States.

Nickel-copper production in northern Manitoba is a new development, following the cross-country tractor-train move of the buildings of an entire mining town to provide shelter for workers and their families in the new location. A 150-mile railway is being constructed so that concentrates can be brought out to the former railhead point, and from there taken to a new smelting plant at Fort Saskatchewan, near Edmonton, Alberta, where vast supplies of natural gas make the cost of processing the ore concentrates economical enough to offset the expense of the long rail haul.

Lead-zinc-silver in the Mayo district of the Yukon; asbestos in northern British Columbia, prospects of base metals at Pine Point near the west end of Great Slave Lake; nickel prospects at Rankin Inlet on the west coast of Hudson Bay; iron ore deposits discovered at Payne Bay on Quebec's far northern coast; lead and zinc prospects near Bathurst, New Brunswick; titanium production at Allard Lake, Quebec, and the discovery of copper deposits in the Gaspe country—these are all Canadian natural resource developments that recently have been commanding the attention of engineers.

Uranium is being located in many places in Canada. Next to the original source of Canada's radio-active ores at Port Radium, Great Bear Lake, the most significant discovery and development is at Beaverlodge Lake in northern Saskatchewan; a new settlement, Uranium City, is being established there on a basis that indicates an orebody sufficiently large to warrant planning long-term development.

Water is perhaps the most basic natural resource. Its natural function of giving life to soil and of nourishing all manner of living things, vegetable and animal, is paramount, and at the same time it is one of the chief means of securing power by which our program of natural resource development is made possible. Canadians already use almost twice as much electric power per capita as Americans do, and it is developed and utilized at about half the cost per kilowatt hour. With less than one per cent of the world's population in Canada, we develop over 10 per cent of the world's hydro-electric energy. Even so, we are not yet using a quarter of our known potential.

Although new discoveries of oil and natural gas reserves or mineral deposits perhaps make more interesting headlines, in some ways the harnessing of additional hydro-electric energy is even more important to us and consequently really more newsworthy. We need more power in order to increase production of raw materials at lower unit costs. When power is available it stimulates industrial expansion, which in turn requires still more raw materials and more low-cost power to maintain output at economic rates. New communities spring up on the frontiers of resource development. They require power for domestic purposes. Industrial expansion in the older settled areas is making it necessary for us to expand present facilities, so that all the power that can be derived from the water resource at that point is developed and utilized.

During the twelve years following the outbreak of World War II Canada's hydro-electric capacity was enlarged by 60 per cent, and we have since been adding to it at just about two-and-a-half times the pre-war rate. Just a few miles west of here the Ontario Hydro-Electric Commission is well along with the work of developing power from the water allocated to Canada under the Niagara River Treaty of February 27, 1950. Almost everywhere there are signs of a move to increase the capacities of power projects whose outputs have fallen behind the need. Two outstanding examples of undeveloped power sites in Canada are the Yukon River drainage basin in the Yukon Territory and northern British Columbia, and the great Hamilton River system in Labrador. The potential of these two alone is estimated conservatively at over 8 million horsepower. Just to give you a basis of comparison, the world's largest power plant at Grand Coulee, Washington, has a capacity of some 2½ million horsepower. In Canada we have a known potential of about 66 million horsepower still waiting to be harnessed. Included in this total is the Canadian share of the 2½ million horsepower to be derived from the International Rapids section of the St. Lawrence River, a project which is close now, we hope and believe, to its long-awaited commencement.

It is not my main purpose this evening to give you a recital of the full extent and variety of Canada's natural resources. But knowledge of these facts helps to point up the tremendous job the engineer has been, and is, doing today in Canada. It also poses a great challenge. Because the engineer is the greatest developer and user of natural resources, he must, at the same time, become our chief conservationist. Not much can be done about the minerals and fuels that have been used, and which, by their nature are not renewable. But we can employ care and ingenuity to see that the very highest use is made of this type of natural resource in the future, avoiding wastefulness of all kinds, and developing substitutes made from renewable or more plentiful materials wherever possible. In the case of our renewable resources of forests and wildlife, and of soil and water which can be husbanded, the engineer can play an important part. By suggestion and advice—broadly, by using the tools of education—the engineer can induce a thoughtful approach to development and utilization, even to the point of convincing hard-headed finance that today's quick profits are likely to prove much too costly if they should contribute to loss of productivity of the resource at some future date. Ideally, this is application of the vital human privilege of showing concern for the future welfare of one's family and neighbours the world over. We are our brothers' keepers and the highest concept of the engineering profession is dedicated to this proposition.

This principle is a fundamental part of the Canadian Government's economic policy as it applies to the development of the natural resources of my country. During the last session of Parliament our Prime Minister said, "We recognize, as do all other Honourable Members, that the natural resources of Canada are a heritage to be developed and conserved for the purpose of providing the greatest possible measure of opportunity and security for all Canadians. We recognize that proper government policies are those which promote and develop the country's natural resources for the benefit of the people of every part of Canada."

So you see, our Government recognizes its responsibility too! While we are most happy when private industry does what is required to be done, there are times when it is appropriate that public authorities take the initiative. In Canada, however, as in the United States, we believe in free enterprise as a general policy. Under our constitutional system the natural resources of our country are the property of the people in the right of the provinces. The Canadian Government administers the natural resources in the National Parks, on federal forest experiment stations, on Indian lands, in the Yukon and the Northwest Territories, and in respect of fisheries the Federal Government has authority in Canadian territorial waters. All the rest come under Provincial Government authority.

By providing leadership and indicating certain desirable objectives which would benefit the people of the nation as a whole, the Canadian Government, working with the ten provincial governments, attempts to create the atmosphere in which free enterprise will want to step out and do things. Regulatory measures are kept to a minimum, and when they are enacted, they are designed to allow fullest scope for freedom of individual action commensurate with the common good.

There is much more I could say about our resource development program. I am sure any engineer would find most interesting such projects as the recently undertaken program to spray some 4,000 square miles of budworm infested forest in New Brunswick, the building of a causeway across the Straits of Canso; the construction of transcontinental pipe lines, and so on.

But I would like to change the emphasis a bit here and deal a little more directly with the engineer himself—the human side, which some people might think we engineers lack.

In reply to the question as to what is the role of the engineer in the development of natural resources, my answer is that the role of the engineer is, in short, anything we engineers want to make it. I wonder if therein doesn't lie the greatest challenge to the profession. The field has been so vastly widened by specialization, particularly in the manufacturing industries and in business, that the opportunities greatly outnumber the engineers available. Scarcity of a commodity usually enhances its value. Engineers are now in short supply. This not only increases the relative importance of each, but it puts us as a professional group in a better position than ever before to shape our own destiny. But the new importance of the engineer has tremendously increased the burden of responsibility he must bear. In Canada alone, there are excellent positions awaiting 2.000 young graduate engineers, and in our present buoyant, expanding economy the demand is continuing to outrun the supply as we see it today. There is a great responsibility imposed by this condition. We engineers have it in our hands to shape our own course, but we must know what that course is to be before we can steer it.

It was not long ago that the engineer was a pretty much stylized individual. He wore breeches and high boots even on the college campus, and the badges of his calling were the T-square over his shoulder and the slide-rule in his hip pocket. He liked to view himself as a specialist, and he tended to concern himself with a narrow field of activity. Naturally, that is the way the public came to regard him.

As time went on, the pattern changed. Our countries developed—and this is particularly true of Canada—and the frontiers were moved back so that the engineer often found himself a key figure in new municipalities. He was required to assume broader and heavier responsibilities. The good engineering colleges realized this trend and added to their curricula subjects designed to broaden the educational base of the engineer. He was asked to study literature, to learn accounting and business practices, and even to do some public speaking.

But we engineers, in many ways, are a conservative lot. We often, subconsciously, resisted these developments, considered them unnecessary frills and, accordingly, individually and through associations, we have in many instances been our own worst enemies. I believe that engineering is the best training any man, or for that matter any woman, can take. The technical side of it is precise, and if pursued any reasonable distance, especially in the field of research, it is one of the best of all mental developers. When this is rounded out by some background in the general arts, it provides a solid base from which to launch a successful career. Anyone who has demonstrated his mental capacities by weathering successfully the rigours of present day college training in engineering can most certainly, with equal success, apply his knowledge to virtually any other problem that confronts him, no matter in what field it happens to occur.

We engineers know this and yet, time after time, when an important administrative or executive position has been begging for occupancy, we have been guilty of saying, and permitting other people to say, that such positions are better filled by a lawyer, or an accountant or some type of commercially-trained person.

I cannot be convinced that engineers have ever lacked confidence, but there is a danger that as a group we may sometimes allow ourselves to be led into the belief that it is not, perhaps, in keeping with our profession, to deviate from the narrow, restricted, technical path. If and when that does occur, it is a great mistake.

Problems are a by-product of the day-to-day activities of normal human beings. Engineers are specialists in solving problems; the riddles of living give way to the same clarity of thinking, the same searching analysis, the same honest measuring of opposing factors and the same unselfish desire to find and use the right solution, as do the problems created by natural forces.

I am suggesting that the role of the engineer is not complete until the special skills of the profession are being applied to the utmost for the solution of our social and moral, as well as our material and economic problems. This leads to the thought that as a group, and as individuals, wherever the opportunity arises, we should be willing to accept posts of responsibility in the administration of industry and business, in government at all levels and in the social life of our communities.

The world is changing; developments are crowding upon developments; rates of obsolescence have quickened, and the Atomic age is closer than most people realize. In my own field as an electronics engineer, I have seen amazing developments during the past generation. And in all these fluid developments on a global scale, Canada and the United States, more than any other two countries in the world, can look forward to a bright future of growth and progress, to the benefit of our own peoples and mankind generally.

The challenge to the engineer is there. Because the role of the engineer is so completely integrated with the whole pattern of our development, principally through utilization of natural resources, our future, in very large measure, depends upon engineering genius for bridging the gap between the scientists' discoveries and our citizens' material needs.

The engineer is in a position of prior stewardship. The awakening of public interest in the need for conserving our natural resources is largely his responsibility. He is the man who knows why, and how much, care must be taken with our God-given treasures. It is in becoming more actively concerned with this enlightened aspect of his calling that the engineer contributes his best—more than just his knowledge as a scientist or technician—he becomes a leader, a teacher, a true citizen of his community in the broadest sense.

And if the major projects that have been planned or will become necessary within the next fifteen or twenty years, are completed—then we may look back and review what will surely be an even more impressive picture of the role of the engineer in the development of not only natural resources of rock, soil and water, but of our even more precious resource—people—men and women in nations striving together for a better world. √

# Technical Arrangements

for the

# Sound and Television Broadcasts

of the

# Coronation Ceremonies

on 2nd June, 1953

*by*

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*A paper presented to the Institution of Electrical Engineers of England, and by radio link to a joint meeting of the Montreal Branch of The Engineering Institute of Canada and the Institute of Radio Engineers, on December 3, 1953.*

The arrangements of the sound and television broadcasts of the coronation of Her Majesty Queen Elizabeth II are described in detail after a brief comparison has been drawn between the coverage provided for this event and that for the coronation of King George VI in 1937. Both sound and television programmes were broadcast simultaneously to the United Kingdom and to much of Europe, temporary equipment being installed at several European centres to convert the 405-line signal to the several standards (441, 625 and 819 lines) used on the continent.

The problems of siting microphones and cameras in Westminster Abbey—where they had to be invisible—are enunciated, and the methods of overcoming the difficulties of siting the sound and vision control rooms at the Abbey and along the processional route are discussed.

The nature of this largest outside broadcast ever undertaken by the B.B.C. and the Post Office called for many special arrangements, and details are given of the signal circuits installed, the lip microphones which enabled commentaries to be heard above adjacent crowd noises, and the equalization and synchronization necessitated by the number of cameras televising the broadcast.

Finally, an account is given of the sound and television recording arrangements of the B.B.C. and the North American organizations, so that telefilms and commentaries could be screened in America within 24 hours of the event, and so that a permanent record of an historic occasion would be available for the future.

## Introduction

The broadcasting operation carried out on Coronation Day, 2nd June, 1953, was on a scale which far exceeded that of any previous broadcast undertaken in Great Britain and represented a very major undertaking by the authorities most directly concerned, namely the B.B.C. and the Post Office. Quite apart from the magnitude of the operation, however, the technical arrangements, particularly on the television side, included a number of novel features which were brought to fruition in time for this most important occasion.

It is perhaps of interest to make a broad comparison with the corresponding broadcasts at the time of the coronation of King George VI on the 12th May, 1937. On the sound side, in 1937 there were altogether 17 commentary positions, including 10 for oversea services, whereas in 1953 there were 95, including 84 for oversea services. Six B.B.C. transmitters were in service in 1937 to broadcast to oversea audiences, whereas 48 were employed in 1953.

On the television side the comparison is even more striking. In 1937, the B.B.C. television service had been in existence for only six months, and this was the first outside broadcast in which a mobile unit was used. It was stationed near Hyde Park Corner, and possessed three cameras using pick-up tubes of very low sensitivity by modern standards; pictures of the procession as it passed down East Carriage Drive were broadcast by the only transmitter then in operation, that at Alexandra Palace, to perhaps 30,000 viewers.

Sixteen years later, 21 cameras were used, five of which were in Westminster Abbey and were able to show viewers the solemnity of Her Majesty's coronation; the remainder showed views of the Royal procession to the Abbey and of the return proeession to Buekingham Palaee, in a broadeast whieh lasted some seven hours. The broadcast was transmitted by eight stations in Great Britain and 12 on the Continent, and the number of viewers has been estimated at 20 million in Britain and perhaps 1½ million on the Continent.

In addition, some millions of viewers in Canada and the United States, as well as many in Denmark, Italy, Cuba, Japan and Venezuela, saw recordings of the broadeast.

The description which follows deals separately with the sound and television broadeasts, which, in fact, were largely planned and executed as separate operations, although there were certain respects in which they were complementary. Notably, the television service relied on the sound service entirely for sound pick-up within the Abbey and on the route immediately outside the Abbey, while at certain sound-commentary points, television screens provided an indispensable guide to sound commentators. Moreover, from the Post Offiee aspect the requirements of the two services had to be treated, in eommon with other special com-

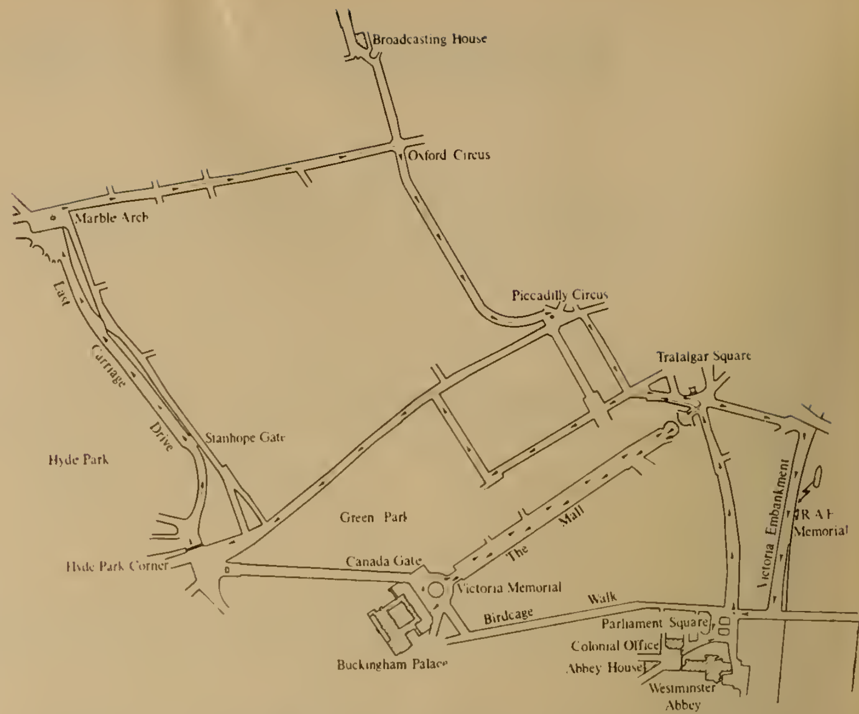


**Fig. 1. The processional routes.**

Point 1. Hut on Colonial Office site.
Point 2. On pavement by R.A.F. Memorial on Victoria Embankment.
Point 3. Victoria Memorial.
Point 4. In Hyde Park on the west side of the East Carriage Drive about 300 yards south of Marble Arch.

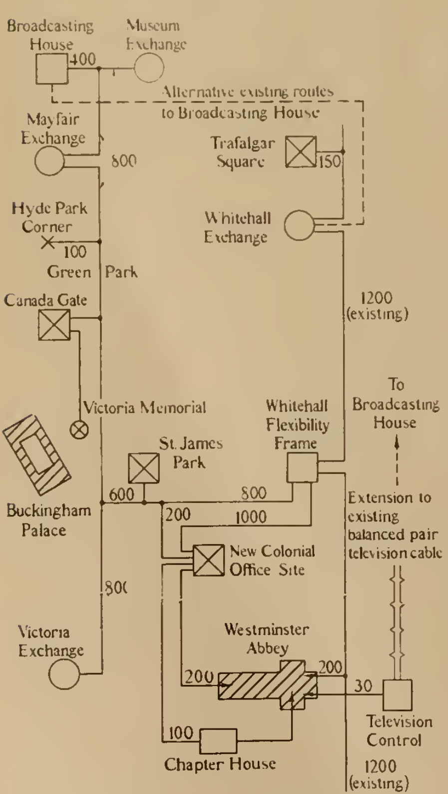


**Fig. 2. Telephone cables provided for coronation ceremonies.**

The figures indicate the number of pairs per cable.

munieation needs, as one overall problem.

Fig. 1 shows the routes of the processions to and from Westminster Abbey, and indicates the locations of the sound and television commentary and camera positions.

## Sound

### Outline of Arrangements

The broadcasting arrangements for the sound services had to cover the requirements both for home and oversea listeners, the latter including both the services radiated by the B.B.C.'s own European and oversea transmitters and broadcasts sent direct to the eountries concerned by Post Office links, both cable and radio, for broadcast by local transmitters.

In each case the broadeast was made up of two main parts, one the coronation ceremony in the Abbey, and the other the eommentaries, with appropriate background of effeets, from various points on the route to and from the Abbey.

For the Home Service it was desired—for programme rather than technieal reasons—to retain eontrol of the whole day's broadeast at one central point from which direetions and advice eould be given by the programme produeer throughout the broadcast. The mixing and control arrangements at the Abbey itself (in the head verger's room) were therefore extended to cover both the ceremony in the Abbey and the contributions from the commentary points on the route.

For Home Service listeners there was one commentary position in the Abbey, one in the Abbey Annexe and nine at various points on the route, including one in the Inner Court at Buekingham Palace.

For oversea broadcasting the commentators were grouped at four main observation points on the route, namely the Colonial Offiee site opposite the entrance to the Abbey Annexe (26 commentary positions), Trafalgar Square (27), Victoria Memorial (24) and Stanhope Gate, Hyde Park (7). At each of these points it was necessary to construet temporary huts to house the assoeiated control positions. At the Vietoria Memorial there were two such huts, one at Canada Gate handling 11 oversea commentary positions as well as the Home Service commentary position, and the other on the opposite side of the Memorial behind a Ministry of Works stand, whieh handled the remaining 13 oversea eommentary positions.

Each broadeast for overseas ineluded the Abbey ceremony, of course, and, in the majority of cases, commentaries from the first three, or all four, of the points named. All included the Colonial Office site, which was therefore made the central mixing point for each of these services.

There were a few isolated commentary positions at some of these sites which were connected direct to the broadcasting centre where the recording channel was located, and not via the Colonial Office site.

To provide the necessary programme, cue and control circuits between the various commentary points on the route and to the broadcasting centres for distribution, the Post Office installed 1,040 circuits, the general routing of which is indicated in Fig. 2.

### The Abbey Ceremony

Twenty-eight microphones were installed in the Abbey, as shown in Fig. 3; Table 1 indicates the purpose of each and Fig. 4 indicates how inconspicuously they were mounted. The music microphones for orchestra and choir were of the new B.B.C. design of ribbon microphone, but all the others were of the moving-coil type. Many of the latter were fully concealed or camouflaged, and were therefore surrounded closely by objects which altered their frequency response; appropriate electrical correction, as judged aurally, was therefore applied, being generally of the order of a 6-db cut at 100 c/s rising to a 4-db lift at 5,000 c/s, relative to 1,000 c/s.

When running cable to the microphone points within the Abbey it was required that no attachments of any kind should be made to the fabric of the building, save such as could be removed without leaving any permanent marks. This involved the use of clamps and ties of various descriptions in place of the more usual nails, screws, cleats, etc. Moreover, since microphone circuits of necessity use single-pair lead-covered cable, the long and awkward runs of cable for all purposes were a feature not encountered in normal installations. The final positioning of the wiring was particularly difficult in the vicinity of the altar, where microphones had to be sited within extremely narrow limits to avoid excessive background noise and pick-up from the public-address system. Another consideration was the need for so fixing the wiring and suspending the microphones that they would not obstruct the operation of film and television cameras.

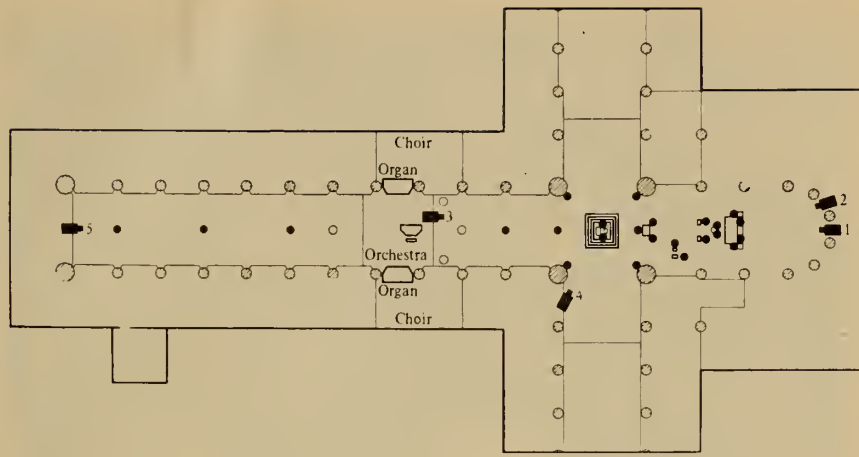


**Fig. 3. Location of microphones and cameras in Westminster Abbey.**

Television cameras ○ Ribbon microphones (No. 4, 5, 6, and 9) ● Moving-coil microphones

### Table 1
#### Location of Microphones in Westminster Abbey

| Microphones | Location and purpose |
|---|---|
| 1, 2, 3 | Nave processional microphones; suspended from triforium approximately 20 ft. above floor level. |
| 4 | Trumpet fanfares, general orchestra and choir, and general atmosphere; suspended from triforium approximately 35 ft. above floor level. |
| 5, 6 | Primarily main choir pick-up; suspended from triforium approximately 30 ft. above floor level. |
| 7, 8 | Choir processional and clergy responses; suspended from triforium, No. 7 approximately 20 ft. above floor level and No. 8 approximately 20 ft. from lantern flooring (enthronement area). |
| 9 | General music (orchestra and choir); approximately 50 ft. above choir-floor level. |
| 10, 11, 12, 14 | Recognition microphones; mounted in masonry crevices. |
| 13 | Point not used. |
| 15, 16 | Delicately concealed and mounted on top of each of the front legs of the homage throne. |
| 17, 18, 19 | One microphone on each ornamented base support of the front legs and one on the apex of King Edward's chair. |
| 20, 21 | Chair-of-estate faldstool; one facing outwards towards the theatre approximately 2 ft. above floor level and camouflaged behind silk covering; one below the kneeling cushion support and facing Her Majesty. |
| 22, 23 | Altar faldstools; one facing the altar in each faldstool approximately 2 ft. above floor level and camouflaged behind silk covering. |
| 24, 25 | Supported by candelabra facing the altar, for addresses, prayers, etc.; approximately 12 ft. above floor level. |
| 26, 27 | One on southern candlestick and one on northern candlestick; approximately 4 ft. above floor level and oriented towards candelabra for prayers, responses, etc. |
| 28, 29 | Concealed behind altar plate; for prayers, blessings, etc. |

The reconciliation of all these unusual requirements was an exceptionally difficult process.

All these microphones were connected to mixers at the central control point (the head verger's room), where a careful selection was made throughout the ceremony, the operator being assisted in this by being able to watch the ceremony on a television screen. The output from these mixers was passed through a standard B.B.C. outside-broadcast amplifier, which includes both a volume-control potentiometer and a volume indicating meter. The output of this amplifier was fed through trap valves to several destinations, to provide feeds respectively for the low-intensity loudspeaker system (over 200 loudspeakers) in the Abbey itself, for the public-address loudspeakers on the processional route and for newsreel film companies, etc., as well as for all the sound services (Home and Overseas) and for television. The only difference so far as the television service was concerned was that, in addition to receiving a feed of the whole of the ceremony from the sound service (clear of any commentary), they were given a split feed off two of the key microphones, one in the nave and one on the homage throne, to provide an independent pick-up when they found it more appropriate.


Fig. 4. View of Westminster Abbey from the triforium, near No. 2 camera position, showing some of the camera and microphone points and part of the special lighting.

#### Home Service Arrangements

The Home Service control position was also in the head verger's room and had available, on the associated mixers, outputs from the Abbey ceremony position described above, from the two commentators in a soundproof cubicle at triforium level in the Abbey, who respectively set the scene and read the rubrics for the benefit of listeners, from a commentator in a room overlooking and soundproofed from the Abbey annexe, which was the assembly point preceding the ceremony, and from the commentators at the nine points on the route (Fig. 5). Each of these commentary points was connected to the Abbey control room by three lines, one carrying the contribution from that point, one carrying the full mixed output (Home Service) back for cueing purposes and the third for normal telephone communication whereby the technical operators at the respective control positions could speak to each other; alternatively, the line could be extended at each end for the commentator or his assistant to talk to the programme producer in the Abbey control-room. The producer was also provided with a talk-back unit, whereby his talk-back microphone could be connected, via an amplifier and by selection of the appropriate key, to one of these cue lines in place of the normal programme, his headphones simultaneously being connected, via an appropriate attenuator and amplifier, to the incoming contribution line. By keeping each of these contribution lines continuously open (control amplifiers at the points concerned faded up), the producer had an easy and quick means of 2-way communication with each point for use when the point concerned was not actually broadcasting. Even during a broadcast he could use the facility for passing on urgent messages to the commentator's assistant, who would be listening on this cue line. A master key on the unit gave facilities for talking to all points simultaneously for general briefing when none of the nine points was broadcasting.

#### Standby Provisions

Very comprehensive safeguards were provided against possible failure of the Home Service at any point in the chain. All commentary microphones and circuits and all control amplifiers were duplicated, the latter being provided with standby battery supplies—which is a normal feature on all outside sound broadcasts. To guard against the failure of any of the circuits from the commentary points to the Abbey control-room, each point also fed the programme via a separate circuit direct to Broadcasting House, where it appeared on a mixer; this effectively duplicated the one handling the Home Service in the Abbey control-room. The output from the Abbey itself was also fed to Broadcasting House on a standby circuit and, as a final precaution, it was also sent via a short-wave radio link from a low-power transmitter mounted on the roof of Westminster Abbey and picked up on a receiver on the roof of Broadcasting House. An operator at the mixer in Broadcasting House continuously shadowed the mixer at the Abbey, and both outputs were made available to both the Home Service and Light Programme continuity rooms in Broadcasting House, from which the full networks of transmitters in this country are fed. The general arrangements at the Abbey are shown in Fig. 5.

#### Oversea Broadcasting

As mentioned in Section earlier, the central mixing point for each of the oversea networks was at the Colonial Office site. There were 26 such central control and mixing positions, apart from the one for the Home Service contribution from this point and another for the general-effects microphones. The output from the latter was distributed to the other positions and was attenuated at each position to a level suitable for mixing as a background to the commentator's microphone. The 28 control positions were installed in a temporary hut, 90 ft. x

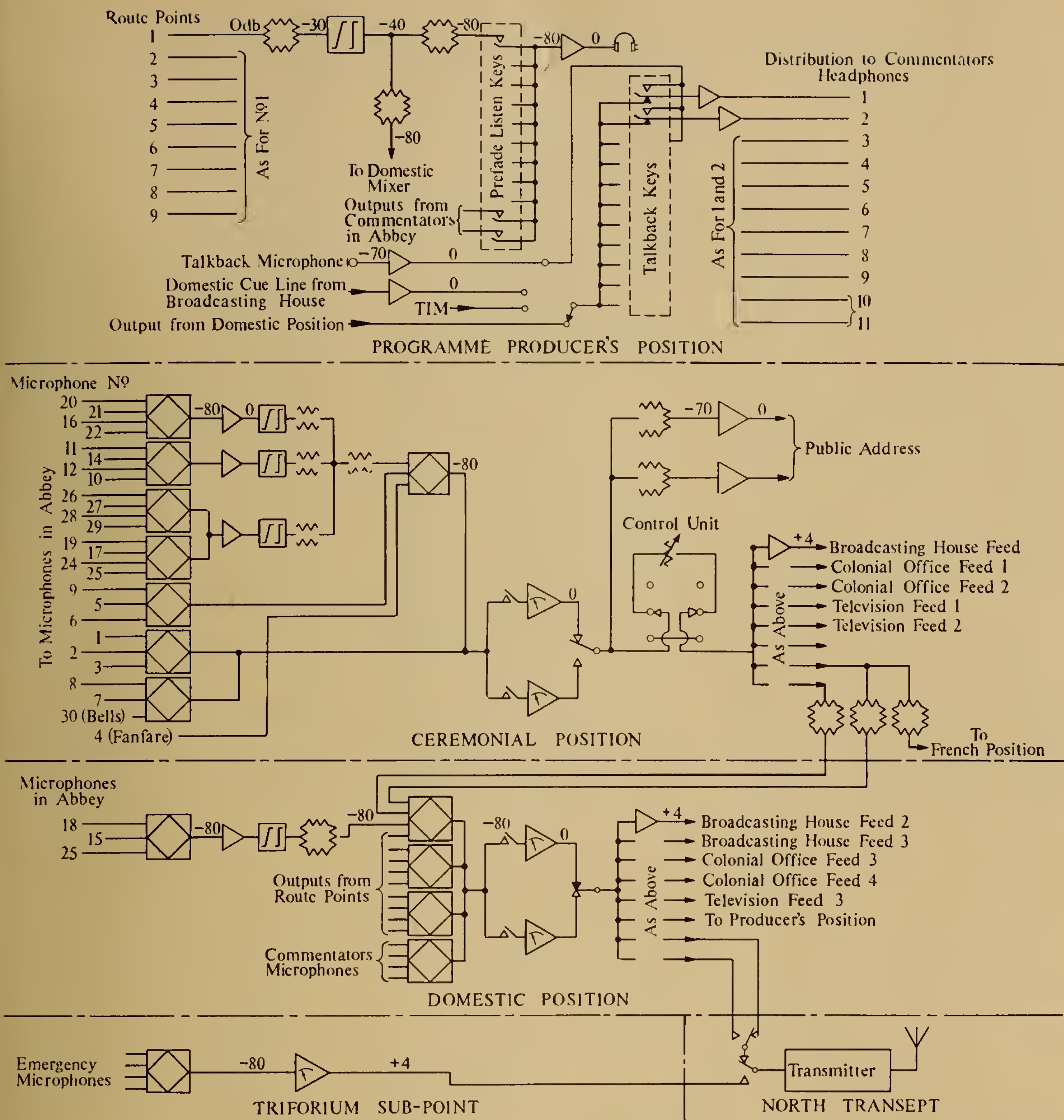


**Fig. 5. Arrangements at Westminster Abbey.**

Four-channel mixer — Control amplifier with programme meter

**Route Points:**
1. Buckingham Palace
2. Canada Gate
3. St. James Palace
4. Trafalgar Square
5. Playhouse Theatre
6. Colonial Office
7. Stanhope Gate
8. Marble Arch
9. Piccadilly Circus
10. and 11. Abbey commentators

Approximate programme volumes are indicated in decibels relative to standard reference level (1 milliwatt into 600 ohms.)

20 ft., at the rear of one of the public stands. Each technical operator at an oversea control position had with him a programme assistant who spoke the language of the country concerned. Fig. 6 shows the general layout of one of these control positions.

Each position fed the mixed output back to the headphones of each commentator contributing to that service. A talk-back microphone was available at the control position for the programme assistant so that he and all the commentators on his network could talk together over their respective microphones before the broadcast began, to make any last-minute arrangements.

For direct oversea transmissions, circuits were provided to the continental trunk exchange and to the radio transmitter terminal via Bush House (B.B.C. Centre). The majority of these were programme circuits and therefore required a frequency band from 50 to 8,00 c/s, and their routing required special care. In all, about 75 circuits were concerned in oversea transmissions.

Since there were to be about 12 programme circuits to the Continent, all being set up simultaneously and routed to various cities on the Continent, many of them following the same route through a number of exchanges, it was thought advisable to make special arrangements to help the Post Office and other engineers *en route* to ensure that the respective circuits reached their correct destinations. For this purpose, disc recordings were made beforehand for each destination concerned, with a phrase such as "This is the B.B.C. circuit to Norway" repeated in the language of each country through which the circuit passed. This disc was played on an automatic repeating gramophone turntable and the output was fed via the spare control amplifier to the appropriate line for about an hour before the broadcast. This left the main control amplifier still available for last-minute briefing and tests, etc. For the American broadcasting companies special facilities were provided, at their request, whereby their New York headquarters could talk only to the producer at the central control position, and the producer could talk to the commentators while listening on the circuit from New York, with New York hearing this local discussion. For this purpose the producer was provided with facilities for switching his talk-back microphone either direct to New York, via the spare amplifier, or in parallel with the commentators on the main control amplifier, the earpieces of his headphones being separated so that one was connected to the incoming circuit from New York and the other to the output of the amplifier through which he was speaking. In this way over-elaboration of the equipment was avoided and the basic standard arrangements of apparatus were retained.

### Commentary Positions

All commentators used a lip microphone of the type which was first developed by the B.B.C. Research Department in 1937; it permits commentators to stand side by side, but not less than 4 ft. apart, without any danger of mutual overhearing. At the Colonial Office site, therefore, it was possible to have one line of 27 commentators talking simultaneously.

In every case a spare microphone circuit was installed. At each of the 11 commentary points on the route and in the Abbey contributing to the Home Service, a spare microphone was also installed, but in all other cases at each site one spare plug-in microphone was provided for every four or five commentary positions. In addition, each commentator had a communication unit which gave two-way light signalling with the technical operator at the local control position, and telephone communication, and also provided a choice of two programmes on his headphones, one of which was that on the network to which he was contributing and the other the Home Service programme whereby he could keep in touch with what the commentators on the latter were saying. At the Home Service commentary positions both feeds were of the Home Service, but one was 10db above normal to permit a commentator to listen at the higher level for his word cue when the crowd noises in his vicinity were particularly loud.

To meet these requirements, three separate cables were provided to cover the microphone, the spare microphone and the cue and control circuits, and where a number of commentator positions were concentrated the total number of the three types of circuit were arranged in three multi-core cables to a termination point central to the

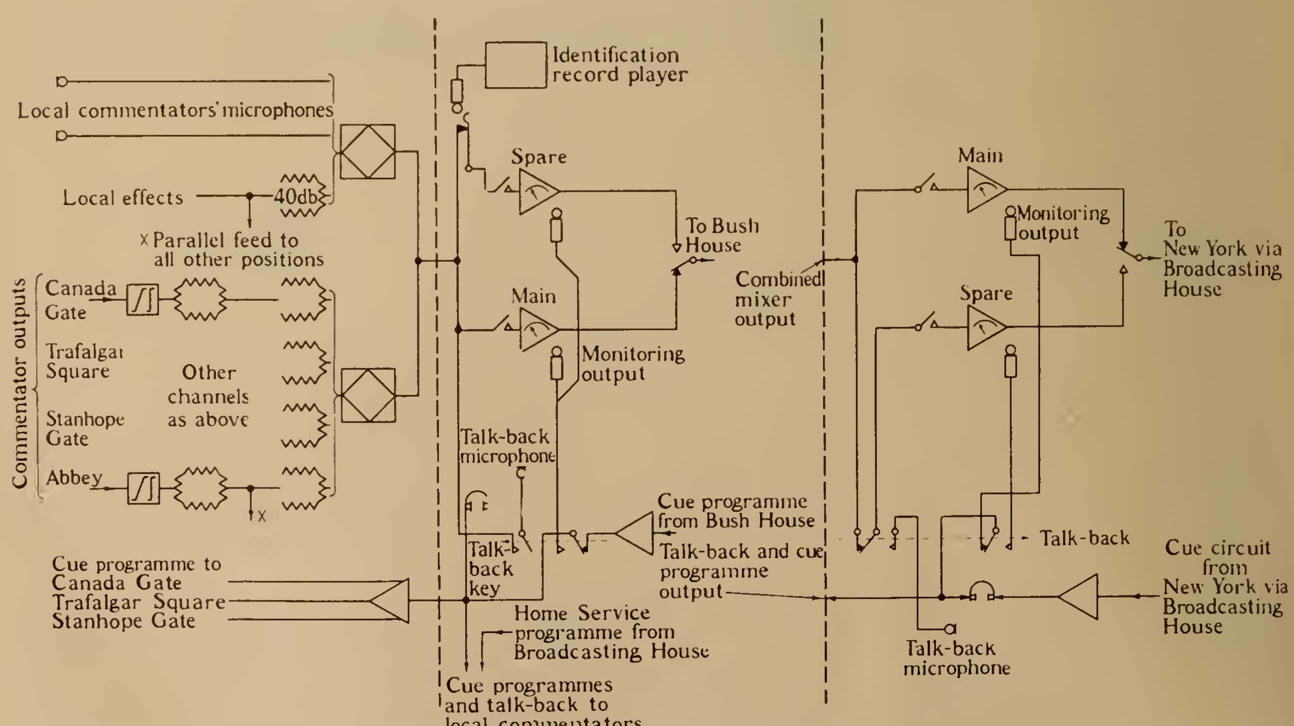


**Fig. 6. Overseas control positions at Colonial Office site.**

Four-channel mixer — Control amplifier with programme meter commentators' positions, whence two single-pair cables and one 7-pair cable served each position.

Finally, since it was not possible, other than for the French network, to accommodate any oversea commentators in the Abbey, they were helped to cover the ceremony in their own language by being provided at the Colonial Office site with a television screen each. This, coupled with the facility of listening to the Home Service, was undoubtedly of great assistance to them.

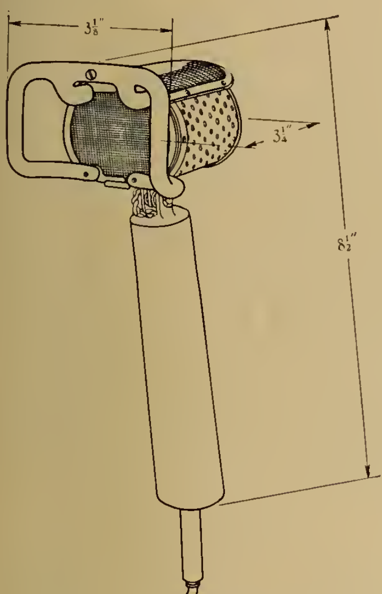

Fig. 7. Lip microphone.

### Lip Microphones

The type of lip microphone used was specially designed for commentators broadcasting in difficult conditions where extraneous unwanted sounds are so loud that the commentator would scarcely be heard if a normal type of microphone were used. It consists of a miniature ribbon microphone mounted in a protective case with a handle, the latest model being shown in Fig. 7. It exploits two characteristics of the pressure-gradient microphone, namely a figure-of-eight response characteristic—i.e. it is insensitive to sound arriving from the sides—and a great exaggeration of low frequencies for close-up speech.

In the lip microphone there is a mouth guard-ring which, for correct use, must rest on the lips of the commentator. The ribbon is then about 2½ in. from the mouth, and this, in a normal microphone of the pressure-gradient type, would result in exceedingly boomy speech quality; in fact, there would be an increase of about 20 db at 100 c/s compared with higher frequencies. However, in this lip microphone, partly by the use of silk-gauze screens in the protective case acting as an acoustic resistance and partly by an electrical network, the low-frequency rise is equalized. By acoustic screens, protection from wind noises is also obtained. The low-frequency components of sound originating from sources at least 2 ft. away from the commentator are greatly attenuated. By these means it is possible for a commentary to be given under conditions of very loud ambient noise.

### Recording

The recording of the coronation broadcasts for the purpose of repeating the events of the day in programmes to all parts of the world and for their preservation in the B.B.C. archive library was an operation which used all the B.B.C. recording resources. There were times on Coronation Day when 58 recording channels—47 disc and 11 magnetic tape—were in simultaneous use.

More than 20 recorded programmes, on 2,400 16-in. pressings, to explain the ceremony which would take place on June 2nd, had been sent to many parts of the world by the B.B.C. transcription service several months in advance. These were followed on the day itself by recordings of the Abbey ceremony which were flown to Canada, Australia, Bermuda, Fiji, Hong Kong, Malta, the United States, Tanganyika, Mauritius, Ceylon, Burma, Lebanon and South Africa, the first recordings being used in Canada and the United States on the evening of Coronation Day.

Because of the need to select with great speed comparatively short extracts from the long broadcast for subsequent B.B.C. programmes, the bulk of the Coronation Day recordings were handled on discs, and on this day more than 3,700 disc records were made. In addition, 85 miles of tape were recorded.

Some commentators from abroad brought their own recording equipments; the B.B.C. undertook the servicing of these, as well as the editing and dubbing of recordings made on them.

The selection and processing for permanent retention of recordings of the broadcast and of events leading up to it is still in progress at the time of writing the paper. When this task is finished, a valuable addition to the sound archives of the B.B.C. will have been made, not only for use by the B.B.C., but for the benefit of posterity.

## Television

### Outline of Arrangements

Like the sound broadcast, the television broadcast fell naturally into two sections, namely the ceremony inside the Abbey and the processions outside. In the matter of equipment and staff, however, the two services were very differently situated. A sound outside-broadcast (o.b.) unit nowadays costs about $1,000 and is operated by one or two men, whereas a television o.b. unit (mobile control room, cameras and sound equipment) costs about $50,000 and requires a technical team of ten men. It follows that, whereas it is economically practicable for a broadcasting organization to keep a stock of sound units over and above those required for normal operation, the same does not hold good in television.

Consequently, in planning the television coronation broadcast, careful thought was needed to make sure that o.b. units were withdrawn from their normal activities for the minimum period only, otherwise it would be impossible to handle many of the other important outside broadcasts both immediately before and after Coronation Day.

At the time, the B.B.C. possessed six television o.b. units, three normally based in London and one each at Glasgow, Birmingham and Bristol. It was decided at an early stage of the planning that all these would be needed for the coronation broadcast, and although at that time it was uncertain whether cameras would be allowed inside the Abbey, two units were allocated for this purpose, the remaining four being destined for separate points on the processional route. This was the plan finally adopted from the moment when permission was given to transmit the Abbey ceremony by television.

Each of the five control points (one at the Abbey and four on the route) was connected by cable to Broadcasting House, where a temporary television central control room had been installed, and this was the focal point throughout the day's broadcast.

Unfortunately, the rain which fell during most of Coronation Day reduced the clarity of outside pictures and particularly marred the wider scenes and distant views, such as that of the Mall from the roof of Buckingham Palace. By careful selection of those cameras giving the clearer pictures and the avoidance of too wide or too distant shots, it was possible to conceal the worst effects and to maintain a reasonable standard of quality.

Reserve arrangements for vision equipment on the scale provided in the sound service were out of the question. All vital items and links were duplicated, however, and, in particular, camera positions were so planned that had any one camera channel failed, the same scene could have been picked up, though perhaps not so effectively, by another camera in the same group.

The programme was broadcast by all existing television transmitters in France, the Netherlands and Western Germany, while in North America, recordings made by the B.B.C. as well as by Canadian and American broadcasting organizations were extensively used on Coronation Day and the succeeding days.

## Westminster Abbey

### *General.*

The equipment from the two mobile control rooms allocated to the Abbey was installed in a temporary hut erected outside the east end of the Abbey, alongside the King Henry VII Chapel, and amalgamated to form one composite control point. The cables to the cameras and other equipment inside the building had to be laid or suspended with the utmost care. Several circuitous routes were followed, and, allowing for duplicate cables to each camera, about 6,200 ft. of camera cable was installed, in addition to some 9 miles of other cables for communication and subsidiary purposes.

### *Camera Positions.*

The principal problem was that of the selection of camera positions which would give the required variety of views, be acceptable to the Earl Marshal and other authorities, and fit in with the space requirements of many other operators, such as B.B.C. sound broadcasting, newsreels, colour films, and others. Despite the compromises necessary in such circumstances, the B.B.C. had finally some excellent viewpoints. Fig. 3 shows the positions of the five cameras inside the Abbey; their effectiveness can also be judged by comparison with Fig. 4.

At cameras Nos. 1, 2 and 5 the operating boxes were so cramped that the cameramen had insufficient head-room, even when sitting, the maximum height being four feet; in one case the viewfinder fouled the roof and had to be removed and placed on the floor to one side. The cameraman attending No. 3 camera was so hemmed in by the orchestra that he could not stand in his normal position behind the camera but was obliged to stand to one side and to squint edgeways into the viewfinder. These and other limitations taxed the ingenuity and ability of the operators to the utmost. With the exception of No. 3, all cameras and cameramen were invisible to those present inside the Abbey.

### *Lighting.*

The special illumination of the principal areas concerned, i.e. the "theatre," choir and nave, was installed by the Ministry of Works; it consisted largely of about a hundred and twenty 1-kw. lamps mounted some 60 ft. above the scene and beaming vertically downwards. About 60 kw. of subsidiary lighting was disposed at lower levels (see Fig. 4).

Thus all the lighting was directly overhead—an arrangement which normally would not be considered photographically ideal. However, the light was "soft" in character and there was appreciable upward reflection from the carpet, so that the general effect was fairly acceptable; in any case, any other style of lighting involving lower-positioned lamps was out of the question for a setting in which participants, onlookers and cameras were at one time or another facing almost every angle of a full circle. The intensity of reflected light was higher than would have been necessary for television, having been prescribed by the needs of newsreel and colour-film cameras. Television benefited from this to some extent by the ability to stop lenses down to apertures of the order of $f$6.3, thus improving definition and depth of field, and also by the partial over-riding of the brilliance of certain naked lights, candles on chandeliers, which otherwise would have caused an excessive contrast range.

## Processional Route

Four mobile control rooms were disposed along the processional route at the points shown in Fig. 1. Point 1 ensured views of the procession, carriages and personages arriving at, and departing from, the Abbey (and entering and leaving through the Annexe). Two cameras were mounted in the Ministry of Works grandstand—one of them about 12 ft. above road level—to

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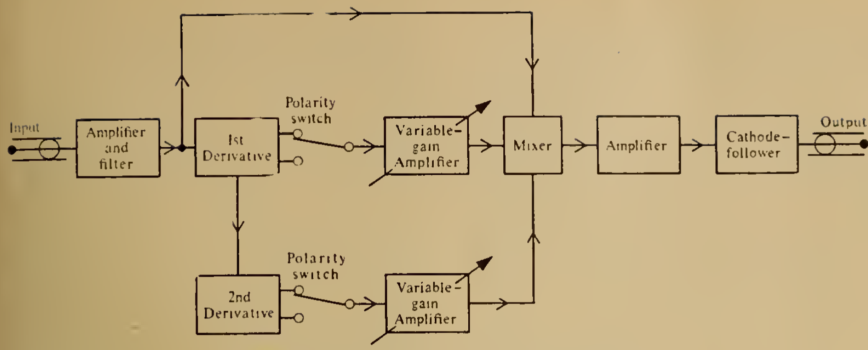


**Fig. 8. Variable derivative equalizer.**

take views through coach and carriage windows. The contents of the mobile control room had been installed in a temporary hut behind the stand, which was connected to these cameras by a few hundred feet of standard camera cable, but two other cameras associated with this control room were too remote to be linked to it in the normal way, and for these it was necessary to install the respective control and amplifying equipment close to each camera and then to carry the video output signal (at 1 volt d.a.p., i.e. standard level) by equalized telephone line provided by the Post Office. One of these cameras was installed on a platform outside a sixth-floor window of Abbey House, at the corner of Tothill and Victoria Streets, and commanded views not only of the west front of the Abbey but along Victoria Street and past the Abbey into Parliament Square. The second of these "remote" cameras peered through a small rectangular aperture let into the wall of the Annexe and only 10 ft. or so from the Royal entrance, this being used for intimate glimpses of Her Majesty's arrival and departure.

Point 2 was on the route of the procession to the Abbey only, and two cameras were supported by a 10-ft. scaffold platform erected on the pavement. A third camera associated with this group was installed on a 50-ft. launch which cruised on the river nearby and from which pictures were sent to the mobile control room by a portable v.h.f. (approximately 200 Mc/s) transmitter. The control vehicle was drawn up on the pavement against the river wall.

Point 3 was of great importance, since it covered the whole of the procession departing from and returning to Buckingham Palace. Victoria Memorial was taken over by the Ministry of Works, who provided stands for newsreel, press, sound broadcasting and television. Four camera positions were secured—one facing the Mall, one facing Buckingham Palace (with a clear view of the balcony) and two spaced intermediately on either side; the latter were used by one camera only, which was moved from the north side to the south side during the long interval between the departing and returning processions. The mobile control equipment for this site was removed from the vehicle in which it is usually operated and installed in a room provided by the Ministry of Works underneath the temporary stands. There were two other cameras associated with this unit, both of which were within the precincts of Buckingham Palace. One was in the main forecourt, just inside the front railings and hidden by one of the piers supporting the central gates; this covered the procession as it crossed the courtyard diagonally between the central archway of the Palace (leading through to the inner quadrangle) and the south gateway. The other camera was on the north-east corner of the roof of the Palace and commanded views over a wide arc, including the whole of the processional route along the Mall as far as Admiralty Arch. This camera was treated as a "remote" unit, with its control equipment installed in a top-floor room of the Palace and the video connection to the Victoria Memorial by Post Office telephone line, but the camera in the forecourt was connected direct by its own cable via an existing 6-in. underground duct which fortuitously crossed the road and broke surface close to the operating points at either end.

Point 4, in Hyde Park, was carefully selected to be about 100 yd. in advance of the head of the main return procession as it was formed up along the two miles of route back to Westminster Abbey. Thus, as soon as the procession began to move and the Queen left the Abbey, it was possible to switch over to Hyde Park and see the whole procession steadily through from beginning to end. Three cameras were installed on two tiers of a 12-ft. scaffold platform built on the grass alongside the pavement. After one or two obstructing tree branches and decorative banners had been displaced these cameras secured unobstructed views of the procession, both approaching and receding. The mobile control room was drawn up on the grass, directly behind the camera platform.

### Camera Tubes and Lenses

All cameras used the image orthicon type of pick-up tube. One camera in each group employed a 5:1 zoom lens[1] (in the Abbey, this was the camera over the west door), most of which had been received from the manufacturers only just in time for the event. Some of these were of a new two-range type with preselected ranges of focal length, either from 3 to 15 in. or from 6 to 30 in.

Long-focus lenses were used extensively, the most important example being the camera on the Victoria Memorial that secured close-ups of the Buckingham Palace balcony scenes. For this purpose, a double-folded 40-in. lens provided a horizontal viewing angle of only 1¾°, so that, although the object distance was 300 ft., the width of the screen was filled by about 9 ft. of the balcony.

### Camera Equalization

Eighteen of the 21 cameras were equipped with a new type of variable equalizer, primarily to compensate for the loss of resolution caused by deficiencies in the optical and electro-optical elements of the camera. It is convenient to classify all such losses under the heading "aperture distortion," since, in common with the distortion caused by a scanning aperture, the attenuation/frequency characteristic is not necessarily accompanied by phase distortion. Thus, while aperture effects may be partially compensated by means of a "top boost" circuit, [2–4] the phase characteristic of the circuit employed must be corrected if satisfactory equalization is to be achieved.

A further complication arises with the image orthicon camera tube in that the resolution of the target is affected by temperature, so that the characteristic required to compensate for loss of definition due to this needs to be variable. The form of equalizer used, which has been termed a "derivative equalizer,"[5] fulfils the requirements that attenuation may be compensated without affecting phase, and that the equalizing characteristic is continuously variable. It operates by virtue of the fact that almost all linear systems permit of equalization by adding to the response its successive derivatives or integrals with respect to time, each having the appropriate amplitude and sign.

This is true whether or not the system can be represented, by analogy, by a realizable electrical network, the only proviso being that it must be of the minimum-phase class. For the low-pass characteristic of a scanning aperture, only derivatives need be added; furthermore, if phase distortion is not present, only even-order derivatives are required.

For aperture correction it is found that subtraction from the response of the second derivative gives approximately the required characteristic. The equalizers used, however, included the additional facility of adding or subtracting the first derivative, since this affords some adjustment of the phase characteristic, which is often desirable to compensate for asymmetrical features of image orthicon target-redistribution effects.

A block schematic of the complete equalizer is shown in Fig. 8. Each derivative generator comprises a pentode with an open-circuited transformer in its anode circuit. The voltage developed across the transformer mutual inductance is thus the derivative of that applied to the pentode grid. The use of a transformer facilitates changing the polarity of the derivatives, which may either be added to, or subtracted from, the video signal. The two amplifying stages incorporate variable-mu valves, so that the gain of each may be adjusted independently by variation of grid bias to permit remote control of the equalizing characteristic from a position near the camera control unit where space is limited. The remote-control boxes are, in fact, only a few cubic inches in volume, each containing the two potentiometers which control the amplitude of the first and second derivatives, respectively, and a switch enabling a rapid comparison to be made of the picture with and without equalization. In order to prevent the equalizing characteristic from rising beyond the working frequency band, thereby reducing the signal/noise ratio, a low-pass phase-corrected filter with a cut-off frequency of 3 Mc/s is included in the unit.

An equalizer as described was installed in the camera channel between the camera head-amplifier and the first stage of the main amplifier in the camera control unit. In this position equalization was applied only to the video signal, and not to the synchronizing signals, which would have suffered distortion in the form of severe overshoots.

Operationally, the unit is simple to use and may be adjusted on a trial-and-error basis while viewing the picture. By adjustment of the second derivative the definition may be improved to a point where symmetrical overshoots are becoming obvious. Any residual asymmetrical defects may then be reduced by adjustment of the first derivative, the sign of which will depend upon the actual form of asymmetry. A limit to the degree of equalization is naturally set by the camera signal/noise ratio, but, because the noise spectrum associated with the image orthicon output signal is uniform and not triangular, it is usually possible to introduce about 10 db of equalization without a serious increase in the subjective annoyance of the noise.

#### Picture Synchronization

An operational feature not previously used in this country was the phase-locking of the frequencies of the frame waveforms from all cameras and sources, thus ensuring vision switching unaccompanied by any loss of frame synchronization. The cameras associated with any one mobile control room normally share one waveform generator; hence they are automatically phase-locked and there is no loss of synchronism when switching or fading from one to another. When changing to cameras from another source, fed by another waveform generator, the phase relationship, unless specially controlled, will be random. Generally this is of little consequence, since changes between sources, e.g. studio to o.b. unit to studio, are at relatively long intervals and one frame slip per programme (i.e. at the beginning and end only) would not be serious. But for the coronation o.b. the situation was quite different: with no fewer than five sources (and three "remote" cameras presenting an exactly similar problem) and quite rapid interchanging at certain periods, it was felt desirable to take steps to prevent any such disturbance or distraction as might otherwise have been caused by momentary frame-slipping.

Equipment was accordingly installed in the television central control room to overcome this. It included a master pulse generator producing, amongst others, a pulse at line frequency (10,125 c/s), which, by means of a conventional divider chain and reactance valve, is made proportional to the frequency of the supply mains. The fundamental 10,125-c/s sine wave is extracted from this signal by a suitable filter, is amplified and applied through a 90° phase-splitting network to the quadrature coils of a goniometer. In the goniometer a rotatable search coil derives from the field produced by the quadrature coils a 10,125-c/s voltage at any desired phase with respect to the ingoing signal. If the search coil is rotated by a complete revolution, there is a phase change of 360°, in advance or retard depending on the direction of rotation.

The 10,125-c/s signal from the search coil is passed by telephone line to the camera point, where it is used to lock the local camera waveform generator. The composite picture and synchronizing signal, after being passed over the link back to the central control room, is then compared in timing with the master waveform on a double-beam oscillograph.

Rotation of the goniometer can now be used to advance or retard the timing of the remote camera signal until it matches with the master signal. For each complete rotation of the goniometer a change of timing of one whole line occurs. If the need arises, therefore, the timing can be adjusted so that the signals are accurately in synchronism with regard to frame and line frequency signals, and also with respect to interlace, if desired.

A separate goniometer was provided at the central control room for each camera source used.

#### Sound

Throughout the broadcast the sound accompaniment of the pictures consisted of two parts commentary and "effects." For the broadcast within Great Britain these two ingredients were suitably combined in the control room of each main camera group and the composite sound was passed to the Central Control point at Broadcasting House. All commentators used lip microphones of the same type as those used by sound-service commentators and, in accordance with established practice, each had in front of him a television screen on which he could see the pictures being fed from his mobile control room to the central control point. The effects at some of the positions (including, of course, the Abbey) were shared between the sound and television services. In the Abbey, the television commentator occupied a soundproof box near the cameras in the triforium.

To meet the needs of the continental countries which were relaying the broadcast, a continental television control point was set up in a studio in Broadcasting House, which was the focal point for all television sound circuits associated with those countries.

For the French television service, complete coverage of the day's events was achieved by placing French commentators at three of the four television points on the route and by arranging that the French commentator in the Abbey should speak for the television as well as for the sound audience. Each of these commentators spoke into a lip microphone, and on a television screen in front of him he could see the picture leaving his own camera point. The outputs of these four microphones were fed to the continental control point for mixing, and from there were fed to Paris. Independently, the "effects" from the four points were fed to the same control point for mixing, which was performed by a French engineer. Thus the complete French commentary and the corresponding "effects" were fed to Paris on two separate lines, the two being combined in Paris.

For the Netherlands and Germany a less ambitious arrangement had to be adopted. "Clean" effects,

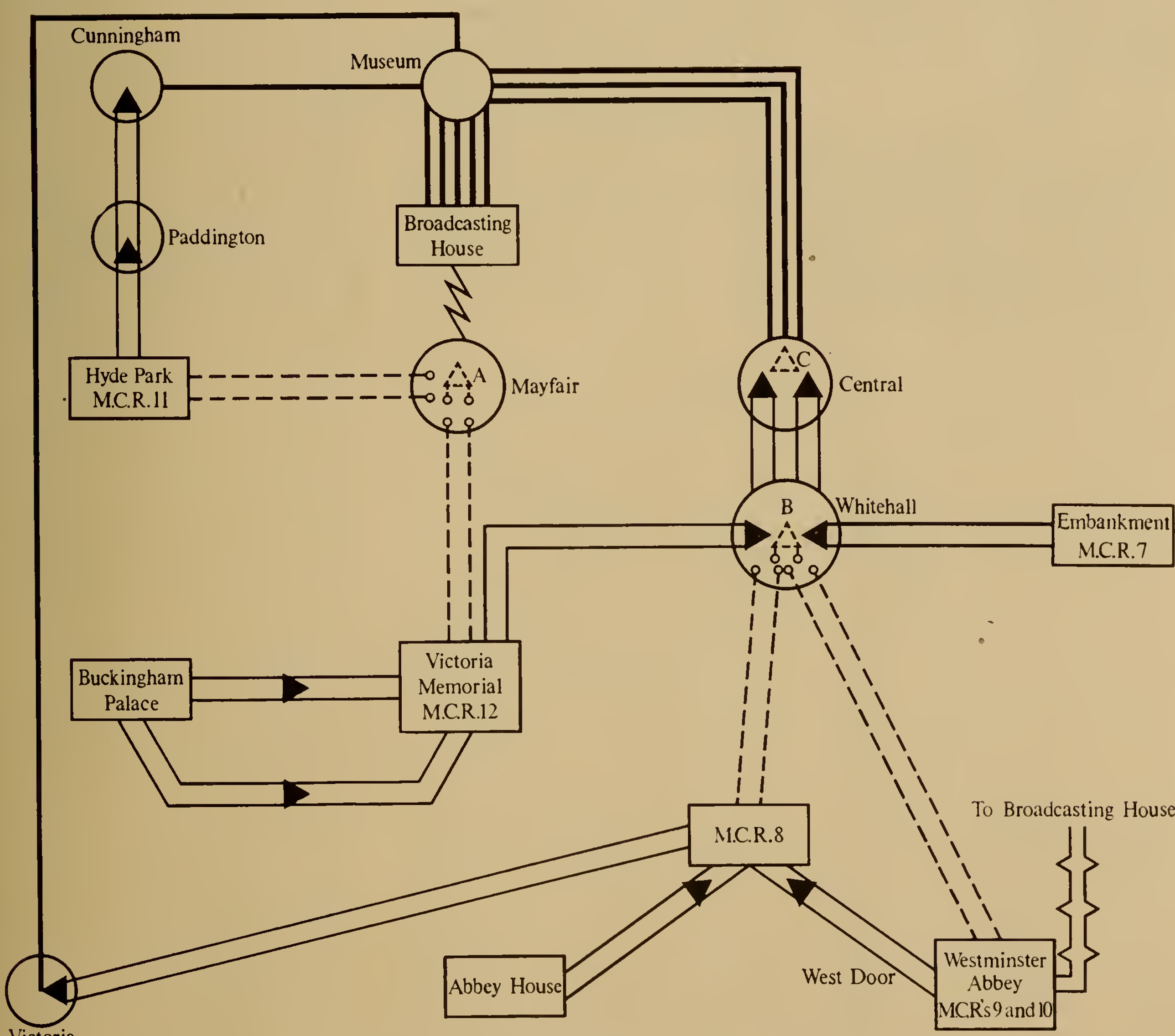


**Fig. 9. Television land lines and video repeaters.**

| | | | |
|---|---|---|---|
| ◯ | Telephone exchange | | Balanced-pair cable |
| —— | Coaxial cable | | Reserve video repeaters |
| ═══ | Telephone cable pair | ▶ | Main video repeaters |
| ==== | Reserve circuits | M.C.R. | Mobile control room |

as fed to France, were fed also to these countries and, on a second line, the English commentary for cueing purposes. The Dutch and German commentators, who had been in London for several days previously for briefing, were back in their home countries on June 2nd, the Dutch commentators at Bussum and the Germans at Cologne. In each case the commentators were in sound studios, and while viewing the pictures superimposed their own commentary in the local language on the clean effects received from London, at the same time listening on headphones to the English commentary. So far as is known, this was the first time that this technique had been used, and it appears to have proved effective in both countries.

### Transmission

The vision transmission from the Abbey required the exclusive use of the special television balanced-pair cable originally laid in 1937 shortly before the coronation of King George VI. This cable now forms a main link to Broadcasting House for outside broadcasts from many points in the West End of London. The four other main circuits into Broadcasting House had therefore to be planned without using this cable. Several coaxial cables used for television outside broadcasts were available at points within the vicinity, and these were extended over ordinary telephone cables [6], [7] to the remaining four control points so that they could form main links. The final arrangement is shown in Fig. 9, and it will be seen that in all these cases the vision links had to take circuitous routes to Broadcasting House.

Seven video repeaters were in simultaneous use for the broadcast, and, in view of the importance of the occasion, three standby repeaters were made available. Since movement of vehicles within the area was likely to be difficult after 6 a.m. on the day of the broadcast, it was problematical where best to locate the standby repeaters. The circuit from Point 2 on the Victoria Embankment would be used only for a short period when the procession passed from Buckingham Palace to the Abbey, and it was decided to close this circuit after the procession had passed until the late evening, when it would be required again for the firework display. This allowed the associated repeater and the main portion of the circuit from Whitehall exchange to Broadcasting House to be used as a reserve link during the whole of the broadcast. Two of the reserve repeaters were installed, as shown by the broken lines in Fig. 9, and this arrangement enabled them to provide standby facilities for five operative repeaters and four main circuits. The third standby repeater was held spare at Central exchange. The reserve circuits were brought into use in accordance with the sequence of use for the various main circuits.

When the Royal procession left Buckingham Palace, pictures were available in Broadcasting House from all outside broadcast sites, and, in addition, duplicate pictures were available from the Victoria Memorial via Mayfair exchange. When the procession approached Westminster Abbey, duplicate pictures from the Colonial Office site were made available by switching out the Victoria Embankment cir-

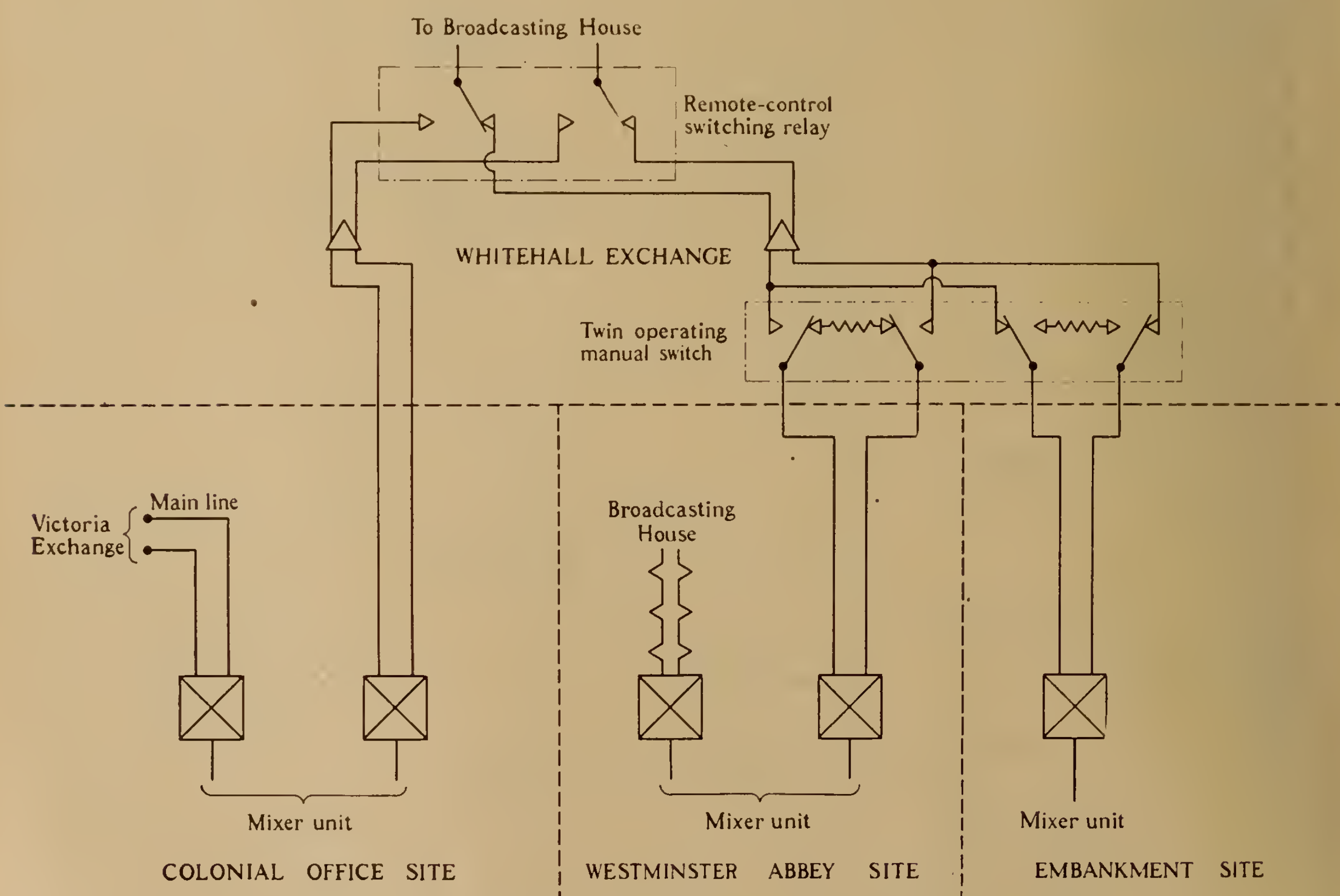


**Fig. 10. Remote-controlled switching arrangements at Whitehall exchange.**

☒ Unbalanced-to-balanced sender

### Table 2
#### Technical Features of Telerecording Equipments

| Recording authority | Film gauge | Location | System | Sound | Photographic process | Film standards | Processing |
|---|---|---|---|---|---|---|---|
| | mm | | | | | pictures/sec | |
| B.B.C. | 35 | Lime Grove | Mirror drum; continuous motion | Variable-area photographic | Negative to positive | 25 | Commercial laboratory |
| B.B.C. | 35 | Alexandra Palace | Suppressed frame; intermittent | Variable-area photographic | Negative to positive | 25 | Commercial laboratory |
| B.B.C. | 16 | Broadcasting House | Suppressed frame; intermittent | Variable-density photographic | Negative to positive | 25 | Commercial laboratory |
| N.B.C. | 35 | Blackbushe Airport | Fast pull-down; intermittent | Variable-density photographic | Negative only | 25 | High-speed machine integral with camera |
| N.B.C. | 16 | Blackbushe Airport | Fast pull-down; intermittent | Variable-density photographic | Negative only | 25 | Separate processing machine |
| C.B.C. | 16 | Alexandra Palace | Fast pull-down; intermittent | Variable-density photographic | Direct positive | 20 | High-speed machine integral with camera |
| C.B.S. | 16 | London Airport | Fast pull-down; intermittent | Separate magnetic tape | Direct positive | 20 | High-speed machine integral with camera |

cuit. Similarly, during the Abbey ceremony, duplicate pictures from Westminster Abbey were made available by switching at Whitehall. After the ceremony and the start of the main procession, duplicate pictures from Hyde Park and Victoria Memorial were arranged in turn. The change-over from one circuit to another, using the Mayfair repeater, required a change of equalization, but there was ample time between the uses of the circuits for this to be done. The change-over of the circuits at Whitehall had to be made quickly, and a remote-controlled switching relay was fitted at Whitehall (see Fig. 10) and operated from Broadcasting House.

#### Television Central Control Room

A television central control room was installed in Broadcasting House specially for this broadcast, and in it were terminated all the vision and sound circuits from the various sources. Here were displayed continuously, on separate screens, the pictures coming in from each source, so enabling the central producer to select the precise instant of switching from one scene to another. This vision switching was very simply carried out by quick-acting pushbutton switches, and the accompanying sound was faded over in the normal way. The producer was also able to speak by talk-back circuit direct to all his local producers at the camera points as well as to the commentators, thus ensuring full co-ordination of sound and vision between the various scenes and commentaries. The final composite programme emerging from this central control point at Broadcasting House was then fed into the British network, and the vision signals were sent simultaneously to the Continent.

#### Coverage in Great Britain

Every attempt was made to provide the maximum possible coverage within Great Britain for this supremely important broadcast. The first part of the B.B.C.'s post-war coverage programme, the erection of four high-power stations outside London, had been completed in August, 1952, with the bringing into service of the Wenvoe station. The second part, the erection of five medium-power stations, had been postponed, however, on instructions from the Government. But in October, 1952, the Government gave permission for three temporary low-power stations to be built near Belfast, Newcastle and Brighton, on the understanding that the B.B.C. would be able to bring them into service in time for the coronation. The stations would be required to continue in operation after the coronation until replaced by permanent stations.

To use efficiently the short time available for the construction of the temporary stations, it was decided to install the equipment in vehicles, thus permitting installation of all three to be completed at a base convenient for supplies and economical in engineering effort. Further time was saved in this way by avoiding the need for buildings to house the equipment.

Some improvisation of equipment was necessary also. The 500-watt vision transmitters and the associated sound transmitters were made by adapting transmitters bought from Armed Forces disposal stocks. The vision transmitters were arranged to operate in the 41-68-Mc/s band (Band I).

Each transmitting vehicle was equipped with duplicate vision and sound transmitters, to give reliability in service, and sufficient test and auxiliary equipment to operate independently on relatively remote sites. Where necessary, receiving equipment was provided for vision and sound programmes.

The sites selected for the three temporory stations were Glencairn, near Belfast, Pontop Pike, near Newcastle-upon-Tyne and Truleigh Hill, near Brighton. To each temporary station was allotted the channel frequencies of the permanent station which will replace it. The Glencairn station, which began regular transmission on the 1st May, 1953, is situated about four miles from the centre of Belfast, on a site 400 ft. above sea level. The aerial is a single-stack batwing powered by both vision and sound transmitters through a combining circuit and is mounted on a 250-ft. stayed lattice mast. The vision programme is received at a nearby Post Office receiving station by direct reception from the B.B.C.'s high-power television station at Kirk o'Shotts. Glencairn is far outside the normal range of Kirk o'Shotts, so that the signal is not always satisfactory, but this was the best arrangement that could be devised in the short time available.

A site at Pontop Pike had already been chosen for the permanent station to serve the north-east of England, and the temporary station was installed there, 1,000 ft. above sea level. An important advantage of this site was the proximity of one of the Post Office radio-link stations which carries programme from Manchester to Kirk o'Shotts. A branch line for the programme feed to the Pontop Pike transmitter was easily arranged. This station also came into service on the 1st May, 1953.

The transmitting vehicle for the Brighton area was stationed on an Air Ministry site at Truleigh Hill, just north of Brighton and Hove. A four-element array of inverted-V aerials on 70-ft. masts was made, in order to pick up the vision transmission at 45 Mc/s from Alexandra Palace, 48 miles away. The arrangement was found effective in rejecting the signal from the local transmitters and also in avoiding interference from the French 441-line transmitter in Paris, which radiates frequencies within the pass band of Alexandra Palace. The vision programme received in this way was reradiated by the local transmitter operating at 56.75 Mc/s, thus improving the service in the Brighton — Shoreham — Worthing area. The station came into service on the 9th May, 1953.

These three stations provide a satisfactory service to about $2\frac{1}{2}$ million people and have raised the coverage figure for Great Britain as a whole from 80% to nearly 84%.

#### Telerecording Arrangements

Seven sets of television recording equipment were in use for this broadcast, three by the B.B.C., two by the National Broadcasting Company of America (N.B.C.) and one each by the Canadian Broadcasting Corporation (C.B.C.) and the Columbia Broadcasting System of America (C.B.S.). All used standard 35-mm. or 16-mm. film.

Some of the technical features of these equipments are set out in Table 2. The B.B.C. mirror-drum (Mechau) cameras at Lime Grove recorded the complete broadcast for archive purposes, while the suppressed-frame cameras at Alexandra Palace recorded selected excerpts for retransmission during the evening of the 2nd June and to provide copies of a shortened version of the broadcast which were needed by foreign television services. About two hours of the programme was also recorded on an experimental 16-mm. suppressed-frame camera installed at Broadcasting House.

In the mirror-drum system the film is drawn through the camera at constant speed and both interlaced frames of the television picture are located correctly on the film frame by optical means; thus the whole picture information is recorded. The result of superimposing two television frames differing in time by 0.02 sec. on a single film-frame is to produce some blurring of outlines in any part of the scene in which rapid movement is taking place, and this is the principal disadvantage of this system. Fortunately, there was little rapid movement during the Abbey ceremony, and very satisfactory recordings were obtained.

In the suppressed-frame system

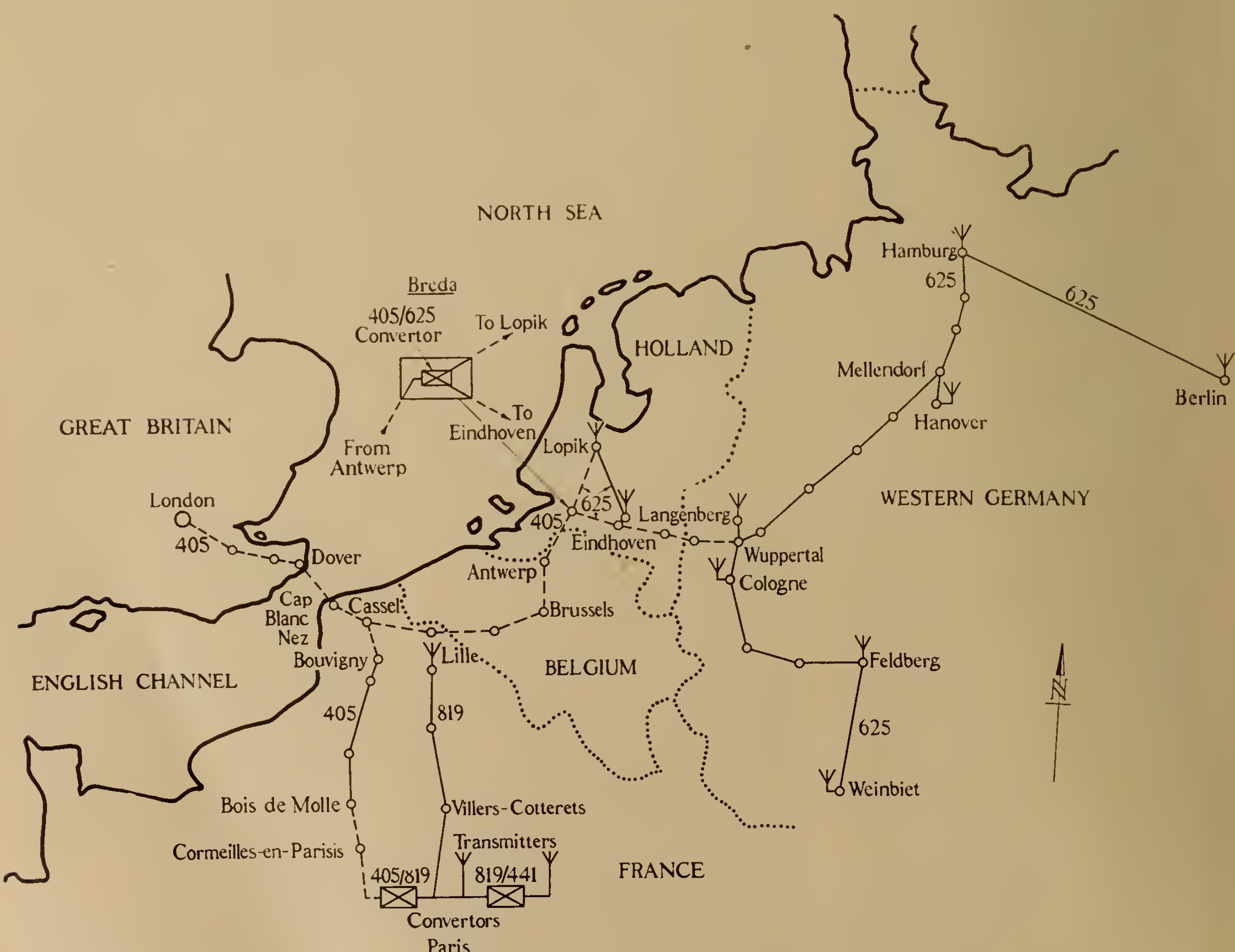


Fig. 11. Continental television circuits.

the film is stationary in the gate during one television frame (0.02 sec.) and is pulled down during the succeeding frame. Thus, only alternate frames are recorded, and consequently only half of the picture information. Line-broadening is adopted in the picture which is presented to the camera, so as to eliminate the line structure. The resulting picture on the film possesses a horizontal definition very nearly up to normal standards, but the vertical definition is, of course, equivalent to only 202½ lines. This system does not suffer from blurring, however, and is thus inherently more suitable for recording rapidly moving subjects.

The three transatlantic organizations used their standard fast-pull-down intermittent-motion cameras adapted to operate on British standards. The C.B.C. and C.B.S. operated their cameras at 20 pictures/sec. with an exposure time of 0.04 sec., so that a complete television picture was recorded on each film frame. Since the resulting film was non-standard, it had to be reproduced in Canada and in the U.S.A. on film scanners specially modified for the occasion.

The N.B.C. 35- and 16-mm. cameras were operated at 25 pictures/sec., so that a number of lines at the top and bottom of the picture had to be blanked out during the film-movement period. The speed of pull-down was not disclosed but appeared to be of the order of 30°, or 6 millisec., permitting about 340 of the 377 active lines to be recorded.

The C.B.C., C.B.S., and N.B.C. 35-mm. cameras were fitted with continuous high-speed processing plant which enables developed and dried film to leave the machine and to be run through a monitoring projector a minute or so after the film is exposed. Apart from the saving of time as compared with sending exposed film to an outside laboratory, this is a most useful facility in that it provides a continuous check on the correct adjustment of the apparatus. It may, however, introduce some loss of quality as compared with normal processing.

The N.B.C. 16-mm. films were developed in separate high-speed processing machines installed in the same room as the recording cameras.

The C.B.C. and the C.B.S. photographed a negative picture, so that the finished film was a positive ready for retransmission; the N.B.C. photographed a positive picture, thereby producing a negative film which was electrically reversed on retransmission.

Elaborate arrangements were made to get telerecordings to Canada and the United States in the shortest possible time, and at 9.15 p.m. B.S.T. (4.15 p.m. Eastern Daylight Time), immediately after Her Majesty's broadcast, viewers on the other side of the Atlantic were seeing, by this means, the start of the day's events in London.

#### Continental Relays

One of the aspects of the coronation television broadcasts which excited particular interest was the successful relaying of these broadcasts by television transmitters in France, the Netherlands and Western Germany. Technical interest centred on three features, namely the method of conveying the signals from London to their various continental destinations, apparatus for converting from the British television standards to those used in the relaying countries, and the techniques used for adding foreign-language commentaries to the effects picked up by B.B.C. microphones.

Solutions to the technical problems of temporary long-distance linkage and standards conversion had been demonstrated in July, 1952, when Radiodiffusion-Television Française (R.T.F.) and the B.B.C. had established a vision link between Paris and London, with a standards convertor, deriving from the French 819-line pictures corresponding signals on the British 405-line standards, at Cassel in Northern France. In spite of some technical troubles, the results were sufficiently successful to justify plans being made for the transmission of signals from Great Britain to the Continent, and over a greater distance, on the occasion of the coronation. Plans were made at a meeting in London in December, 1952, and full-scale trials were carried out from the 20th April to the 26th April, 1953. Towards the end of this period, B.B.C. programmes were successfully relayed by France, the Netherlands and Western Germany.

The circuit, details of which are given in Fig. 11, was reestablished on the 27th May and remained in operation until the 4th June. During this period, 21 programmes were relayed by France and the Netherlands and 24 by Western Germany.

The whole of the vision distribution network shown in Fig. 11 consists of radio links, many of which were temporary. The equipment for the five links from London to Cassel was provided and operated by a British firm acting as contractors jointly to the B.B.C. and R.T.F. This equipment was of the centimetre-wave type, by means of which a great concentration of the radiated energy in a narrow beam is possible, giving satisfactory communication over a line-of-sight path of 30 miles or more.

The departure point in London was the top of the tower of the University of London Senate House in Bloomsbury. This tower had on many occasions previously been used as a terminal receiving point for outside broadcasts, by arrangement with the University of London, but had never before been used as a transmitting point. The first relaying point was at the B.B.C. transmitting station at Wrotham in Kent, where use was made of the mast erected in connection with experimental v.h.f. transmissions. The next relay point was at the top of a hill at Warren Street, between Maidstone and Ashford, using a water-tower. The signals transmitted from Warren Street were received at the R.A.F. station at Swingate, which is on top of the cliffs near Dover, and from this point the signals were retransmitted across the Channel. The receiving point on the French coast was established by R.T.F. at a high point a little inland from Cap Blanc Nez. Here, special steps had to be taken to minimize the effects of fading which occur on centimetre wavelengths when the transmission path is above water. [8] The solution adopted was to use two separate receivers, the receiving dishes of which were mounted on the same mast with a vertical spacing of about 20 ft. When one receiver was exhibiting fading the other receiver was giving a steady signal, and it was found possible at all times, by manually selecting the better signal, to pass on to Cassel a satisfactory video signal.

At Cassel the received video signal was passed on to the French authorities and at this point bifurcation took place, the signal being fed (still on the British 405-line standard) southwards to Paris and eastwards to Lille. The route to Paris was accomplished mainly on a permanently installed circuit which had been recently set up by the French P.T.T. as part of a permanent circuit between Paris and Lille. In Paris the British 405-line signal was converted to the French 819-line standard and was used for feeding the two transmitters, one on 819 lines and the other on 441 lines (via another standards convertor). The signal was also used to feed the Lille 819-line transmitter by the normal R.T.F. distribution circuit. The other route from Cassel towards Lille was used to supply a series of links crossing Belgium via Lille, Flobecq, Brussels and Antwerp, to the first point in Netherlands territory, Breda. Belgium at that time had no television service in operation, but arrangements were made at the relay point at the Palais de Justice in Brussels to make the picture available for purely local viewing.

At Breda the 405-line signal was converted to the 625-line standard adopted by the Netherlands, Western Germany and other European countries. It passed from there to the main Netherlands television transmitter at Lopik, near Utrecht, to which a subsidiary transmitter at Eindhoven is permanently connected. The 625-line signal was also fed eastwards via relay points at Eindhoven, Helenaveen, on the Dutch side of the Dutch-German border, and Süchteln, which is on the German side of the border. At Süchteln the German authorities were also able to receive the Lopik transmission directly, thus giving them a reserve in the event of failure between Breda and Süchteln. The final temporary link in the chain was between Süchteln and Wuppertal, at which point the signal was fed direct into the permanent German network, running from Berlin via Hamburg, Hanover and Langenburg to Cologne, Feldberg (near Frankfurt) and Weinbiet (near Baden Baden).

In spite of the somewhat primitive arrangements which had to be made for some of the temporary links, the inclusion of standards conversion equipment, the absence of standby arrangements and the large number of different organizations which were concerned in providing equipment and setting up and operating the complete chain, remarkably satisfactory pictures were received on Coronation Day by viewers from a total of twelve transmitters in a large area of Western Europe.

The standards conversion equipment[9] used in Paris and Breda was basically the same as that used in July, 1952. The method used is to display the incoming picture on a cathode-ray tube, the phosphor of which is chosen so as to give a relatively long decay time. This picture is viewed by a camera operating on the standard to which conversion is required. In order to avoid any stroboscopic effect between the line structures of the two systems, the scanning lines of the incoming picture are broadened by superimposing a slight oscillation on the linear movement of the scanning beam. In this way the line structure of the incoming picture can be virtually eliminated. This solution to the problem of converting from one national standard to another, although it may appear somewhat inelegant, has in practice proved extremely effective, provided that suitable precautions are taken.

### Communication Circuits In Central London

The planning of the extensive network of communications provided by the Post Office to cover the organization, control, broadcasting and Press reporting of the coronation ceremonies was begun early in 1952, and it soon became obvious that the requirements for sound and television broadcasting would be very extensive and would form the major part of the total requirements. The spare cable pairs available in the area of the processional route were too few to meet requirements, and considerable additions to the line plant serving certain parts of this area were found necessary. The new ducts and cables were so planned that, after the ceremonies, they could for the most part be incorporated into the junction cable network and so provide for the normal growth of circuits serving the West End of London.

The main cable network finally decided upon is shown in Fig. 2. The principal new cables were an 800-pair type from Museum exchange via Broadcasting House and Mayfair exchange to the Victoria Memorial and then on to Victoria exchange; a 600-pair cable from near the Victoria Memorial to a large flexibility frame in Whitehall; and cables from this frame to the Colonial Office site, Broad Sanctuary, and the precincts and interior of Westminster Abbey. The huts provided for B.B.C. control rooms were sited on the cable route and outside Westminster Abbey. The cables were terminated on distribution frames at all these points, and, with the main distributing frames at the exchanges giving access to the junction cable network serving London exchanges, the network had a very high degree of flexibility, making it possible to provide a wide variety of main and alternative routings.

At the Canada Gate hut the equivalent of the cable trench of the orthodox telephone exchange was provided by erecting the hut over a double junction box, removing the covers and making removable that portion of the floor of the hut above the box.

New ductwork was required in several places, particularly in the neighbourhood of the Victoria Memorial. A 4-way duct was provided from a point near Mayfair exchange, across the Green Park and the Mall to Birdcage Walk. Because of the special nature of the red asphalt macadam carriageway in the Mall, trenching was out of the question and tunnelling was necessary. This work was completed by the end of January, 1953.

The cable sizes were designed so that most of the cable required could be provided from cable recovered in other parts of London. All recovered cable was cleaned, examined, reconditioned as necessary and thoroughly tested before being laid. Where required, suitable jointing lengths were obtained by splicing cable lengths together using unidiameter joints.

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# The ASME Boiler Code

In the July 1952 issue of *Mechanical Engineering*, the ASME commenced publication, in serial form, of a history of events leading up to the present ASME Boiler Code, from the first development of boilers in the 18th Century. This history, continued through some ten issues, was prepared by Arthur M. Green, Jr., of Princeton University.

As a preface to the regular publication in future issues of *The Engineering Journal*, of Boiler Code Regulations, this history is here presented in condensed form. It will appear in several issues of the *Journal*, of which this is the fourth.

## IV. Revisions by Annulment of Cases, 1936-1937

The short period between Editions of all sections of the ASME Boiler Code was not due to changes in practice of boiler construction, nor was it in harmony with announced policy of curtailing frequent changes in rules. It was rather because in 1936 there were too many active interpretations of the Code, and hence reference to replies for justification of procedures was difficult.

The need for annulment of inactive cases and transfer of some or all of the active cases into the Code was evident. The minutes of the Executive Committee are filled with records of annulments by revisions or by dropping. In October 1936 it was reported that a list of active cases had been studied, and found to contain 31 that could be annulled. The remaining 80 were reduced during 1937 to about 30 active cases.

It was reported to the Committee in February 1936 that tables for the gauges of tubes for the Power Boiler Code, the Codes for Boilers of Locomotives, and for Unfired Pressure Vessels hand been studied with care. As a progress report, a formula was proposed for allowable working pressure on seamless tubes, and one for minimum thickness. The report included three charts of allowable working pressure for various thicknesses of water tubes and showed curves, tables, and values from German standards for steels.

A proposed table for working pressures for seamless steel tubing was presented at the Executive Committee meeting in April 1936. If the proposed tables were adopted, similar tables could be developed for other types of tubes. The Executive Committee accepted the proposed table, with the understanding that the minimum gauges for different diameters given in the table were minimums for use at all lower pressures, and thicknesses for higher pressures should be determined by the formula, using next higher units of 10 above the determined values.

The Committee also voted that a new rule would be proposed; that for tubes exposed to radiant heat the thickness should be one gauge heavier than shown in the table. Tubes welded by the electric resistance process should be given a working pressure of 90 per cent of that in the table. Lap-welded tubes of Tables P-2 and P-3 should remain as before, except that they should be changed to the next higher unit of 10.

The Executive Committee met in an informal conference with representatives of tube manufacturers in April 1936. Participation by guests was greatly appreciated, and the Executive Committee expressed this by a vote of thanks. The Boiler Code Committee decided to report to the Conference, but to take no action at their meeting, except the approval of the increase of 100 p.s.i. in the tabular values for tubes of unfired pressure vessels and the rounding out of the values of Table 2 of the next higher figure ending in zero.

In May 1936, values in Table 5 Firetube Boilers of the Power Boiler Code, and Table L2 for Boilers of Locomotives in the 1935 Edition, were questioned. On recommendation of James Partington, however, the use of Table L2 was approved as an addendum, because of the increase of pressure in boilers of this type.

At the Executive Session of the Committee in June 1936, test data from one of the manufacturers of lap-welded tubes was reported. As some manufacturers of electric resistance welded tubes had indicated acceptance of 90 per cent efficiency of weld, it was considered advisable to indicate to lap-welded tube manufacturers, the efficiency the Committee had proposed for their product.

In October 1936, a new table was reported for maximum allowable working pressures for seamless steel tubing in water tube boilers, including illustrations. Minimum thicknesses for tubes 2 in. O.D. and under, were the same as in Table P-2. Allowable pressures for 3½ in. and 4 in. tubes of minimum allowable thickness were above those of Table P-2.

After discussion, including consideration of welded tubes, publication of the table was referred to the Executive Committee with power, after deletion of one point and inclusion of a statement that a rating of 90 per cent should be given to electric resistance welded tubes and 80 per cent for lap-welded tubes, provided the data submitted warranted these particular ratings.

Publication of the Table and an article accompanying it in the January 1937 issue of *Mechanical*

*Engineering* brought protests from the Ohio Board of Boiler Rules, and from those interested in electric resistance welds, claiming there were not sufficient data present to warrant a change in the Table. A second conference took place in March 1937 purpose of which was to obtain from all interested parties comments on the proposed revisions. Following considerable discussion, the Boiler Code Committee decided to take no action on the Table for firetube boilers until the table for water tube boilers had been adopted, and to leave the matter in the hands of the Executive Committee.

From communications received following the publication of the Table in January, and from the minutes of the conference, the Executive Committee believed the revised Table was approximately correct for the higher pressures. It appeared unnecessary to revise present values for lower pressures. A revised Table was presented and action on it was referred to the Executive Committee.

#### Conference on Safety Valves

The relieving capacity of safety valves had caused concern to the National Board of Boiler and Pressure Vessel Inspectors. In January 1936, tests on three types of safety valves purchased in the open market showed none of them complied with Code requirements. The National Board then decided to require all safety valve manufacturers furnishing valves for use in states and cities having National Board membership, to build in accordance with Code rules, and in addition to comply with certain test requirements.

A special committee was appointed to co-operate with the National Board in considering revisions of the Code to cover inspections. It was reported at a meeting of this special committee in February 1936, that revisions to paras. A-12 to A-17 would have to be made, and a conference with safety valve manufacturers was called for March 1936. At this conference, deletion of para. A-11 and parts of paras. A-13 to A-16 were approved, while it was agreed other proposed changes would await formulation by the Special Committee.

The Special Committee's report of September 1936 included revisions affecting 14 of the paragraphs between P-270 and P-289, with recommendations that some of these changes be made in the sections on Boiler Locomotives, on Low Pressure Heating Boilers, and on Unfired Pressure Vessels. The report was adopted for publication in *Mechanical Engineering* for comment. The changes appeared in the 1937 Edition of section I, with changes made on December 19, 1936.

#### Conference with Ohio Board of Boiler Rules

At the Boiler Code Committee meeting in December 1936 a letter presented by the chairman of the Ohio Board of Boiler Rules took exception to a statement which appeared in *Mechanical Engineering* preceding the interpretations of the Code, that anyone desiring information on the application of the Code should communicate with the committee secretary. This suggested that the Committee solicited requests for interpretations. When information was desired regarding application, the first request should be made to an administrative body. To clear this matter up, the chairman suggested a conference of representatives of the Committee and the Ohio Board of Boiler Rules.

The Special Committee met with the Ohio Board in March 1937. No notes were taken, since the committee could only give personal opinions, as Committee action would be required for the approval of definite actions. The chairman of the Ohio Board explained the legal requirements under which the Board operated, and why some activities of the Boiler Code Committee had made problems for them. He presented the views of the Board. Representatives of the Committee explained that the Committee welcomed constructive suggestions from various state boards and inspectors. In reporting to the Committee, they expressed belief the conference was helpful and resulted in a better understanding of the problems of the Ohio Board and of the Committee.

#### Conference on Specification S-26

A conference between the Boiler Code Committee and invited guests interested in the use of steel of specification S-26 was held in April 1937. Letters of comment on proposed revisions had been received from two boiler manufacturers. Questions coming under discussion were the limitation of 0.33 per cent carbon in samples taken at any point of the plate; reduction in plate thickness for shells and heads from 1½ in. to 1¼ in. for para. U-69 vessels; and reduction of the requirements for stress relieving in para. U-76(b). After discussions, the revisions to paras. U-13(c), U-69, and U-76(b) were approved by the Committee.

#### Welding

During the years 1936-1937, the Subcommittee on Welding considered many cases, but always in co-operation with the AWS Conference Committee, and at times with the Directors of AWS. In January 1936 the Special Committee on X-ray requirements reported that, as a result of adverse criticism of the master set of radiographs, a conference had been held in December 1935, at which agreement was reached; that from the master sets a new set of films should be selected, that the Special Committee should consider the inclusion or addition of consumer interests; that the enlarged Committee should consider the quality of negatives for different weld thicknesses; that in place of the Special Committee, a joint committee with the API-ASME Committee on Unfired Pressure Vessels should be appointed, with 12 members, four each of whom would represent consumers, manufacturers and neutrals. The Boiler Code Committee adopted the suggestions, and appointed the ASME group. This was a Special Committee of the Boiler Code Committee, the name was changed to Special Committee on Radiograph Examination of Welded Joints.

#### X-Ray Examination

In March 1937, this Special Committee reported that in June 1936, it had approved the grinding, chipping, or suitable machining of weld reinforcement of welds to be radiographed, so as to leave a weld that would merge smoothly into the plate. This should be used in paras. P-102(i) and U-62(i) since both provided for use of a penetrometer. On approval of the limit of 5¼ in. for plate, and the use of the Buckey type grid, the resulting changes were authorized in paras. P-102(i) and U-68(i), covering procedure for welds in plates thicker than 5¼ in., the preparation of welds for X-rays, and the use of a new form of penetrometer.

In April 1937, it was reported that the Special Committee had given consideration to selection of a new standard set of radiographic films, especially the set of five used by the U.S. Navy. The Committee agreed that No. 3 film should be that showing maximum porosity for the API-ASME Code, while No. 4 would apply to the ASME Code. It was reported the new penetrometer would give better information. To assure uniformity between the API-

ASME Code and the ASME Code, the Committee voted to use No. 3 as the maximum porosity for welds by the ASME Code.

#### Testing of Welding Operators

Omission of the full-section tension test specimen of a welded joint was referred to the Subcommittee on Welding and the AWS Conference Committee in April 1935, and in January 1936 a number of sections of para. U-69(c) were omitted on their favourable report, as well as changes in other paragraphs.

A letter of November 20, 1936 from the President of the AWS, enclosing copy of its tentative Rules for the Qualification of Welding Processes and Testing Welding Operators, was presented for consideration in revisions to the Code. These rules were referred to the Subcommittee on Welding, to determine what part of the rules should be incorporated in the Code revisions.

In March 1937, the Subcommittee on Welding reported seven pages of revisions to paras. U-69 and U-70, and to paras. UA-30 to UA-46 using the suggested rules of AWS. These rules were altered at the meeting of April 6, 1937, and the completed changes appeared in the 1937 Edition of section VIII of the Code.

#### Calorized Tubes

The subject of welding carbon steel ends on calorized tubes had been referred to the Subcommittee on Welding, and as there were no rules covering such welding in the Code, the matter was submitted to the National Board of Boiler and Pressure Vessel Inspectors in May 1936. In November 1936, the Boiler Code Committee decided it was not in a position to make rules regarding this procedure, and suggested the practice be tried on an experimental installation, with the approval of the proper inspection jurisdiction.

#### Special Steels

In November 1936, in Case 834, the Committee permitted the use of stabilized austenitic chrome-nickel steel, conforming to grade 4 of ASTM Specification A-167-35T, for an unfired pressure vessel with columbium ten times the carbon but not over one per cent, or titanium six times the carbon, but not over 0.6 per cent. In Case No. 836 the Committee permitted the use of a steel of ASTM Specification A-167-35T grade 6, with 2 to 4 per cent molybdenum. Such actions had been taken several times under paragraphs which permitted the use of new available materials, specifications for which often became parts of section II later.

#### Welding

In March 1937, the Committee approved omission of the radiograph of the final circumferential seams of para. U-68 vessels of inside diameters 24 in. and under, provided radiographs were made by qualified welding operators, and met requirements without cutting out welding repairs, and provided work on the first circumferential joint had been made by such operators. This was approved by the AWS Conference Committee.

In June 1937, the Committee gave as its opinion (Case 84) that a welding operator regularly qualified and engaged in welding U-68 vessels, was qualified thereby to weld U-69 and U-70 vessels, provided the same position was employed as that for which the operator had been qualified. Similarly, welding operators qualified for welding U-69 vessels were qualified to weld U-70 vessels. All such qualifications were not to be effective beyond six months, except as noted in paras. U-69(a) and U-70 (a) respectively.

#### Subcommittee to Revise Section VIII

Since adoption of the API-ASME Code for Unfired Pressure Vessels in 1934 there had been a desire on the part of some of the Committee to revise section VIII, so as to have it close to or the same as that Code, and to reduce the two Codes to one. For this a Special Committee was set up. In June 1936, its statement was published in *Mechanical Engineering*, proposing a revision with two parts. Part I would bring section VIII into the same arrangement as that of the API-ASME Code, with working stresses less than those of Part II. Part II would include such inspection as would justify a safety factor of four, so as to make this identical with the API-ASME Code. In Part I, the reference to paras. U-68 and U-69 would be eliminated, and U-70 would be retained, but with limitation to vessels to be X-rayed or stress-relieved. This report was revised on Sept. 18, 1936, for *Mechanical Engineering* for October.

#### Test of Boiler Drum

In October 1937, tests were reported on a welded drum with radial tube holes in various positions relative to the weld. It had been asked whether, based on data submitted, it would be permissible to modify the requirements of paras. P-105(c) and U-74, to permit drilling of holes 1/8 in. from the edge of the weld, made in accordance with requirements of paras. P-101 to P-109, or para. U-68. It was reported that a severe test on a vessel with the tube holes in the weld of less porosity had been made, and the vessel had ruptured at 190,000 repetitions of pressure to 1½ times the working pressure. The steel of Specification S-27 had a minimum tensile strength of 70,000 p.s.i., giving 21,000 p.s.i. as the maximum loop stress under the repeated load.

Following considerable discussion, during which several views were expressed, the Boiler Code Committee voted that it was permissible to allow unreinforced holes to be machine-cut through plates with welds made in accordance with paras. P-101 to P-109, but that these should not be placed closer than ¼ in. from the edge of the fused metal.

As the Committee had always ruled that only the base metal and none of the clad metal should be used in determining strength of vessels, frequent inquiries resulting in cases or communications had been made. In November 1936, the Subcommittee on Welding submitted the view that instead of considering one type, nickel cladding as in Case 828, the case should be formulated to cover all kinds of cladding material. Rules should be formulated to cover removal of cladding near the joint before welding, contamination of cladding avoided during welding, and cladding replaced to restore complete protection against corrosion.

A Special Committee was appointed to consider the subject of clad vessels. In April 1937 this committee reported that the rules applied to nickel-clad, stainless steel, and chromium-clad metals. Requests would be made to manufacturers for test data to show effectiveness of bond between layers, and twist and buckling tests should be made. Reverse bends and impact tests would be covered. Chemical and microscopic examinations might be advisable, as well as X-ray examination and fatigue tests.

#### Spherical and Hemispherical Heads

Inquiries were received regarding field construction of cylinders with hemispherical heads half as thick as shells, to be used for gas storage, asking if tapering was permissible. The Subcommittee on Unfired Pressure Vessels believed that Code should apply to hemispherical heads as well as other heads. The intent of the Code would be met, it felt, if the provisions of para. U-36(g) for semi-ellipsoidal forms of heads should be applied to these heads for thickness. The subject was referred to the Special Committee to revise section VIII.

In April 1937, the Babcock and Wilcox Company asked permission to use blank hemispherical heads on fusion welded vessels according to Code rules. The rules were submitted to the Subcommittee on Special Design, with the request that it prepare suitable rules and formulas to make this type of construction available for pressure vessels and boilers under Code requirements. The same company had sold two boilers for pressures of 200 2500 p.s.i., using S-27 material of 70,000 p.s.i. minimum tensile strength. The Committee recommended to State authorities where the Boilers were to be installed that the heads in question be sanctioned as a special installation.

The Chicago Bridge and Iron Co. applied in September 1937, to build structures made of two or more intersecting spheres, with a pierced equalizing opening on each plane of intersection. They asked if the design would meet Code requirements, if design complied with Code rules except for physical shape. The Subcommittee report of October 1937 stated that if the thickness of diaphragms were so proportioned as to result in equal stresses in all connecting members, the design could be acceptable for all vessels in which X-ray examination of welded seams was not required. The Boiler Code Committee accepted the report, and voted to transmit the intent thereof to the enquirer.

#### Fusion Welded Locomotive Boilers

In April 1936 blueprints were presented to the Committee of a proposed method of welding an attachment for the front tube sheet of an experimental locomotive by the American Locomotive Co. The attachment was not in accordance with any existing Code rules. The Committee voted to permit this construction for the welded locomotive boiler as an experimental installation. It became the first fusion-welded locomotive, and steps leading to its approval by the ICC and data on its operation are noted in a later chapter.

#### Vessels Subject to Collapse

The Rules for Vessels Subject to External Pressure in the 1934 Edition of the Code had resulted from studies of experimental results on certain ferrous metals listed in para. U-20. During 1936-1937, requests were made to include rules applying to other ferrous and nonferrous metals. In April 1937, the Special Research Committee had presented a report on the basis of theoretical and empirical operations used in section VIII, and advised its publication. The Boiler Code Committee approved this publication.

#### API-ASME Code

The first edition of the API-ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Vapors, published in 1934, was followed by a second edition in 1936, on completion of its third section F, Design and Construction of Integrally Forged Vessels. Besides the new section of 31 pages, there were changes suggested by changes in ASME Codes. Added ASTM specifications were placed in the list of available materials for vessels and parts.

#### Materials

The Subcommittee on Material Specifications presented many reports during this period, on matters referred to it on the form of specifications required for new materials suggested by para. P-1(b). It also selected ASTM specifications where available, or conferred with ASTM on possible changes to suit new uses. Many of its reports dealt with changes necessary to bring Code specifications into agreement with new altered ASTM specifications. The Subcommittee on Ferrous Materials and Non Ferrous Materials had been appointed earlier.

A Special Committee on New Materials was appointed at an executive session of the Boiler Code Committee in May 1936. All recommendations dealing with specifications and welding practice were to be referred to the two subcommittees before presentation of new materials to the main Committee. The Subcommittee on new materials would be responsible for securing recommendations of the Subcommittee on Welding, the AWS Conference Committee, and the Subcommittee on Material Specifications, whenever welding or specifications were involved.

Use of steel of S-26 and S-27 with a certain amount of molybdenum for higher strength with carbon not over 0.25 per cent, was approved in February 1936. The Subcommittee on Ferrous Materials desired these to be silicon-killed. The Subcommittee was directed in March to consult the ASTM, through the Subcommittee on Material Specifications, on this matter. The revisions of allowable stresses of ferrous materials at elevated temperatures was accepted in April for publication. As adverse comments were made regarding the published table, a revised form of Table P-8 was presented in January 1937. The Subcommittee on Material Specifications reported 26 of the 34 adopted specifications, requesting retention of some, replacing or revising certain clauses of the later edition of the ASTM specifications, retaining some and omitting S-14 for the Arbitration Test Bar, as this was included in the revised S-13 for Gray Iron Castings adopted from ASTM A-48-36.

In March 1937, the Special Committee on New Materials recommended certain of the specifications in the 1935 Code that were questioned, should be retained, that four be omitted, three adopted, and two reported upon by the Special Committee on Ferrous Materials. In September 1936, the final form of the so-called Table U-3½ was adopted, and Table P-7½ for the maximum allowable working pressure for ferrous materials at different temperatures was approved.

In the final determination of specifications to appear in the 1937 Edition of section II, the old specifications from S-1 to S-31 were retained, with the exception of S-14, by revising some to agree with later printings of ASTM specifications, by bringing some into agreement with ASTM, or by adopting some from such standards. As a result, of the 30 remaining specifications appearing in the 1935 Edition of section II, 24 were identical with some ASTM specification, one in agreement, one based on and one adopted from such specifications, and 3 without any ASTM specification. The new specifications were numbered S-32 to S-41 inclusive.

#### Rules for Containers for Gas and Liquids at Sub-Zero Temperatures

The need for rules for vessels to be used for liquefaction of solid carbon dioxide (dry ice), other than ICC Rules, had been brought before the Committee by the Compressed Gas Association in January 1935. In January 1936, the Association expressed its desire to co-operate with the Committee on the formulation of rules. A Special Committee was appointed to confer with the Association.

Results of several meetings were reported in March 1936, and a set of rules were presented which were unanimously recommended. The rules had been approved by the Subcommittee on Ferrous Materials.

After discussion and the agreement on several suggested modifications and the inclusion of one or two acceptable forms of vessels, the proposed amended Rules were adopted.

Publication in *Mechanical Engineering* was directed as an addition to the Unfired Pressure Vessel Code. The title was changed to Rules for Containers for Gas and Liquids at Sub-zero temperatures down to —150°F. Minor revisions were made in June 1936, as a result of publication. The rules were issued as part of the Code in August 1936, becoming paras. U-140 to U-144 of section VIII.

In April 1937 objections were raised by the Carbonic Gas Equipment Company, because the rules differed from those of the ICC which that company had been using, and permission was asked to depart from section VIII. In July 1937 the Executive Committee replied that if a factor of safety of 5 was used in place of 4 in the design of dry ice converters, they could be built according to other paragraphs of section VIII of the Code.

#### Unfired Steam Boilers

As electrically operated steam generators were found in certain stations, a statement was added to Para. U-2 in March 1936, that such Unfired Pressure Vessels which generated steam for power or heat to be used externally to themselves, were to be classed as Unfired Steam Boilers. These vessels might be constructed under the Unfired Pressure Vessel Code, and equipped with safety devices required by the Power Boiler Code for the service of the particular installation.

#### Miscellaneous

The minimum size of hand holes was referred to the Subcommittee on Special Design in May 1936 for a report. After an earlier report, the size adopted in March 1937 was 2¾ in. by 3¼ in., with the added clause, "but it is recommended that, where possible, larger sizes be used."

During this period, rules relating to fusible plugs were revised to bring them into agreement with those of the Steamboat Inspection Service. These revisions were published in *Mechanical Engineering* for June 1935. The Service Rules did not permit refilling, and for this reason para. A-19(c) was revised for uniformity. This, and other changes which did not depart from the intent of the former fusible plug rules, were adopted in May 1936.

#### Backing up Water Walls

A letter from the Chief Safety Engineer of Detroit, requesting an opinion on the satisfactory form for supports for backing up the water walls of a certain cross-drum boiler, was reported in November 1936. The Subcommittee on Welding, to which this was referred, reported that no serious difficulty would arise from the proposed construction, but that they could not give a reply to which they could not give full approval.

A reply was sent, stating that there was nothing in the Code to prohibit the proposed practice, but such work should be done with careful supervision to assure good welds. On discussing brackets and supports, the Executive Committee agreed such construction should be covered in the Code, and appointed a Special Committee to consider the correspondence.

In March 1937 it was reported that the Babcock and Wilcox Company had prepared a set of rules for the attachment of supports to tubes by fusion welding, to cover the general subject, and these rules could be used in backing up water walls. These rules were referred to the Special Committee for approval and publication, as proposed revisions for discussion. This proposal, "Allowable Loading on Structural Attachment to Tube", was approved, and appeared as para. P-186(e) with Figs. P-17 and P-18, in the Power Boiler Code of 1937, and in the appendix of that Edition as paras. A-70 to A-73.

#### Acceptance in Massachusetts

The Acceptance of section I of the Code by Massachusetts was announced in May 1936, to become effective November 1, 1936.

#### Safety Valve Requirements

An inquiry from the Massachusetts Board of Boiler Rules, relative to safety valve requirements for boilers with different allowable waking pressures, was referred to the National Board of Steam Boiler and Pressure Vessel Inspectors for their recommendation in December 1936. The National Board in January recommended that the Boiler Code Committee take the necessary steps to provide rules and regulations governing safety valves on any steam headers connecting two or more boilers operated at different pressures.

A Special Committee consulted the National Board. In October 1937 they proposed an additional para. A-45, in which additional safety valve capacity was added to the low pressure side of the system, with at least one valve to be set at a pressure not exceeding the lowest allowable pressure, and the others within a range not to exceed three per cent above that pressure. It was voted to include this in para. A-45, and report it to the National Board. This appeared as para. A-45 of the 1940 Edition of section I.

#### 1937 Edition of Code

The 1937 Edition of the Code received final Council approval in August 1937. The preamble of section I classified Steam Fired Boilers as those in which steam was operated by heat from fuel combustion, to distinguish such boilers from Steam Generators using electrical energy, hot fluids, or vapors for the production of steam and called Unfired Steam Boilers. It ruled that material for forced circulation boilers and boilers with fixed steam or water line should conform with the requirements of the Code.

Para. P-Z(a) on boiler plate was enlarged to include a new specification as in para. P-11 for materials for superheaters and para. P-21(a) for tubes. Tables for working pressures in tubes and pipes were those of the 1935 Edition, except that valves were altered. Para. P-26 was added to cover non ferrous tubes, which included Table P-8 for allowable stresses in non ferrous materials at temperatures up to 450°F. Rules for fusion welding, beginning at para. P-101, extended the limits of the use of such welding, and enlarged para. P-102. The list of usable materials was increased by the inclusion of S-18 and S-40.

Para. P-108 called for pressure parts welded under para. P-101 to be stress-relieved, and para. P-109 was revised to exclude the hammer test on certain vessels. A new section para. P-112 on welded pipe connections, covered four and one-half pages. The new para. P-113 gave details of welding superheater tubes to manifolds and headers without expanding the tubes. Para. P-114 permitted fusion welding of front and back sheets of headers for water tube boilers.

Para. P-186(c) on welded joints was enlarged to permit fusion welding of the bottom edges of plates of water legs in vertical tubular and firebox boilers. Para. P-186(e) with table P.-17 and Fig. 18 was added, with samples of its application in paras. A-70 to A-73. Para. P-186(f) on seal welding was enlarged.

Para. 186(f) of the 1935 Edition became para. P-186(g). Minor changes were made in paras. P-194, and P-195 to P-198. Paras. on braced and stayed surfaces P-199 to P-229 inclusive were changed to define materials for washers in P-199(a), and to delete P-207 on waterleg staybolts.

The section on stays, paras. P-230 to P-244, was changed to permit fusion welding on longitudinal joints of an Adamson furnace flue. Small changes were made in para. P-249. Para. P-266 on hand holes was changed slightly by adding a paragraph. Para. P-268(o) was enlarged to include the use of an inserted nozzle opening in a new Fig. P-43. The safety valve section of the Code, paras. P-269 to P-290 and A-12 to A-17 necessitated the conference already mentioned, at which the final form of these paragraphs was discussed.

Paras. P-291 to P-298, Water and Steam Gauges, were changed only in regard to materials for connections. Under Fittings and Appliances paras. P-299 to P-322, sub-paragraphs were added for the use of cast iron valves, steel valves and fittings and plug type valves. Para. P-325 on settings contained a sub-paragraph giving details of a welded bracket connection for support of horizontal return tubular boilers. An access door was an addition to para. P-327. Paras. P-331 to P-333 on stamping were reworded to clarify the intent.

Para. A-11 on the discharge capacity of valves was deleted for the 1937 Edition, and new tables A-9 and A-10 were added. A sentence was added to para. A-18 on automatic water gauges. Paras. A-19 and A-30 on fusible plugs had been amended to conform with marine practice, and para. A-21 was unchanged, as well as paras. A-22 to A-30. Paras. A-31 to A-62 covering existing installations remained unaltered, except for omission of reference to deleted para. A-11. Paras. A-63 to A-68 showed changes in numerical values in para. A-64(b). New samples of allowable loading on attachments A-70 and A-73 were given at the end of the Appendix. An index for sections I, II, IV and Appendix closed the volume.

#### Section II—Material Specifications

Section II contained 46 specifications: S-1 to S-13 and S-15 to S-41, extending through 193 pages. The list contained 34 specifications identical with ASTM, one in substantial agreement, one based on ASTM and one adapted from such, while for three there were no ASTM specifications available.

#### Section III—Boilers of Locomotives

In the 1937 Edition of the Code for Boilers of Locomotives, the only important change from 1935 was the new Table L-2 on allowable working pressures for steel or wrought iron tubes conforming to material of S-17 or S-32, in place of former tables of minimum gauges. The pressures of the new Table were somewhat higher than those in the earlier edition.

#### Section IV—Low Pressure Heating Boilers

In the 1937 Edition of Low Pressure Heating Boilers, minimum allowable thickness of the tube sheet or heads of Table H-1 were increased, while for shells or other plates they were reduced. In para. H-12 all sheets except those having tube holes supported by braces were to be classified as shell plates, and in para. H-21 the allowable distance from a corner-welded joint to the nearest row of staybolts might be a full stay pitch. In the last paragraph of para. H-28 the limiting diameter for access openings was increased to 28 in.

Paras. H-38 and H-91 were enlarged to prohibit introduction of feedwater through openings used for the water column, etc. Paras. H-40 and H-93 described the form of stop valve when diameter exceeded 2 in. Diaphragm valve seats or rubber disks were prohibited for relief valves of paras. H-44 and H-93. In paras. H-65 and H-118 the valve of 30 p.s.i. for operating pressure was changed to 40 p.s.i. In paras. H-64 and H-117 the point of action of water relief valves was made not lower than bottom of water glass. In para. H-70, fusion welded joints might be considered as fully supported in figuring pitch of staybolts, except where joint was a flat surface.

#### Section V—Miniature Boilers

In the 1937 Edition of section V, para. M-1 was enlarged to include circulation boilers and those with no fixed waterline. Para. M-13 was enlarged to prohibit the introduction of feedwater through water column openings, etc., when the boiler was under pressure. In the Appendix, Fig. MA-2 was replaced by the former Fig. MA-3, while old figures MA-4 and -5 became MA-3 and -4. In para. MA-3 the last sentence on Reduced Section Tension Test Specimen was deleted.

#### Sections VI and VII

The 1937 Edition of Rules for Inspection was published in the same volume that contained sections I and II and the Appendix. The 1937 Edition of section VII, suggested Rules for Care of Power Boilers, of 88 pages, with paras. C-1 to C-341, and Appendix with paras. CA-1 to CA-27, was unchanged.

#### Section VIII—Unfired Pressure Vessels

In the 1937 Edition of section VIII, the preamble contained an addition to division (c) to include vessels containing air, the compression of which served only as a cushion, or in an air lift pumping system among excluded vessels mentioned. Para. U-1 contained the new limitation to the meaning of volume when used for a single vessel with jacket. A new paragraph limited the Code to vessels in which all materials used and type of construction complied with the Rules. Para. U-2 contained an added paragraph defining unfired vessels in which steam for power or heat was generated for external use.

Para. U-3 was shortened to require spring loaded safety valves to be ASME standard. Para. U-4 of the 1935 Edition was not needed, and the new para. U-4 provided for the effect of static head. Para. U-12(c) provided that parts of small size carried in stock might be used when suitable. Para. U-13(c) limited the use of S-26 steel, and U-13(c) permitted the use of S-32 for Electric Resistance Welded Steel and Open Hearth Iron for tubes. U-13(g) permitted the use of S-13 cast iron.

Para. U-19 was enlarged. Paras. U-20(c) and (d) on non ferrous tubes and pipes were added with Table U-4 for allowable stresses at different temperatures. A paragraph added to para. U-32 permitted welding of abutting edges of shell plates under certain conditions. In paras. U-36(a) the efficiency "E" and the values of stress "S" were fixed by Table U-3. Para. U-36(d) and (e) required the reinforcements of heads to be that required by para. 59(g) and para. U-36(f). A change was made in constant "C" in para. U-29. Paras. U-53 and 54 were rewritten and made more complete than in the 1935 Edition. Para. U-59(o) was enlarged to cover use of the inserted nozzle as described in para. P-268 section I.

Para. U-66 was enlarged to make intent more definite. Rules on test plates, para. U-68(a), had paragraphs added, but U-68(i) on non-destructive tests was altered extensively, as occurred to a similar section para. P-102(o) as described under section I. Para. U-69 was

*(Continued on page 57)*

# From Month To Month

**Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers**

## "Help Wanted"

The Council of the Institute has authorized the employment of an assistant to the General Secretary to be located at Headquarters in Montreal. The position carries excellent prospects for development on a permanent basis.

Applicants should have ability and experience in meeting people, in public speaking, and in writing. Personality is very important. Experience in organizing, in conducting meetings and in office routine is essential. Experience in editing can be used to good advantage.

Membership in the Institute is not essential but naturally a preference will be given to members. Persons who have been active in Institute affairs will also have an advantage.

Age requirement is not fixed rigidly but it is thought a senior person would be best suited to the work. The upper age limit would be about fifty.

This is a good opening for a person who is ambitious and energetic. Please mail applications with full particulars of education and employment experience to the General Secretary, Engineering Institute of Canada, 2050 Mansfield Street, Montreal, Que.

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## Something New in Meetings

On December 3 the members of the Montreal Branch of the Institute met in the auditorium of the Bell Telephone Company's Head Office Building on Beaver Hall Hill to participate in a technical meeting with the members of the Institution of Electrical Engineers assembled in their headquarters' building, London, England.

As far as can be determined this is the first time that groups of this nature have met together to hear and discuss a paper through the medium of a two-way radio link. While the reception conditions were far from perfect the meeting was successful to the point that further endeavours along the same line should be made again in the future.

The paper appears in this issue of *The Engineering Journal* under the title "Technical Arrangements for the Sound and Television Broadcasts of the Coronation Ceremonies". The authors are M. J. L. Pulling and F. Williams, senior superintendent engineers of the B.B.C., and W. S. Procter, chief regional engineer, London Telecommunications Region Post Office.

The program was arranged so that it was opened by the president of the Institution of Electrical Engineers of London, England, Mr. H. Bishop. His greetings were replied to by the president of the Institute, R. L. Dobbin. Then the paper itself was presented by Mr. Pulling and was discussed on the Canadian side by J. E. Hayes, chief engineer of the Canadian Broadcasting Corporation.

The next speaker on the program was the Dean of Westminster, The Very Reverend Alan Campbell Don who added his praise for the work of the engineers and who, at the same time, spoke of the need of reconstruction and rehabilitation work within the Abbey.

The authors then followed with their response to the discussion and the meeting was closed by the president of the I.E.E. in London, followed by the president of the E.I.C. in Montreal.

The Institute is greatly indebted to the C.B.C. and the Bell Telephone Company without whose co-operation the whole affair would have been impossible. Not only did

### Cover Picture

The launching of M.V. *William Carson* depicted in the cover picture of this issue took place at the shipyard of Canadian Vickers Limited, Montreal, on November 26, 1953. This picture will be of special interest to the members of Cape Breton, Corner Brook and Newfoundland Branches because the *William Carson* is to operate as a ferry on the run between North Sydney, N.S., and Port aux Basques, Nfld. —*Photo courtesy Canadian Vickers Limited.*

they assist in the technical aspects of the program but the telephone company as well loaned its splendid auditorium which was filled to capacity with about 400 people.

In advance all the proceedings had been recorded on tapes and one complete set was in Montreal and the other in London. Both were ready for use in case the radio communications failed. This was a fortunate precaution because both in Montreal and London, the tapes had to be resorted to during certain portions of the program.

Members are advised to read the complete paper. It will be found that the story is a fascinating one, even for someone who is not an electrical engineer. The ingenuity of the British engineers in carrying out this unsurpassed performance is something which everyone, engineer and layman alike, must admire.

## International Council— ASME-EIC

This joint council was set up by a written agreement between the two societies in 1943. It has met twice a year ever since at the annual meeting of each organization. The meeting of the American Society of Mechanical Engineers in New York was the background for the meeting on December 3.

Delegates representing ASME were Frederick S. Blackall, president of the society, Thompson Chandler a vice-president, past-president Dr. A. G. Christie, R. R. Service and C. E. Davies, secretary. The Institute delegates were John G. Hall, G. N. Martin, H. S. Van Patter and L. Austin Wright, general secretary.

There were also some guests and observers including Fred Malette, Director of Research, ASME, H. Oatley, D. D. Panabaker and C. R. Davis, a member of the Council of the Institute representing the American Society. Dr. Christie, chairman of the Council, presided.

There were several interesting items on the agenda, some of which were concluded by resolutions to be presented to the Councils of each organization for approval and action. Others were referred to the next meeting of the Council for further consideration. All these will be reported in the *Journal* in due course as they are settled by the societies' governing bodies.

The next meeting will be at Quebec on May 14, 1954.

## The 1954 Graduate's Income

This is the time of year when the 1954 graduates' thoughts are turning more and more to their first permanent jobs. Many of them know what they are going to do, others are considering offers and only the dregs of the class, the last choice of any employer, are in any doubt as to the future.

The intelligent student realizes that salary is not everything, yet is important. More graduates than used to be the case are married, some have gone into debt to pay for their educations, both good reasons for needing a larger income than was formerly the norm, but most will start at about the same level as last year, if the figures of the Technical Personnel Section of the Department of Labour mean anything.

Neglecting a few salaries obviously out of line, 1953 graduates received from $195 to $400 a month at the start, with an average of $295 and a median of $300. There are no significant differences in the salaries paid to graduates in the various fields. In the six major courses, graduates in chemical, civil or mining engineering received median salaries of $300 a month; graduates in mechanical or metallurgical engineering, $285, and graduates in electrical engineering, $270, a spread of only $30 or 10 per cent.

Starting salaries for graduates have increased nearly 60 per cent since 1946, while the consumer price index has risen about 50 per cent in that time. Thus, salaries seem to be a little more than holding their own, perhaps because the demand for graduates during those years has been somewhat greater than the supply, a condition which seems likely to continue for some time to come.

Our recent mining, oil and gas development has created a sellers' market among mining engineers, metallurgists and geologists. The Department has the records of 2,349 in its files. Of the 2,209 who are in Canada, 451 are in Quebec, 953 in Ontario, 270 in Alberta and 345 in British Columbia, the other 190 being scattered from Newfoundland to the Yukon. It is noteworthy that 30 per cent of the geologists hold doctor's degrees and another 30 per cent master's degrees. Among engineers their nearest competitors are in the electrical field, where fewer than one per cent have doctor's degrees.

There must have been a considerable number of 1953 graduates who received starting salaries well above the median and not included in the figures given above. One of the writer's acquaintances began at $1,000 a month and he knows several who received more than $400. The man in question was older than his classmates, a brilliant student, with a lot of practical experience and his employment took him to a quarter of the world where most of us would not care to live.

Times change. Nearly 50 years ago, when the writer got his first job, he was paid $50 a month for 84 hours' work and that at night, too, a raise to $75 put him among the plutocrats, so much so that he promptly married.

## Correspondence

December 5, 1953.

Dear Mr. Editor:

Your interesting and informative article "What Causes This Sort of Thing" in the November issue, makes no attempt to answer the title question, and yet it would seem to me an answer *is* important.

Don't you think the answer is to be found in the fact that man tends to inflate the importance of anything he does not understand. Then, too, the doing is seeming proof of ability to do.

The whole thing leads back to comment I used to make to the membership when Chairman of the Sault Ste. Marie Branch between 1915-1920, that the engineer was too close to commercial practice to sit back and be a pure professional. As purchasing agent of a steel company I made more money than the chief engineer. If the engineer does not want to sell his wares, he needs must have contacts with construction concerns that will do so for him.

Lionel L. Jacobs, M.E.I.C.,
Lionel L. Jacobs & Sons,
Wayne, Pa.

# President's Travels

Starting off from Montreal by air on November 2, the president made his first stop at New Glasgow where he met with the branch and spoke to 250 students at St. Francis Xavier University at Antigonish. Vice-President Don MacNeil accompanied by the branch secretary D. G. Dunbar drove Mr. Dobbin to Sydney. Here there were tours through the industries and a meeting with the branch.

From North Sydney Mr. Dobbin left by boat on November 5 for Port aux Basques and Newfoundland. He held meetings with the two branches in that province at Corner Brook and St. John's. In the latter place he called on the Lieut. Governor, The Hon. Lieut. Col. Sir L. C. Outerbridge, the premier, Joseph Smallwood and the mayor, H. G. R. Mews. Also he spoke to the students at Memorial College.

From St. John's he flew to Halifax arriving on the evening of the 10th. In Nova Scotia, November 11 is a provincial holiday but Dean Bernard Cain, M.E.I.C. of Acadia had arranged for a meeting with the students, so the president accompanied by Frank Bennett, chairman of the Halifax Branch, travelled to Wolfville and had a very enjoyable talk with the students and members of the staff.

At Halifax the president was joined by the general secretary on November 12. That day, in the morning, the president spoke to the students at St. Mary's University and Nova Scotia Technical College. A luncheon was tendered by the Association of Professional Engineers, after which the president and general secretary attended the meeting of the Council of the Association. Then there was a meeting with the executive of the branch followed by a talk with the students at Dalhousie. Then followed the dinner meeting of the branch at the Nova Scotian Hotel. It was quite a day!

Eight a.m. on the 13th saw the party on the train en route to Amherst and Sackville. At Sackville the president spoke to the engineering students of Mount Allison University, accompanied by past president H. W. McKiel, vice-president of the University. The branch meeting was at the Fort Cumberland Hotel, Amherst. It was a very pleasant dinner meeting with the ladies present. After the dinner the executive met with the Institute officers to talk shop.

Early in the morning of the 14th, the chairman of the branch, L. F. Kirkpatrick drove the party to Moncton to catch the plane for Montreal.

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**Peterborough**

**At left, R. L. Dobbin and G. S. Wade, chairman of the Peterborough Branch.**

**Below left, John G. Hall (left) and Edgar A. Cross of Toronto.**

**Below right, The president and three of his many charming nieces, left to right, Mrs. Frank Pope, Mrs. J. P. Watts and Mrs. Jack Dobbin.**

Toronto. Left to right, R. Bleakley, R. W. Teagle, C. D. Carruthers, E. R. Graydon, C. R. Davis, Professor E. A. Alleut, Mrs. Robertson, President Dobbin, Dr. A. E. Berry.

Toronto. Left to right, S. Segsworth, C. E. Potter, M. McMurray, M. Whelan, J. H. Ross, L. A. Wright, C. P. Brzozowiez, E. R. Davis, J. G. Hall.

Top. Windsor. Right to left, W. G. Mitchell, Mrs. Mitchell, Mrs. Maguire, P. Maguire, Mrs. Donnelly, D. Donnelly.

Border Cities, left to right, C. G. R. Armstrong, J. G. Hoba, Mrs. Armstrong, R. L. Dobbin, J. C. Aitkens, chairman, Mrs. Hoba, L. A. Wright, Mrs. Aitkens.

Cornwall. Left to right, J. Morris, R. L. Dobbin, J. M. Hawkes, chairman, L. Snelgrove, secretary-treasurer.

Below left, London. Left to right, D. Cooke, R. L. Dobbin, J. D. Patterson, chairman, J. A. Ogilvie, J. A. Vance, F. W. Jones.

Below right, London. Left to right, M. Dillon, H. Stead, G. Humphries, D. Campbell of Woodstock.

The president and members of the Hamilton executive, including W. A. Dawson, chairman, and J. A. Reid, secretary-treasurer.

J. B. Nickerson and family, of Hamilton. The president called on a member who is recovering from a long illness.

Photographed at Wallaceburg, Ont., the president appears above (fourth from right, in second picture), in the company of H. B. R. Craig, G. R. Angle, C. G. Forberg, J. L. Fraser, John E. Stott, J. A. Burgess, N. J. Southern, C. Wm. Case, E. C. Brisco, Jr., A. G. Price, W. J. Collins.

New Glasgow. This group includes (left), D. G. Dunbar, Branch secretary, President R. L. Dobbin, centre. The third gentleman is not identified.

At Laval University, Quebec. Left to right, A. E. Pare, Quebec Branch chairman, R. L. Dobbin, Bernard Michel, winner of the E.I.C. prize, Dr. A. Pouliot, dean of engineering.

**Top left, The president, at Mount Allison, was greeted by Dean H. W. McKiel and a group of engineering students.**

**Top right, At Amherst, Mayor F. C. Whitman, Mrs. McKiel, R. L. Dobbin, L. F. Kirkpatrick, chairman, Mrs. Whitman, Dr. H. W. McKiel, Mrs. Kirkpatrick.**

**Lower left, at the Halifax meeting. Left to right, J. D. Kline, A. R. Harrington, J. B. Hayes, G. J. Currie.**

**Lower right, the Halifax meeting. Left to right, G. J. Currie, R. L. Dobbin, G. F. C. Bennett, I. P. Macnab, D. J. MacNeil.**

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# Smart Answers

Are scientists illiterate, inarticulate and irresponsible? A chap named Ritchie Calder, described as chairman of the Association of British Science Writers, says they are.

Here is how the news item runs as reported in the October journal of the Professional Institute of the Public Service of Canada.

LIVERPOOL, England. Sept. 8—(AP)—A body of august British scientists were told to their faces on Monday that their profession is "illiterate, inarticulate and irresponsible".

Scientists were so sized up by Ritchie Calder, chairman of the Association of British Science Writers, at the 115th meeting of the British Association for the advancement of science.

In his prepared address Calder justified his harsh judgement this way:

"1. Illiterate — because the test of literacy is the capacity to communicate ideas, and, in these days of specialization, scientists are the hostages of their own professional slang.

"2. Inarticulate — because they cannot, or do not bother to express themselves intelligently.

"3. Irresponsible — because they will not accept their responsibility to consider, and explain, how their work will affect ordinary people's lives, at a time when science is producing convulsive changes and dangerous stresses in our civilization.

"They are content to leave their discoveries on the doorstep of society like abandoned foundlings, without concern as to the way in which they are used, misused or not used at all."

Now sit back and enjoy yourself. Here is the answer given by the president of the National Research Council, Dr. E. W. R. Steacie as reported in the same publication.

"Mr. Calder suggests that scientists are illiterate because the test of literacy is the capacity to communicate ideas and because scientists are the hostages of their own professional slang. This statement is, I think, illogical in two respects. In the first place "professional slang" is merely a language designed for accuracy. It is in no way slang to the specialist and is the only way in which he can state what he means in such a way that other scientists will understand him. The language is not designed for the non-specialist.

"Mr. Calder states that the test of literacy is the capacity to communicate ideas. My own feeling is that a test of literacy is the capacity to communicate ideas to those who are capable of understanding them. Would Mr. Calder seriously suggest that a philosopher is illiterate because he is unable to communicate his ideas to a cow? Is not the cow perhaps the one that is illiterate? Or is the cow the hostage of her habit of mooing?

"Mr. Calder says scientists are inarticulate because they do not bother to express themselves intelligently. This overlooks the fact that the average scientist is primarily concerned with research and not with popular entertainment. The outlook of the average scientist on the relative importance of research and the writing of popular articles is naturally different from that of Mr. Calder, since the scientist makes his living from the former and Mr. Calder makes his from the latter.

"The statement is that scientists are irresponsible because they will not bother to explain how their work will affect ordinary people's lives. One does not have to understand nuclear physics to understand that an atomic bomb is a dangerous thing, and while it is no less the scientist's responsibility to interest himself in the sociological consequences of it, it is certainly no more his responsibility than that of anyone else. It should also be realized that scientific discoveries are merely pieces of information which may or may not be used by society. The work that leads to better explosives can be used in mining or in warfare. The development of the automobile is essentially the development of the tank. It is no more sensible to criticize the scientists for obtaining fundamental information which may be used for purposes of warfare than it is to criticize a dairy because a bottle of milk is a convenient weapon with which to hit someone on the head.

"In short I feel that it might be said with some justice that Mr. Calder is himself illiterate because he appears to be ignorant of the reasons for the existence of a specialized scientific language. He is irresponsible because he appears to be distributing scientific information without attempting to understand the basic philosophy behind it, but he is certainly far from inarticulate."

Another interesting comment appears, this time from Dr. K. W. Neatby, Director, Science Service, Canada Agriculture.

"To repudiate the charges that Ritchie Calder is reported to have levelled at scientists is no easier than to substantiate them. It is, perhaps, not fair to comment at all without first learning exactly what Mr. Calder said, but this I am unable to do. It is certain that he did not mean precisely what he is reported to have said, and we may confidently assume that he considers scientists to be illiterate, inarticulate and irresponsible only in relation to scientists of the past, to other classes of supposedly educated people, or to what they ought to be. After all, these qualities have no absolute values, nor can they be expressed in precise terms.

"Probably most scientists will agree Mr. Calder has focussed attention upon a very real and serious problem, but it is equally likely that they will credit him with no special powers of observation or that they will admit justice in singling out scientists for special attention. That scientists are less erudite and scholarly than they ought to be is certain; but surely this is only a symptom of a disease that is as apparent outside scientific circles as within them. Even parliamentarians will hesitate to affirm that they have maintained the standards of debate established by their fathers and grandfathers! While allowing for the tendency of an aging generation to feel that its own decay must inevitably be accompanied by a decline in virtue, evidence of a deterioration in scholarship is impressive. But not only among scientists. There are those who contend that musicians, writers and painters are illiterate and irresponsible . . . though anything but inarticulate!

"Perhaps the scientist has deteriorated and is deteriorating faster than his fellow man, and I think it would be surprising were this not so. The difficulty of becoming technically competent in any one branch of science is such that a broad knowledge is possible for the exceptionally gifted and, perhaps, privileged. If, in addition to general scientific learning, we expect or hope to find high standards of literacy, articulation and responsibility to the public, we shall probably be tempted to express our findings in terms akin to those employed by Mr. Calder.

"We must admit that modern scientific education and experience have produced but few gifted writers with (or without) a sense of public responsibility. I, for reasons other than the one just defined, am not ready to admit that the blame lies at the scientist's door. Nowadays it appears that education, at least to high school graduation, is concerned more with method than with matter. This, if true, combined with the necessity for "educating" thousands at our seats of learning when hundreds were enough for our fathers, and the inevitable concomitant lowering of minimum standards must surely produce results that will explain if not justify Mr. Calder's somewhat sweeping and decidedly unscientific generalization.

"To say that 'they (scientists) are content to leave their discoveries on the doorstep of society . . . without concern as to the way in which they are used . . .' is an assertion much more difficult to defend. Indeed, it could be argued that the application of scientific discovery is proceeding faster than discovery itself. Even in the realm of what might be called the sociological applications of biology, there is evidence of an increased awareness of personal responsibility. Surely, during the past decade, more has been said and written about the significance of preventive and curative medicine and the wise exploitation of agricultural resources in relation to population trends than ever before.

"Finally, no amounts of literacy, articulation and responsibility on the part of scientists will avail without corresponding virtue discernible in responsible governments and their electors.

"Lest my remarks be interpreted as an effort to justify the existing level of erudition among scientists, I hasten to confess that in an effort to establish justice, I may have inflated my defense arguments unduly. It is a fact that the proportion of scientists incapable of expressing themselves clearly is far too great. There is even evidence that muddled expression is sometimes a perfectly logical sequel to muddled thinking. Science cannot serve society if it is to be held in custody by technicians. Perhaps we shall discover, someday, that specialization not carefully disciplined and established on broad bases can be little better than ignorance."

A perusal of these comments gives one the definite impression that these two scientists at least are not illiterate, inarticulate or irresponsible. It would be interesting to know how Mr. Calder receives these cool, considered and crushing observations.

# New Building Research Centre Formally Opened

Believed to be the first of its kind anywhere, a new building to be devoted to building research has been formally opened on the Montreal Road near Ottawa. This "Building Research Centre," as it is to be called, will house most of the staff of the Division of Building Research of the National Research Council.

The new building is located on the site of the National Research Council's laboratories on Ottawa's outskirts, and is similar in external appearance to the other buildings located there. It differs from them, however, in that many functions are served by the one building instead of having a separate structure for each main branch of the work of the Division.

New building research centre.

The formal opening of the building took place on the afternoon of October 23, 1953, before its main entrance. Hon. C. D. Howe, Hon. M.E.I.C., minister of Trade and Commerce, who was introduced by Dr. E. W. R. Steacie, president of the Council, in his address at the opening ceremonies, before unveiling the plaque signifying the acceptance of the building, stated that the erection of such a building is an indication of the public recognition of the value of science and research as applied to construction. With advancing techniques, he said, the need for research in the solving of technical problems is one that must be met and in this case met by a public agency.

The opening ceremonies culminated a three-day Conference on Building Research, the sessions of which were held first at the Council's main building on Sussex street, Ottawa, and then at the Central Mortgage and Housing Corporation building on the Montreal Road.

Attendance at the Conference, due to limited accommodation, was by invitation. There was a good representation from United States. Dr. F. M. Lea, director of the British Building Research Station, recognized as a pioneer amongst building research organizations of the world, made a special trip to Canada to attend the Conference and to be present at the official opening.

Dr. Lea spoke before the Conference on the subject of Building Research in Great Britain. At the formal opening of the new building he extended felicitations and stated that he looked forward to continued co-operation with Canadian workers.

N. D. Lindqvist, secretary Swedish State Committee for Building Research, who has for the past year been with the National Research Council as a guest worker in Canada, outlined the progress of research in Denmark, Norway, Finland and Sweden. Research in these countries, as in most other countries, has only recently been placed on an organized basis. Production technique studies for engineers have been started by the four different countries but so far have been conducted to a limited degree only, except in Sweden where they have been carried on for about five years.

Speakers at the Conference from United States on various aspects of building and housing research in that country included: D. E. Parsons, chief Building Technology Division, National Bureau of Standards, U.S. Department of Commerce; W. H. Scheick, executive director Building Research Advisory Board, National Research Council; L. Haeger, director National Association of Home Builders Research Institute, all of Washington; and Prof. J. T. Lendrum, acting director Small Homes Council, University of Illinois, Urbana, Illinois. In addition there were technical talks by others relating to building science.

Canadian speakers included members of the staff of the Division of Building Research of the National Research Council; of the staff of the Central Housing and Mortgage Corporation; and others R. F. Legget, M.E.I.C., director of the Division of Building Research of the Council, who was chairman of the opening session of the Conference, gave a brief talk on future plans of the Division and stressed the value of co-operation between all organizations associated in any way with building and research.

Delegates to the Conference inspected the Building Research Centre after the formal opening. They toured the building and had the various features explained to them by members of the staff.

The building has a total "cubage" of approximately one million cubic feet. The total contract price with extras but not including furniture and equipping of laboratories was $1,174,000 so that its unit cost was $1.17 a figure that shows clearly the basic economy of its design. The figure is noteworthy when the large amount of plumbing and electrical work in the building is considered.

Founded throughout on solid rock, it consists of a reinforced concrete basement with two upper floors of structural steel framing and terra cotta tile outside walls finished with stucco on metal lath. A small penthouse is integral with the steel frame and is the only projection above the flat roof, most of which is of bonded tar and gravel construction but with one part tiled for outdoor experimental work.

The plan is basically that of a large T, the top being the front and office part of the building, the stem being the main open laboratory. Smaller laboratory facilities are provided on the three floors of a wing at the rear of the building. This wing and the main laboratory are so arranged that, if and when necessary they can be extended without difficulty.

## New York Reception, 1953

Following a custom started five years ago, the Institute has again held a reception in New York for its members in the United States and the officers of sister societies. The date was December 1st and the location, the Statler Hotel.

These functions are held at a time to coincide alternately with the annual meeting of the American Society of Mechanical Engineers and the American Society of Civil Engineers. This year it was the Mechanicals.

The president of the Institute, Ross L. Dobbin, and past-president James A Vance received the guests, who numbered just over one hundred. They came from many parts of the United States, and from Canada as well.

The Institute membership in the United States to a large extent is made up of American engineers who worked north of the border for some substantial period. Others came to Canada for their education and became Student members at that time. Others are Canadian engineers who have migrated south in following their professional careers. It is an extremely pleasant experience to bring these groups together occasionally under the auspices of E.I.C. It is apparent that the reception serves a useful purpose.

**Top left, left to right, F. Pope, Peterborough, Ont.; R. J. G. Schofield, N.J.; E. N. Jefferies, Philadelphia; P. C. Christofides, N.Y.; J. H. Schuster, N.Y.**

**Lower left, C. E. Davies, secretary of ASME (left); F. S. Blackall, president, ASME (centre).**

**Top right, left to right, R. J. Carson, Mrs. F. Pope, Mrs. R. J. Carson.**

**Bottom right, left to right, Miss Jean Lamb, Mr. J. Knight, Mrs. Schmelz, and Mr. Schmelz.**

# Good Roads Association Meets at Victoria

More than 500 delegates and their ladies gathered at the Empress Hotel, Victoria, B.C., October 14-17, for the 34th annual convention of the Canadian Good Roads Association. Every Province and many States were represented, as well as some countries of Europe and Asia. They were greeted by Col. the Hon. Clarence Wallace, the Lieutenant Governor, and by Premier the Hon. W. A. C. Bennett, and welcomed to the City by His Worship Mayor Claude Harrison. The Hon. Gordon E. Taylor, Alberta Minister of Highways, was elected president of the Association for 1954.

Hon. E. S. Spencer, Minister of Public Works for Newfoundland and President of C.G.R.A., told the opening session that roads are "one of the highest ranking problems of municipal and provincial governments," and "in so far as it has become a problem affecting the national interest, it has become a problem of the Federal Government."

Though gratifying progress had been made in reconstructing roads and streets, the progress was modest in terms of need, he said. Predicting further increase in traffic congestion, he pointed out that in our major cities it had passed the critical point and is now desperate. C.G.R.A. activities in the field of public education were being reflected in a more favourable public attitude to adequate road budgets, and the task of administrators in obtaining money for road building was made easier in consequence.

### Road Building in 1953

Compared with $424 million for 1951 and $422 million for 1952, Canadian Governments and business will spend $449 million in 1953, according to the Dominion Bureau of Statistics. Atlantic Provinces will spend $28 million, Quebec $10 million, Ontario $173 million, Prairie Provinces $74 million, and British Columbia $67 million. Shortages of experienced engineers and technicians have imposed restrictions, while wet weather in the West has retarded construction during the current year. As reported by the Federal and various Provincial Governments for the annual "Roads Roundup", progress during the current year is as follows:

Newfoundland has been forced to build to low standards to connect outlying settlements. Only 52 per cent of revenue is collected from users in that Province. New Brunswick has been concentrating this year on secondary highway construction, and repairs on worst sections of main trunk highway. Nova Scotia is spending 7½ million, mostly on paving and will start work on the Trans Canada Highway next year. The bridge building program is lagging. Prince Edward Island is spending a third of its 1953 budget on roads, and has completed about half of its share of The Trans Canada Highway.

Quebec has been giving special attention to rural mileage, particularly in remote areas, and has been steadily increasing the road mileage it maintains. Nearly 26,000 miles are kept open in winter, compared with 4,000 miles a decade ago.

Ontario's current budget of $125 million is a record for that Province. Highlight of the 1953 construction program has been an emergency program for relief of congestion at or near major urban centres. By next year main highways will by-pass most large cities and towns.

Wet weather has retarded road construction during the 1953 season in all three Prairie Provinces. Manitoba has completed only two thirds of its Trans Canada Highway work scheduled for this year, though completion by 1956 is probable. In Saskatchewan, 1953 progress has been fair, in spite of a labour shortage. The Province's share of the Trans Canada Highway should be completed by 1956. Rural roads are still a major problem but much more has to be done to free urban tourists from mud, snow and dust. The present year's road program in Alberta is the most ambitious in its history. Progress on its share of the Trans Canada Highway is satisfactory. Some areas are suffering from a shortage of gravel supply.

Despite record expenditures and construction in recent years, British Columbia is still far from the ultimate goal of bringing highways up to standards necessary for ever-increasing traffic. Main objectives are completion of the Trans Canada Highway, the Southern Trans-Provincial Highway, the Cariboo Road, the John Hart Highway, and connecting and feeder roads.

### Army Axles Need Tough Roads

Canadian roads are insufficient for strategic military purposes, Lt.-Col. D. W. Cunnington, Commandant of the Royal Canadian School of Military Engineering, Chilliwack, B.C., told the convention. Any large scale military movement would suffer such interferences, that its arrival at its destination in a reasonable time and in condition to operate effectively would be a matter of conjecture, he said.

**Hon. Gordon E. Taylor.**

The Canadian Army is undertaking a study of Canadian roads. The study shows there are enough roads, though they are unsatisfacttory for military purposes. The most serious bottleneck is narrow bridges, less than half of which are suitable for military traffic. A carefully integrated plan for all new highway construction is essential, he warned, and there are many problems yet to be solved before Canada will have roads suitable to her military needs.

### Auto Industry Spokesman

D. C. Gaskin, President of the Studebaker Corporation of Canada, Ltd., told a convention luncheon that the automobile industry had a strong and immediate interest in the Nation's highway systems. "A better road system for the Nation will lead to better markets," he stated, "yet our interest is small compared to the Nation's interest in the health of the whole vast system of highway transportation. The automobile industry recommends strongly that the Nation's highway requirements be met."

### Who Shall Pay for the Roads we Need?

Participating in a Panel Discussion, numerous speakers emphasized that financing improvement and expansion of roads and streets has become one of the toughest and important of national problems. Dr. R. W. McColough, executive assistant to Minister of Highways of Nova Scotia, voicing the views of the provinces, noted that vehicle production and traffic growth exceeded the capacity of the provinces to provide new highways. Highway revenues, he stated, should be raised from the users and from those who benefit from the roads. Two-thirds of the cost of roads should be borne by users and one-third by those who benefit from them. The Government of Canada receives enormous revenues directly from highways, and should therefore go beyond assistance given in the Trans Canada Highway Agreement, he said.

Speaking for municipal governments, Dean F. C. Cronkite of the University of Saskatchewan stated that municipal governments cannot bear the cost of needed street and road improvement. The whole highway problem should be a national problem, he observed, and Federal funds should be used in amelioration. In allocating taxing privileges, the Fathers of Confederation did not foresee the coming of the automobile, nor the appalling potential obligations of municipal governments arising therefrom. Ottawa, he pointed out, has extended substantial Federal aid in fields of provincial responsibility such as health and welfare. There is no jurisdictional barrier to Federal aid for highways as well, if the public interest demands it.

R. W. Macdonald, a director of the Canadian Automotive Transport Association, representing commercial users of roads, pointed out that it was generally accepted that all roads have social and economic value, and there are other beneficiaries besides the motor vehicle users themselves. Motor vehicle owners obviously have a special tax-paying role in the provision of these roads. No reasonable person expects them to pay the entire bill, but they should pay their fair proportion.

The trucking industry, he said, was making a substantial and fair contribution, and stood ready to co-operate in any research on the subject of who shall pay for the roads we need. It would be better for the climate of trucking industry co-operation, he added, if such research were not railroad inspired and instigated.

"The Federal Government is incomparably the greatest and most opulent beneficiary of road use in Canada," Alex R. Morrison, president of the Canadian Automobile Association, stated. The British Royal Commission decided that roads should be financed first by users, second by those who benefit, and third by community interests which profit from them through higher property values and enhanced living standards. Was it not ironic, he asked, that our Federal Government was even today contributing but a small fraction of the income it derives from motor vehicle owners, towards the construction of highways?

W. G. Scott, Transport Economist for the Railway Association of Canada, pointed out that the C.G.R.A.'s estimate of needed annual highway expenditure is $600 millions. Highway user taxes are accounting for a progressively smaller part of total expenditures, seventy per cent before 1940, down to 63 per cent in 1951. By any measure—construction costs, cost of living, price of automobiles or repairs, or car insurance—highway taxes are unrealistically low, he said.

Using the principle of relative use based on weight carried and distance travelled, research studies by railways in the past year demonstrate the present inequality in highway taxation. A private auto pays 3½ to 6 times as much as a gasoline propelled tractor trailer combination for use of the roads. The growing tendency to provide roads at less than cost for large motor transports is one of the most serious competitive problems with which the railways are faced.

The Director of Research, Canadian Tax Foundation, J. H. Perry, told the Panel discussion highway construction is one of the three most pressing problems facing governments today. Defence and education are their other two biggest responsibilities. More vehicles, more traffic, more speed, plentiful fuel and a booming economy have called for an incessant demand for roads of better standards. Increasing costs per mile of these better roads and improved maintenance have been sharply accentuated by the rise in prices of labour and materials.

The argument for increasing taxes on users was that those who use the highways should pay for them, he pointed out. Yet highways and urban streets provide many direct and indirect benefits to persons other than vehicle owners, such as fire and police protection and garbage disposal. These benefits accrue in some measure to the whole community, and it therefore seems equitable that the general taxpayer should contribute. What his share should be will vary with time and place.

The share of revenue from trucks and buses exclusive of gasoline tax revenue has progressively increased. It represented more than 42 per cent of license revenue in 1951, he continued, but such vehicles comprised less than a fourth of all motor vehicles. It is generally assumed that commercial vehicles do more damage to roads and streets than lighter passenger vehicles, and that they should therefore contribute relatively more per vehicle in licenses and taxes. Moreover, proper compensation for highway use should be levied on commercial vehicles to offset the public aid they enjoy over competing carriers, notably railways.

These two approaches suggest that commercial users should contribute relatively more than other users. Based on 1951 data, each truck or bus accounts for more than twice the revenue of each other vehicle. A much more comprehensive study, he observed, would be needed to determine the real validity of alleged more scientific methods of charge, being developed by certain American States.

Advocating more Federal generosity towards provincial road aid, Mr. Perry pointed out that while Ottawa was under no onus to share its vehicle revenues, the heavy burden of Federal taxes on the automobile user makes it more difficult for provinces to obtain more money from him. Certainly, he felt, it was incumbent on the Federal Government to share heavily in any road vital to national defence. It should be possible to extend the Trans Canada Highway agreements to include other roads having an agreed national importance.

#### More Help for Grade Crossings

"The only real solution to the grade crossing problem is enlargement of the grade crossing funds," F. M. MacPherson, commissioner of the Board of Transport Commissioners, told the convention. The accident rate at level crossings had grown steadily worse, he said, giving the great increase in road traffic and more and faster trains as the main reasons.

An increase from the present $2 million yearly to $10 million was being advocated, he added. Other measures suggested were increasing the Federal share from the present 40 per cent, to 50 or even 60 per cent; maximum contribution for any one project to be doubled to $300,000; and availability of the fund for use on reconstruction of existing grade separations.

### Uniform Traffic Code Nearly Ready

Details of a draft Uniform Traffic Code for Canada, being prepared by a committee of the Canadian Bar Association, were revealed by A. C. DesBrisay, Q.C. Under preparation for several years, it is to be submitted to provincial governments in a year's time. The rules cover every aspect of highway movement and traffic regulation, including traffic devices and controls, passing, turning, starting and signals, right of way, pedestrians rights and duties, streetcars, safety zones and other subjects. The rules are very similar to the Uniform Act Regulating Traffic on Highways, which forms part of the Uniform Traffic Code recommended for adoption in the United States.

### Roads Vital to Small Business

The guest speaker at the Association's annual dinner was E. D. McPhee, director of the School of Commerce, University of British Columbia, who told delegates good roads, rather than railways, are the primary need of the small business man. Some four million Canadian workers are employed in manufacturing, commercial or service organizations, employing fewer than 20 persons, or are self employed as farmers, miners, fishermen or in the professions. Their success is essential to the economic welfare and health of the Nation.

While production has increased greatly, railways have not gained the increased tonnage, nor have large truckers carried the bulk of the great new movement—operators of single trucks, farmers, market gardeners, stores, plumbers and painters are carrying much of the Nation's commerce. Firms with their own small fleets of trucks carry a great volume.

The fact that the number of trucks has trebled in 12 years while vehicles on the road have increased 56 per cent in five years is evidence of this, he said. During this time our surface road mileage has increased only 19 per cent. Better roads must come, because they serve the needs of the greatest volume of people.

### Need More City Traffic Planning

Jacques Barrière, traffic engineer of Montreal, told delegates of a study of traffic conditions in the 19 largest Canadian cities. Traffic planning in Canada was "overly modest" and municipal budgets grossly inadequate, he said. Compared with the $134 million which the average Canadian motorist pays yearly in taxes, the most ambitious traffic planning by a major Canadian city cost $2.80 per registered vehicle, while the Canadian average was only 75 cents.

Trained traffic engineers were in short supply, he said, and there must be wider recognition of the need for training them. Much remained to be done to tighten up safety regulations. Two-thirds of the 19 cities had no compulsory driving tests, while none had compulsory blood tests for drunken drivers. Few cities provide off-street parking facilities.

### Other Business

J. H. Lowther of the Dominion Bureau of Statistics, called for a great increase in available statistics on all aspects of road-work. No comprehensive picture of the economic development of road transportation was criticized for delay in publishing statistics, they could only produce what they receive when they receive it.

W. N. Carey, project engineer of the U.S. Highway Research Board, as well as members of the C.G.R.A. Observer Committee, outlined experience to date on the traffic tests on flexible pavements, being conducted by the U.S. Highway Research Board.

L. R. Kain, chairman of the C.G.R.A. Operating Committee, forecast that motor vehicle registrations would grow to 3½ million by the end of 1953, and would reach four million by the end of 1954. Congestion would get worse, he said, and there was a critical need for road and street improvement.

### Convention Resolutions

Resolutions presented to the meeting called for the Federal Government to make a much larger contribution to the Grade Crossing Fund; to adopt a distinctive road sign at frequent and regular intervals along the Trans Canada Highway; to develop in co-operation with the Provinces a plan for road improvement that would meet the demands of national security; to initiate or support a nation-wide study or enquiry into the cause of traffic accidents; and to convene a meeting of governmental authorities to improve statistical information on roads and road transport.

## Duggan Medal

**The Duggan Medal is presented at Toronto to Prof. E. A. Allcut, M.E.I.C., for his paper "Possibilities of the Heat Pump in Canada". Left to right, R. L. Dobbin, president, Professor Allcut, John G. Hall, chairman, Toronto Branch.**
*—Photo by Canadian Power Engineer.*

# Annual Meeting, ECPD-ASEE

The *Journal* is indebted to George M. Stetson, editor of *Mechanical Engineering*, for permission to use this material which in greater detail will also appear in that publication.—Editor

## The General ASEE-ECPD Program
## Presented at the Twenty-first Annual Meeting of ECPD, October 14-17, 1953

Success of the joint meeting of the American Society for Engineering Education and the Engineers' Council for Professional Development, held at Chicago in September, 1952, in connection with the Centennial of Engineering, prompted decision to hold another joint meeting at the Hotel Statler, New York, N.Y., Oct. 14-17, 1953.

### Sessions on Creativeness

Two sessions of a conference, one devoted to creativeness in the arts and the other to creativeness in engineering, were held at the Hotel Statler on Thursday morning and afternoon. These sessions were sponsored by the Engineering College Research Council and Engineering College Administrative Council and were open to all members and representatives of ASEE and ECPD and to the general public. The sessions were enthusiastically received and provoked considerable discussion.

At the morning session, Eric A. Walker, vice-president ASEE and dean of engineering, Pennsylvania State College, presided. The theme, Creativeness in the Arts, was developed by three speakers: Virgil Thompson, music critic, New York Herald Tribune; John Fevien, internationally famous painter: and Ralph Bates, Department of Literature, New York University.

W. L. Everitt, vice-president ASEE, and dean of engineering, University of Illinois, presided at the afternoon session where the theme, Creativeness in Engineering, was developed by Fred Olsen, vice-president for research and development, Olin Industries, who presented the industrialists' point of view, and Maurice Nelles, director, Borg-Warner Laboratory, the engineering point of view.

At the luncheon, with L. E. Grinter, president ASEE, and dean of engineering and director of research, University of Florida, presiding, Morris I. Stein, professor of psychology, University of Chicago, spoke on the subject, "A Psychologist looks at Creativeness, Its Environment and Its Measurement."

### Sessions on Engineering Accrediting

Recent developments in accreditation of educational institutions as a whole and of individual curricula, not only in ECPD and its constituent bodies, but in the institutions and other accrediting agencies as well, prompted the decision to devote the general program of the twenty-first annual meeting to the subject of engineering accrediting and the studies of the ASEE Committee on Evaluation of Engineering Education, with which the ECPD Education Committee, which is in charge of the ECPD accreditation procedures, is closely associated.

### Needs of Students in Choosing an Engineering School

The point of view of a consulting engineer who frequently has been asked to advise students and their parents on the choice of an engineering school and who criticized ECPD for issuing lists of accredited curricula based on the meeting of minimum standards only, was expressed by Gregory M. Dexter in a paper, "Our Neglected Future Engineers." He contended that wide variability in many important factors among institutions was not recognized in the ECPD lists and hence young people and their parents were uninformed in respect to these factors. He asserted that evaluation of the comparative merits of engineering schools involved, beyond the accreditation accorded by ECPD which is based on minimum standards, such factors as teacher load, cost per student, adequacy of laboratory equipment, and educational qualifications of instructional staff. Other factors of importance to prespective students, in his opinion, are the number of chapters of honorary fraternities in the institution, entrance requirements, fees, number of living alumni and their active interest in the institution, source of income, whether public or private, attitude of the institution on academic freedom, and the size of endowment funds. He also cited ten criticisms of accrediting agencies, and closed with a plea for publication of the data needed by our future engineers in making a choice of the college they should attend.

### Evaluation of Engineering Education

The third speaker at the Friday morning session was L. E. Grinter, dean of the graduate school, University of Florida, president ASEE, and chairman of the ASEE Committee on Evaluation of Engineering Education.

Dean Grinter stated that the Committee on Evaluation of Engineering Education had been appointed in May, 1952, by Dean S. C. Hollister, at that time president of ASEE. "The charge to the committee," he said, "was to determine the pattern or patterns that engineering education should take to provide the leadership that the profession must have 25 years from now." He then cited examples of the "increased importance of the basic sciences in engineering progress," and the reorientation of research physicists toward nuclear problems, which made it seem doubtful "if the interest will ever be returned in sufficient measure to influence greatly research in vibrations, elasticity, heat transfer, engineering thermodynamics, fluid flow, and other engineering sciences. Hence," he continued, "engineers have become responsible for the continuity of research in all the fields of engineering science. The leaders of the engineering profession 25 years hence must be engineers who are at no loss in interpreting or themselves contributing to the extensions of the fields of engineering science."

In respect to curricula changes, Dean Grinter, who was presenting a summary of the preliminary report of his committee, stated, as regards the basic sciences, which include mathematics, physics, and chemistry, that "mathematics through ordinary differential equations seems close to a minimum essential for all engineers. Chemistry deserves increased emphasis . . . and for a larger portion of engineers considerably more than the usual freshman chemistry course is necessary." He asserted that the Committe has "indicated its belief that modern physics including nuclear and solid-state physics has become an essential study in engineering. Since the physicists' teaching of mechanics, thermodynamics, and electricity is largely duplicated in engineering courses, it is believed that better co-ordination would provide opportunity for the study of modern physics. The Committee, therefore, recommends greater emphasis upon basic science in engineering curricula."

Nine important background sciences of engineering have been recognized by the Committee, said Dean Grinter. They are: statics, dynamics, strength of materials, fluid flow, thermodynamics, electrical circuits, fields, and electronics, heat transfer, engineering materials, and physical metallurgy. "It is believed," he reported, "that all of these studies should be represented in curricula that train engineers in research, development, or design and that no less than seven should be integrated into every curriculum that is represented as education for engineers."

Studies in analysis, design, and engineering systems, along with the necessary background of the engineering sciences, "represent the features that distinguish engineering education from education in science on the one hand or technical institute education on the other," Dean Grinter asserted. "In all curricula except those intended for training in management or other general professional service, studies in design or in analysis leading to design, should occur as an integrated study over four successive semesters. Even the most general curricula should include such studies as a continuing program for at least two semesters."

Turning his attention to "engineering courses selected for broadening purposes such as electrical engineering for nonelectricals," Dean Grinter stated that "such courses should avoid the study of special machines or devices including their construction, production, or operation. The Committee affirms its conviction," he said, "that the most important broadening courses in engineering are those listed as the engineering sciences. Additional studies in these fields are recommended in place of survey courses in engineering practice."

Dean Grinter stated that "the Committee recognizes the importance of social studies and the humanities as an important part of an engineer's education. . . . The Committee recommends a much broader study of the effectiveness of the social-humanistic stem of engineering education."

Dean Grinter then went on to discuss faculty selection and development, "An educational background which includes the PhD. degree is the strongest evidence usually available to measure the probable usefulness in teaching and research of a relatively young candidate for a faculty position," he said, "For older persons evidence of the productivity of the individual in creative teaching and research may be gaged by other criteria, and the formal educational background is of less significance."

In respect to the development of superior teachers, Dean Grinter said: "A faculty that can be expected to provide adequate leadership for students will have at least one member in five who has achieved professional distinction by creative activities. Such persons will (1) be conducting high-grade research of an engineering or educational nature or other creative activity, including publishing of good quality; (2) be engaged in consulting work at a creative level; (3) be exercising leadership in scientific, educational, and professional societies; or (4) preferably be serving in a combination of such activities."

Another section of Dean Grinter's report deals with accreditation of curricula. "For proper handling of accreditation," he said, "ECPD needs improved standards for measuring the effectiveness of the educational process and also criteria that distinguish engineering curricula from those in science and from those in technical institutes." The Committee has devised the terms "professional-scientific" and "professional-general" education to distinguish between curricula designed for the training of two separate groups of engineers. In order to raise the standards of accreditation of engineering curricula, Dean Grinter recommended that "the accreditation process be reorganized on the basis of a distinction between professional-scientific curricula and professional-general curricula." Professional-scientific curricula are those, embodying the characteristics previously mentioned, intended for the instruction of engineers for research, development or design. Professional-general curricula are those designed to produce engineers "(1) to serve in areas between engineering, management, law, real estate, or agriculture; (2) between engineering and a branch of science where the opportunities to apply engineering analysis and design may be limited; (3) between engineering and a highly applied technology, such as production processes, operation, construction, or air conditioning, welding, or wood technology."

To ECPD, Dean Grinter recommended "liberal acceptance of experimental programs that meet the definition given of engineering education. . . . The length of the curriculum should be one such factor subject to wide experimentation. The Committee does not foresee difficulty in meeting within a four-year program its recommendations for an accredited professional-scientific engineering curriculum plus all of the specialized courses of the degree-granting department, but it believes that specialized engineering courses are of far less value in professional-scientific education than a broad background of engineering science and its application in one field of analysis and design."

Dean Grinter's report ended with a statement that "there appears (to be) merit in identifying those curricula which meet criteria substantially above the minima. The major factor in such identification should be the background and eminence of the faculty and its attention to creative teaching."

#### Discussion of Accreditation and Evaluation

The extensive and spirited discussion which followed Dean Grinter's report was summarized by S. C. Hollister who said that the speakers had approached the subject of accreditation from three points of view, (1) that of the institution seeking accreditation, (2) that of the student and his parents, and (3) that of professional licensure. He cited as three concepts of the accreditation process (1) the classification of the relative qualities of a college; (2) the minimum standards of an institution; and (3) stimulation of the improvement of individual programs.

There was evidence that the needs of the profession are changing rapidly, and he asked what was being done to meet change. Also, there had been introduced into the accreditation picture a new element which suggested the possibility of indicating schools that are doing a superior job in engineering education. The central theme which ran through the discussions, he said, was an indication that the public does not understand the engineering schools.

The most important need at present, he said, lay in the evaluation of engineering education. There was a need for a definitive statement of objectives and a unification of patterns to meet these objectives. What would be done at the campus level with the preliminary report of Dean Grinter's committe was therefore of great importance, and the question of accreditation would be secondary until other facts were known. It was the quality of the faculty, he said, which defined the nature and set the tone, level, and objectives of engineering operations. However, there was no good way to measure the functions of the faculty. Judgement and experience counted greatly, he asserted, but quantitative specifications might result in a "hardening of the categories." Accreditation must not standardize or paralyze education, he contended, nor must it interfere with the growth of sound experimentation. It must provide for a shift of educational attack, but not a shift of objectives to meet standards of a quantitative nature.

There was confusion in respect to the objectives of higher education, he said, and then listed three objectives which appeared to him to be valid; (1) Education for leadership for intelligent progress in a dynamic world; (2) high scholarship; and (3) training for responsible practice of engineering, which is something the engineering profession owes to the community.

In closing he stated that accrediting was not an end in itself but an aid to the objectives which education sets for itself.

#### General McNaughton Discusses Water Problems

Despite large hydroelectric resources and recent power developments, Canada has no power surplus, General A. G. L. McNaughton, chairman of the Canadian Section of the International Joint Commission, told the luncheon group on Friday.

Presently foreseen expansions in the Canadian economy will employ all of Canada's available economical power, General McNaughton said. Future power developments in two important areas, he pointed out, are involved in Canadian negotiations with the United States. These are the St. Lawrence Seaway and Columbia River system.

Canada is hoping to begin power works development along the St. Lawrence next spring, General McNaughton said. It seems to Canadians "that every conceivable argument against the St. Lawrence project has been answered," he declared. The issue of American association with the Ontario Hydro Electric Power Commission for construction of power works is still in the U.S. Courts, he said.

Turning to the Columbia River basin, General McNaughton reported "sharp differences" in hearings on the U.S. application to erect a dam at Libby, Mont. The project would produce about 1,000, 000 hp. at the site and would benefit industrial plants in both countries. While financial compensation can be negotiated for lands, rebuilding of roads, railways and communications, damaged forests and minerals and resettlement of residents, major disagreement centres on the lands that will be flooded 42 miles over the border into Canada.

Downstream interests will settle only in terms of monetary compensation, while the flooded areas are asking for recompense in the form of increased power allocations, General McNaughton said.

The use of the Watertown and Belly Rivers for irrigation in Alberta has also aroused a "sharp, determined, and long enduring" controversy, General McNaughton said. The rivers rise in Montana and flow into Alberta. Their application to irrigation, he said, would transform a desert into productive farm land.

In contrast to the St. Lawrence, Columbia, and Montana-Alberta difficulties, General McNaughton said, cases concerning the St. John River (between Maine and New Brunswick) and remedial work at Niagara Falls are being concluded in "the spirit of close co-operation and understanding of the points of view of those on both sides."

Col. L. F. Grant, chairman of the Engineers' Council for Professional Development, presided at the luncheon meeting.

#### Post-College Training

A community project to assist in the professional development of young engineers was described by Cornelius Wandmacher, professor of civil engineering, University of Cincinnati, Cincinnati, Ohio, during Friday afternoon's session.

Local engineering societies, industrial companies, and the University joined forces in a program of post-college training, he said.

Professor Wandmacher, who is chairman of the ECPD Training Committee, is working with others in the Cincinnati area on a "pilot" project to assist young engineers in their professional development. Cincinnati was chosen as a typical American industrial community in which to test the Committee's recommendations.

The program embraces the following six basic points of endeavor: Orientation and training in industry, continued education, integration into the community, professional registration, self appraisal, and recommended reading. Nine of the city's industrial companies, 23 local sections of national technical and scientific societies, and members of the administration of the University are participating in the program.

A total of 285 engineers and scientists have enrolled in advanced evening courses at the University of Cincinnati.

#### Engineering Manpower Utilization

The steps taken by two firms toward more effective utilization of engineering manpower during the present acute shortage of engineers were also discussed at this session.

Guy Kleis, manager of the Central Technical Departments of the Westinghouse Electric Corporation, Pittsburgh, Pa., explained the Westinghouse "Three-Point Program," and Chester L. Brisley, chief industrial engineer for the Wolverine Tube Division, Calumet & Hecla, Inc., Detroit, Mich., illustrated the "sampling" techniques employed by his firm.

The "Three-Point Program" at Westinghouse, Mr. Kleis said, includes (1) employing non engineers for "fringe area" jobs; (2) purifying "engineering area" jobs; and (3) raising the performance level of both professional and supporting personnel through an educational assistance program.

Fringe area jobs in the electrical manufacturing industry, he stated, include semi-technical sales, purchasing, production planning and control, time and motion analysis, quality control, industrial relations, and shop supervision. Experience has proved that business adminstration, liberal arts, and law graduates, with supplemental training in engiеering fundamentals and industry methods, can perform these functions as well as engineers, derive more honest satisfaction from the work, and possess equal or greater potential for advancement into management positions.

He described "engineering area" jobs as those in which a bachelor's degree in engineering or science is a minimum requirement. At Westinghouse they were "purified" by the delegation of "all extraneous detail" to clerks and technicians. Mr. Kleis said this resulted in a 15 to 20 per cent increase in engineering output.

The "long-range, wide-range" educational program was established to meet the varying needs of all Westinghouse employees. It includes graduate and undergraduate study in engineering, science, business, and management at 16 affiliated universities, and a technical institute program for high school graduates who want to become technicians. The management of Westinghouse not only encourages participation, but also makes substantial contributions by refunding tuition, he declared.

The second speaker, Mr. Brisley, defined sampling as an intelligent application of the laws of chance. Stating that management too often plays hunches, he asserted that the gamble can be taken out of production or management problems by making use of the work-sampling technique.

At the Wolverine Tube Division, said Mr. Brisley, the technique was used to determine time-study allowances. The general practice, he observed, is to make continuous time studies over a long period of time. However, this takes a lot of specially trained manpower, he said. Now we get the same data by work sampling, he declared, and it requires only a fraction of the man-hours needed to make continuous time studies. Observers need much less training than a qualified time-study man. Experience, he pointed out, has taught us all that the data are sufficiently accurate.

The technique, he said, was successfully applied to determine how engineers in the firm's Decatur, Ala. plant could increase their productivity. It was also used in the Detroit plant to help executives make better use of their time.

T. H. Chilton, chairman, Engineering Manpower Commission, served as chairman of the session.

### Annual Dinner

Nearly 200 engineers and engineering educators, in attendance at the Annual Engineers Dinner, heard Horace P. Liversidge, chairman of the board, Philadelphia Electric Company, Philadelphia, Pa., review the present engineering manpower shortage. This shortage, he said, has been occasioned in large measure by the rapid and broad industrial expansion of recent years without corresponding attention being given to concurrent demands for more technically trained men and women.

Mr. Liversidge's speech will appear in full in an early issue of the *Journal.*

As part of the dinner program, Col. L. F. Grant, chairman of ECPD, briefly reviewed the ECPD Annual Report, which includes reports of the chairmen of the various committees and reports of the representatives of the constituent organizations.

Henry T. Heald, vice-chairman, ECPD, and Chancellor, New York University, presided.

## R.C.E.M.E. Corps Association Annual Meeting

The eighth annual general meeting and annual dinner of the Royal Canadian Electrical and Mechanical Engineers Corps Association was held on Saturday, October 24, at the R.C.E.M.E. School at Barriefield, Ontario.

The meeting, convened by the president, Lt. Col. F. W. Cranston, E.D., of Toronto, was attended by delegates Lt. Col. J. K. Bradford, O.B.E., Toronto (Central Command); Lt. Col. A. G. Edward, D.F.C., M.C., Montreal (Quebec Command); Capt. H. G. Bowes, M.E.I.C., Halifax (Eastern Command); and Lt. J. E. McCann, Vancouver (Western Command).

The Hon. Brooke Claxton, D.C.M., K.C., M.P., Minister of National Defence, and Lt. Col. A. O. Monk, M.E.I.C., representing the director of electrical and mechanical engineering for the Canadian Army, were speakers at the meeting.

Addressing the executive meeting were Lt. Gen. C. B. Simonds, C.B., C.B.E., D.S.O., Army Chief of Staff, and Brig. A. Wrinch, O.B.E., Deputy Quartermaster General and the Kennedy Commission on Reserve Army Affairs.

Lt. Gen. Sir Archibald Nye, G.C.S.I., C.G.M.G., G.C.I.E., K.C.B., K.B.E., British High Commissioner to Canada, was guest speaker at

Members of the R.C.E.M.E. Corps Association, attending the annual meeting in Barriefield, in October 1953.

the dinner. He spoke on some of the problems experienced in the mobilization of men and equipment in England during World War II. Other guests at the dinner included Dean D. S. Ellis, D.S.O., V.D., M.C.E., M.E.I.C., dean of the Faculty of Applied Science at Queen's University; Brig. G. M. Grant, C.B.E., chairman of the Conference of Defence Associations; and Lt. Col. T. M. Medland, executive director of the Association of Professional Engineers of Ontario.

Lt. Col. F. W. Cranston, E.D., and Lt. Col. LeSueur Brodie, E.D., of Toronto, were re-elected president and secretary-treasurer, respectively, of the Association for 1953-54.

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# Evaluation of Engineering Education

## Summary of Preliminary Report

## Committee of American Society for Engineering Education

### The Committee

H. H. Armsby, U.S. Office of Education.
M. M. Boring, General Electric Company, Schenectady, N.Y.
G. G. Brown, University of Michigan.
A. B. Bronwell, Northwestern University.
R. S. Burington, Bureau of Ordnance, Navy Department.
J. F. Calvert, Northwestern University.
A. P. Colburn, University of Delaware.
C. S. Crouse, University of Kentucky.
N. W. Dougherty, University of Tennessee.
T. H. Evans, Colorado A. & M. College.
R. C. Ernst, University of Louisville.
D. F. Gunder, Cornell University.
G. A. Hawkins, Purdue University.
H. L. Hazen, Massachusetts Institute of Technology.
P. Hemke, Rensselaer Polytechnic Institute.
J. A. Hrones, Massachusetts Institute of Technology.
L. H. Johnson, Tulane University.
J. H. Lampe, North Carolina State College.
F. C. Lindvall, California Institute of Technology.
J. Marin, Penn State College.
G. Murphy, Iowa State College.
M. P. O'Brien, University of California, Berkeley.
R. L. Pigford, University of Delaware.
J. H. Rushton, Illinois Institute of Technology.
T. Saville, New York University.
R. J. Seeger, National Science Foundation.
H. H. Skilling, Stanford University.
R. L. Sweigert, Georgia Institute of Technology.
K. F. Tupper, University of Toronto.
E. A. Walker, Penn State College.
E. Weber, Polytechnic Institute of Brooklyn.
H. E. Wessman, University of Washington.
W. C. White, Northeastern University.
W. R. Woolrich, University of Texas.
D. Young, University of Minnesota.

### Co-Chairmen of the Four Sub-Committees

L. E. Grinther, University of Florida, *Chairman.*
D. H. Pletta, Virginia Polytechnic Institute, *Secretary.*
L. M. K. Boelter, University of California.
W. L. Everitt, University of Illinois.
S. C. Hollister, Cornell University.
B. R. Teare, Jr., Carnegie Institute of Technology.

The Committee on Evaluation of Engineering Education was appointed in May, 1952 by Dean S. C. Hollister, then President of the American Society for Engineering Education. The charge to the Committee was to determine the pattern or patterns that engineering education should take to provide the leadership that the profession must have 25 years from now. It had become evident that the tremendous strides taken in the physical sciences during the past decade had begun to influence requirements being placed upon the profession of engineering while only minor adjustments have occurred in engineering education.

As examples of the increased importance of the basic sciences in engineering progress one can point out that electronic developments have demanded greater knowledge of physics from electrical engineers. Such problems as continuity between structural members produced by welding and problems of vibrations of suspension bridges have demonstrated the need for greater scientific background for civil engineers. Mechanical engineers found new fields for research in heat transfer, fluid mechanics and later in jet and rocket propulsion. Practical metallurgy has changed from an art to a science based upon physical chemistry and physics of the solid state. The need for new reactor materials, new nuclear-thermal processes and new materials and systems for radiation protection add to our picture of the increasing influence of science upon engineering practice. Hence, even without considering the major changes that are inevitable in engineering as nuclear power becomes available, we conclude that the many developments of the past ten or fifteen years would inevitably necessitate major changes in the character of engineering education.

From another direction there comes an even greater influence upon education in engineering. Since 1940 a large percentage of research physicists have had their interests reoriented toward nuclear problems, and it seems doubtful if the interest will ever be returned in sufficient measure to influence greatly the research in vibrations, elasticity, plasticity, heat transfer, engineering thermodynamics, fluid flow, and the other engineering sciences. Hence, engineers have become responsible for the continuity of research in all the fields of engineering science. The leaders of the engineering profession 25 years hence must be engineers who are at no loss in interpreting or themselves contributing to the extension of the fields of engineering science. Typical curricula of the era 1910-1940 were not designed with such an objective in mind.

### Curricula Considerations

#### *Basic Science*

The basic sciences for all engineering curricula include mathematics, physics and chemistry. Mathematics through ordinary differential equations seems close to a minimum essential for all engineers. Chemistry deserves increased emphasis in engineering education and for a larger proportion of engineers considerably more than the usual freshman chemistry course is necessary. The Committee has on three occasions indicated its belief that modern physics including nuclear and solid-state physics has become an essential study in engineering. Since the physicists' teaching of mechanics, thermodynamics and electricity is at least partly duplicated in engineering courses, it is believed that better coordination would provide opportunity for the study of modern physics. The Committee, therefore, recommends greater emphasis upon basic science in engineering curricula.

#### *Engineering Sciences*

The Committee has recognized nine important background sciences in engineering. They are statics; dynamics; strength of materials; fluid flow; thermodynamics; electrical circuits, fields, and electronics; heat transfer; engineering materials; and physical metallurgy. It is believed that all of these studies should be represented in curricula that train engineers for service in research, development or design and probably no less than seven should be integrated into every curriculum that is represented as education for engineers.

#### *Analysis, Design and Engineering Systems*

Such studies of the junior and senior years, along with the necessary background of the engineering sciences, represent the features that distinguish engineering education from education in science on the one hand or technical institute education on the other. In all curricula except those intended for training in management or other general professional service, studies in design, or in analysis leading to design, should occur as an integrated study over four successive semesters. Even the most general curricula should include such studies as a continuing program for at least two semesters.

#### Non-Departmental Engineering Courses

Curricula often contain certain engineering courses selected for broadening purposes such as electrical engineering for non-electricals and heat engines for non-mechanicals. When given, such courses should limit the study of special machines or devices including their construction, production or operation. The Committee affirms its conviction that the most important broadening courses in engineering are those listed as the engineering sciences.

#### Humanistic-Social Studies

The Committee recognizes the importance of social studies and the humanities as an important part of an engineer's education. Such studies reveal the richness of human experience so that students may in turn enrich their own lives. They should trace the political, economic and social history of mankind to give students a clearer perspective of our civilization today. They should provide inspiration for seeking greater knowledge and understanding. They should aid the student to develop judgment and discrimination, a sense of value, and a sound personal philosophy.

The seeking for immediate usefulness in the social studies and humanities, as tool subjects in engineering, may well lead to failure to achieve the objectives set forth above. Such courses as accounting, industrial psychology, investment economics, comparative costs, or city management may be just as technical as engineering studies. It is outside of such fields that the social-humanistic studies must lead the student. The Committee recommends a much broader study of the effectiveness of the social-humanistic stem of engineering education.

### Faculty Selection and Development

Since a more scientific approach to engineering education is needed it will be essential to improve the scientific background of engineering faculties. Within a given faculty there should exist a balance of experience in both the science and art of engineering. An educational background which includes the Ph.D. degree is the strongest evidence usually available to measure the probable usefulness in teaching and research of a relatively young candidate for a faculty position. For older persons evidence of the productivity of the individual in creative teaching and research may be gauged by other criteria, and the formal educational background is of less significance.

Engineering education cannot develop superior students without developing superior teachers who will be recognized as creative leaders in the fields in which they teach. A faculty that can be expected to provide adequate leadership for students will have at least one member in five who has achieved professional distinction by creative activities. Such persons will (1) be conducting high grade research of an engineering or educational nature or other creative activity including publishing of good quality, (2) be engaging in consulting work at a creative level, (3) be exercising leadership in scientific, educational and professional societies, or (4) preferably be serving in a combination of such activities. It is recognized that development is quite as important as selection of a faculty and also that a definite policy on termination of employment for those who do not live up to their expected performance is a necessary factor in faculty development.

### Accreditation of Curricula

A request from ECPD brought the Committee on Evaluation into the discussion of accreditation. For proper handling of accreditation ECPD needs improved standards for measuring the effectiveness of the educational process and also criteria that distinguish engineering curricula from those in science and from those in technical institutes. As already indicated the Committee on Evaluation concluded that an increased background in mathematics, physics and chemistry, a study of nine engineering sciences, and a continuity of study of engineering analysis and design, or of engineering systems, extending through four semesters should distinguish an engineering curriculum intended for the training of engineers for professional - scientific service such as research, development or design. Then recognizing the need for additional engineers for general professional engineering services, the Committee concluded that a bifurcation in engineering education is the practical answer to such diverging functional objectives. It has, therefore, devised the terms *professional-scientific* education and *professional-general* education to designate the two broad functional objectives of engineering education.

*Professional-general* education is that designed for producing engineers qualified (1) to serve in areas between engineering and business, management, law, real estate, or agriculture, (2) between engineering and a branch of science where the opportunities to apply engineering analysis and design may be limited, (3) between engineering and a highly applied technology such as production processes, operation, construction, or air conditioning, welding, or wood technology. Such programs may have somewhat reduced requirements of mathematics, physics and chemistry, and only seven of the nine engineering sciences need be included. Also, the study of engineering analysis and design may be reduced from four to two continuous semesters. However, the decision as to whether a planned program curriculum is really engineering education is to be made wholly upon its content of the engineering sciences and the use made thereof in the study of engineering analysis, design and engineering systems.

A decision has been reached by ECPD, upon the recommendation of the Council of ASEE, that the standards of accreditation of engineering curricula shall be raised. To achieve this result without undue hardship it is here recommended that the accreditation process be reconsidered on the basis of a distinction between *professional-scientific* studies and *professional-general* studies. Some institutions may choose one function or the other for all programs; other institutions may have a bifurcation between the objectives selected by different departments; and in large departments dual curricula serving different functions may develop. The Committee on Evaluation recommends that each engineering college determine for itself the best way to meet either or both of the dual objectives that the Committee has defined for engineering education. To ECPD it recommends liberal acceptance of experimental programs that meet the definition given of engineering education, i.e., those that include an adequate content of engineering science and of applications thereof to engineering analysis and design. The length of curricula should be one such factor subject to wide experimentation. The Committee does foresee difficulty in meeting within a four-year program its recommendations for an accredited professional-scientific engineering program plus all of the specialized courses of the degree-granting department, but it believes that specialized engineering courses are of far less value in professional-scientific education than a broad background of engineering science and its application is one field of analysis and design.

#### Special Designation of Accredited Curricula

There appears merit in identifying those curricula which meet criteria substantially above the minima. The major factor in such identification should be the background and eminence of the faculty and its attention to creative teaching. When the program conducted by this faculty is of such a nature as to develop in a considerable proportion of the graduates a capacity for creative technical activity or creative leadership in engineering it is the recommendation of the Committee that this curriculum should be given special designation. For such designation curricula should be taught by faculties including a substantially larger proportion of distinguished staff members, as defined previously, than is required for minimum accreditation. The recommendation of a curriculum for special designation should be referred by the Inspection Committee for final action to a group of national representatives whose background of examination of institutions covers a wide geographical area.

#### Conclusions

1. By joint action of ASEE and ECPD the Education Committee of ECPD has been instructed to develop higher standards for accreditation of engineering curricula.

2. One objective of the Committee on Evaluation has been to establish a philosophy of engineering education appropriate to the training of engineers for leadership a generation hence, and to clarify the significant factors that contribute to high standards of engineering education.

3. Another objective has been to study the influence of higher standards of accreditation upon the Engineering Colleges and to consider ways in which institutions may appropriately justify accreditation based upon the performance of different functions in the broad field of engineering education, if they so desire.

4. The functional divergence so evident in engineering activities, which range from research to management and sales has led to the Committee's recommendation that accreditation be based upon either of two defined functions in engineering education, i.e., *professional-general* education and *professional-scientific* education. Such divergence should not necessarily require curricula but might be based upon options, groups of electives, thesis study, etc.

5. In order that the decision to develop advanced standards of accreditation may not unduly restrict the number of possible accredited curricula, the Committee recommends that a special designation be given to any curriculum taught by a faculty of unusual distinction where the program conducted by the faculty is of such a nature as to develop in a considerable proportion of the graduates a capacity for creative technical activity or creative leadership in engineering.

#### Further Studies

The Committee on Evaluation has made the report summarized above as a *Preliminary Report* for study by each College of Engineering. Each of the recommendations tentatively adopted will be reconsidered in the light of the suggestions, criticisms and revisions presented by reports from Institutional Committees on Evaluation and Deans of Engineering Colleges. Resolutions from engineering groups will be welcomed although mere criticism or approbation without supporting analyses will not be very helpful to the Committee in revising its report into final form. Therefore, the Committee on Evaluation particularly requests thoughtful, mature analyses of the Preliminary Report without undue emphasis upon the form or mechanism of accreditation which is of secondary importance in this study.

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## THE ASME BOILER CODE. Part IV

(*Continued from page 38*)

slightly changed and a paragraph was added. Similar additions were made in para. U-70. Para. U-71(b) was changed to permit use of castings. Para. U-72, Preparation for Welding, contained only one addition, excluding any welding process where proper fusion and penetration were obtained without impurities.

Changes were made in para. U-73 on joints and in U-76 on stress relieving, and a new limitation for thickness appeared in para. U-69. Rules for Brazing, paras. U-91 to U-96, contained an addition to U-95 permitting welding of unbrazed edges where the joint did not extend the full length of the sheet, and where weld was not over four times the plate thickness.

Rules for containers for gases and liquids at low temperatures were found in paras. U-140 to U-144. The preamble limited the rules to vessels containing uncorrosive gases and vessels and to temperatures not lower than -450°F. Para. U-140, Seamless Containers, prohibited their use where holes might be made in the shell, and called for S-18 material and the Charpy impact test. Para. U-140(c), Design, gave maximum stresses for three grades of S-18 material.

Para. U-141 placed seamless containers under all of the requirements of section VIII, prescribed welding under para. U-68 with impact test, and para. U-141 required the same number of such tests. Para. U-143 called for safety devices of para. U-2, but excluded those of paras. U-3 to U-10. Para. U-44 provided for stamping.

The Appendix contained the Standard Practice for Hydrostatic Tests to determine maximum allowable working pressure, paras. VA-1 to VA-9. Paras. UA-10 to UA-15 and VA-16 to VA-29 were unchanged from the 1935 Edition, except that in para. VA-29 paragraph (e) was added for ring and hubbed flanges. The new extensive section on rules for qualification of welding process and testing of welding operators comprised paras. VA-30 to VA-46. The Appendix closed with forms of the manufacturers' partial data report and manufacturers' data report for unfired pressure vessels. An index of seven pages was added in this section VIII. √

# Elections and Transfers

At the meeting of Council held at Headquarters on Friday, December 18, 1953, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

*Members:*

A. I. Archavsky, *Montreal.*
S. Babkin, *Sorel.*
A. Baptist, *T. Rivers.*
R. A. Boorne, *Sackville.*
L. E. Burrill, *Amherst.*
J. F. Chantler, *Temiskaming.*
J. A. de Monte, *Goose Bay.*
A. L. Dempster, *Montreal.*
A. W. Gilmour, *Victoria.*
J. T. Henderson, *Ottawa.*
J. T. Higgins, *Trail.*
J. F. Hirshfeld, *Detroit.*
T. A. Hughes, *Montreal.*
T. K. Hum, *Hong Kong.*
T. G. Irving, *Toronto.*
M. M. Kennedy, *Hamilton.*
L. R. Marsh, *Montreal.*
A. H. Mingail, *Calcutta.*
D. E. Peatfield, *Kingston.*
C. J. Scott, *Montreal.*
A. Skarzynski, *Montreal.*
A. S. Townshend, *Toronto.*
L. Williams, *Trail.*

*Juniors:*

N. J. Deck, *Lethbridge.*
T. de Haas, *Montreal.*
T. M. Dick, *Port Arthur.*
F. F. Eccheli, *Montreal.*
G. C. Heaton, *Toronto.*
R. M. Heaton, *Hamilton.*
M. J. Masterson, *Montreal.*
L. F. Speed, *Toronto.*

*Transferred from the class of Junior to that of Member:*

R. S. Allison, *Montreal.*
L. G. Bratty, *Montreal.*
R. F. Brooks, *Shawinigan Falls.*
J. A. Brown, *Fort William.*
D. A. Burris, *Montreal.*
J. A. D'Angelo, *Windsor.*
S. Gagliardi, *Montreal.*
A. H. D. Haiblen, *Toronto.*
L. J. Hammerschmid, *Montreal.*
K. E. G. Hellstrom, *Montreal.*
J. W. Howard, *Vancouver.*
R. C. Hughes, *Arvida.*
L. C. Johnson, *Victoria.*
R. O. Lafond, *Montreal.*
P. Laporta, *Montreal.*
R. A. LeBlanc, *Montreal.*
A. R. Leger, *Grand Falls.*
J. P. Lemieux, *Quebec.*
A. M. Lount, *Toronto.*
R. P. Lynch, *Fredericton.*
B. W. McCrae, *Hamilton.*
J. C. Macdonald, *Winnipeg.*
R. M. McKnight, *Kingston*
G. L. Metcalfe, *Lloydminster.*
J. E. Mews, *Toronto.*
J. R. Moore, *Toronto.*
J. R. Morris, *Winnipeg.*
J. R. O'Grady, *Temiskaming.*
H. D. Paavila, *Espanola.*
K. B. Parkinson, *Ottawa.*
J. W. Powers, *Lunenburg.*
G. E. M. Proctor, *Toronto.*
C. W. Ross, *Ottawa.*
G. Ross, *Windsor.*
J. F. Runge, *Guelph.*
F. O. St. Pierre, *Iberville.*
T. F. Scott, *Prescott.*
A. C. Shamess, *Niagara Falls.*
J. E. Smith, *Ottawa.*
G. O. Taylor, *Toronto.*
J. M. Thomas, *Quebec.*
W. R. Tracy, *Arvida.*
W. M. Tremayne, *Montreal.*
G. A. Verge, *Montreal.*
E. P. Walsh, *Quebec.*
J. H. Ward, *Picton.*
A. P. Wiles, *Vancouver.*
R. A. Zurowski, *Chicago.*

*Transferred from the class of Student to that of Member:*

R. W. Gilbert, *Devon, Eng.*
R. G. Mulcaster, *Kamloops.*

*Transferred from the class of Student to that of Junior:*

K. R. Crean, *Windsor.*

The following Students were admitted:

*Ecole Polytechnique*

A. Allard
R. Arsenault
J. M. Audette
R. Auger
J. Aumont
J. Barette
M. Beaudet
G. Belcourt
G. Bellehumeur
R. Berard
D. A. Bertrand
M. A. Bock
P. Boisseau
Y. Boissonneault
B. Bouchard
J. Brascoupe
R. Briand
J. Brunet
J. C. Caron
R. Caron
A. Chadillon
C. Charette
G. Chartrand
J. R. Cornellier
H. Coutu
J. Couture
R. Dallaire
N. Danis
A. David
W. Delage
G. Denis
C. Devieux
G. Dubois
J. J. Dubois
L. Dumas
G. Dupuis
J. Fisette
P. J. A. Fluet
P. Fortier
J. Fugere
Y. Gaudette
L. Germain
P. Gervais
B. Gravel
J. M. Gravel
R. Gregoire
P. H. P. Grondin
F. Guerin
A. G. Guertin
J. P. D. Hamel
J. E. Harvey
A. Henrichon
J. G. Houde
R. J. M. Huc
C. Hunziker
A. Jurkus
C. A. Laberge
B. Laforte
R. Lalonde
J. J. F. Lambert
J. P. Lanctot
R. P. Langlois
V. C. Lanthier
P. Larocque
Y. Ls. Rovgery
M. C. Lavigne
J. P. G. Labiqueur
M. Lavoie
J. P. Leduc
C. A. Lefebvre
P. A. Leger
C. Lemieux
R. Levasseur
J. M. F. G. Levesque
J. W. G. Marier
J. G. Marinier
A. Martin
M. Milot
C. Mongeau
J. Montpetit
G. Morin
J. M. J. O'Shea
G. Page
R. Paquin
Y. Paquin
R. C. Pesant
J. C. Phaneuf
J. Y. Phaneuf
J. G. Pilon
R. G. Plamondon
O. Platonow
A. Potvin
R. Remillard
J. P. Rivest
G. Roberge
P. Robitaille
J. J. Rouleau
G. Rousseau
J. A. Roy
R. Roy
J. G. R. Sabourin
J. T. J. Sabourin
B. St. Aubin
J. St. Denis
R. St. Louis
E. Seguin
F. Senecal-Tremblay
J. A. G. Sicard
J. R. Simard
J. F. Y. Sorel
G. O. Starke
B. Tomachevsky
A. S. Vauclair
A. Veronneau
R. Verreault

*University of Manitoba*

E. H. Balchen
P. N. Bardal
I. Brucky
R. P. Cinq-Mars
H. W. Cochrane
A. O. Dyregrov
W. G. Gall
A. Gurowka
J. J. Hamilton
K. L. Hansell
R. Lazar
A. A. MacLeod
A. A. Maltz
M. Mindess
W. H. Mitchell
A. D. Morin
G. D. McKenzie
K. Peaker
W. G. Pethybridge
R. L. Sandberg
T. H. Shepertycki
I. Thomassen
B. T. Whiticar

*University of British Columbia*

A. Csepe
N. G. Davies
W. Dietiker
D. M. Fletcher
W. M. Gaskell
B. Gisborne
R. S. Gruno
D. G. Hepburn
S. G. Hodgson
T. Honkawa
D. W. Jack
E. B. Jakeman
R. G. Johnson
P. J. Riley
C. McGinnis
J. Mar
E. J. P. Matzen
J. Miller
T. E. Mulder
P. J. Neild
R. H. Silversides
C. H. Stephens
R. J. Talbot
H. B. A. Vogel

*Royal Military College*

G. T. Engman
T. M. Eyolfson
E. J. Hearn
J. P. Munroe
J. D. Palmer
N. K. Sherman

*McGill University*

I. Charow
P. A. H. Franche
P. R. E. Taschereau

*Carleton College*

D. W. Cluff

H. C. Kingsbury, B.Eng., N.S. Tech College, 1953

### Applications through Associations

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

ALBERTA

*Members:*

W. M. Beckett
D. W. Harvey
C. F. Watts

*Junior to Member:*

G. B. Davies
H. E. Palmer

SASKATCHEWAN

*Members:*

P. L. Graham
H. E. Leith
H. G. E. Rhodes
H. W. Stoneman

*Students:*

L. E. Anderson
R. L. Dorey
D. L. Gingerick
H. S. Granger
C. S. Griffith
L. F. Janiskiewicz
D. R. Jepson
B. G. Jones
G. J. Last
H. S. Mandryk
E. D. Stark
R. L. Tinkess
J. P. Toronchuk
L. F. Toth
A. N. Tufts

*Junior to Member:*

J. C. Molaro
E. K. Overgaard
W. A. Sheard

*Student to Junior:*

F. W. Catterall
B. C. Doell

MANITOBA

*Junior to Member:*

W. R. Brownlee

NOVA SCOTIA

*Members:*

E. L. Cameron
G. H. Edsall
J. B. Gunnermann
S. C. Ings
R. Wallworth

*Junior to Member:*

H. L. Archibald
W. H. Armstrong
R. I. Fiske
R. S. Green
A. W. Greenius
R. W. Hodgson
G. C. King
T. C. MacAulay
R. L. Mollon
W. L. Single
F. S. Skerry
J. E. Terry
P. R. Terry

# *Students and IAESTE*

***IAESTE*** means the International Association for the Exchange of Students for Technical Experience.

This organization with headquarters at the Imperial College in London, England, is engaged in finding employment in 18 different countries for engineering students who have just one year to go to finish their courses. In 1953 almost 4,000 students were exchanged.

***Canada*** has just recently joined the organization and the activity is carried out by the Engineering Institute of Canada. Last year 21 students came to Canada from Great Britain, Holland and Germany.

***In 1954*** it is proposed to send Canadian students abroad. If you are interested, write the Institute at 2050 Mansfield Street, Montreal, for all the information. Bear in mind that you must be in the year before your final year; you have to pay your own expenses including travel, but you receive wages for your work. Tell us the type of experience you want and name the country or countries in which you would like to get it.

Here are the countries that belong to IAESTE:

*Austria, Belgium, Canada, Denmark, Finland, France, Germany, Great Britain, Iceland, Israel, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, United States, Yugoslavia*

# The *Journal* Thirty-five Years Ago

Here at the turn of the year a person can look back at the first issues of *The Engineering Journal* published in 1918 and forward to the year's volume for 1919... It is apparent immediately that the *Journal* has gone ahead with great strides. Not only are the issues for 1919 better prepared but the contents are more varied and in greater volume.

As was pointed out at the time this series was started the re-reading of the old issues is an interesting occupation. Again it is recommended to all readers of the *Journal* who have the old volumes that they should read them over in detail. These brief references in the current issues of the *Journal* do not do justice to the originals.

So much of the business of the Institute and the profession of today is related to these early publications. There we find the beginning of registration, the setting up of branches, the interest in the salaries of engineers, particularly in the government services and so on. It is too bad that space does not permit publishing many of these references in their entirety. They would make fascinating reading to the present generation of engineers.

#### Volume Two, Number One, January 1919

The leading article is a draft of model by-laws for a branch. Several times an endeavour has been made to provide a set of by-laws acceptable to all the branches so that there could be complete uniformity. However, each time the effort has failed, although even to-day differences in branch by-laws are not great.

H. K. Wicksteed presents an interesting paper on "The Montreal Tunnel from an Economic Point of View". This paper was read before the Toronto Branch. It is filled with references and information that are fascinating in the light of developments within the last thirty-five years. For instance, the article touches on the matter of terminals, including ocean freight, passenger, express and so on. It tells of the advent of Canadian National Railways and of its effect on the transportation of Canada. Reference is made to the financial aspects of the tunnel, the selection of a route, the model city at the back of Mount Royal, the selection of the two portals, the station site, the grades, the head room, the lining, the instrument work, ventilation and so on. It's too bad it cannot be reproduced in its entirety.

The memory of Mr. Wicksteed was honoured recently by the unveiling of a tablet in the new Canadian National Terminal in the City of Montreal. His work on the tunnel and on the whole terminal's early planning was very important and it is certainly fitting that such a tablet should be erected to him in such a place.

J. M. de Stein has an interesting article on "Remarks Regarding Rural Roads". This paper was presented to the Saskatchewan Branch. In fact, the January issue looks very much as though it might well have been called the Saskatchewan issue because there is another article entitled "Doubly Reinforced Beams" by E. G. W. Montgomery also of Saskatchewan.

In the editorial section there is an article based on a statement made by Julian C. Smith, at that time a member of the Council of the Institute, and later president of Shawinigan Water & Power. In this article Mr. Smith speaks of Canada's future and indicates how closely it is related to the development of water power in its different provinces. All of the prophecies made in that article by Mr. Smith have since come true in full measure.

There is reference to the creation of a new membership certificate which superseded the one established in 1888. The certificate used today is the same one.

There are several references to the salaries paid to engineers in the government service. One article gives the history of all the many efforts made by members of the Institute to influence the Federal Government favourably towards engineers. It refers to "a strong committee of the Council which has been appointed, consisting of W. F. Tye, chairman, president H. H. Vaughan, and president-elect Lieut.-Colonel R. W. Leonard, to represent the Institute in securing more adequate recognition and remuneration from the government for engineers". Later on this committee met with the officials of the Federal Government and in commenting on this the article says "In meeting the representatives of the Institute the commission has shown a willingness to be educated in this connection, and the education they will receive from the committee will work for the advantage of every engineer employed in the government."

It seems as if that problem would never be solved. The Institute has kept closely in touch with it for all the thirty-five years that have passed since that article was written, and in the period there have been several increases but even as things stand today, they are far from satisfactory.

#### A Special Meeting of Council

This meeting was called to consider an urgent request received from the Saskatchewan Branch "that approval be given for the submission of an act to the Saskatchewan Legislature immediately". This act was to set up the conditions for controlling the profession in that province.

Council decided at that time it had no authority to approve an act for submission to a provincial legislature without a mandate from the membership. The minutes however, stated that Council was sympathetic towards the idea and urged that the other provinces as well consider the matter, in the hope that an act uniform across Canada might be developed.

A proposal was presented for the inauguration of a branch at Sault Ste. Marie. The committee which was handling this was J. W. LeB. Ross, chairman, B. E. Barnhill, C. H. E. Rownthwaite, J. H. Ryckman, N. L. Somers, L. R. Brown, secretary.

#### Branch News

Under news of the Ottawa Branch there is reference to a discovery by E. Viens, Director of the Public Works Laboratory, for testing materials. The invention related to a type of concrete used for floors in the new Parliament Buildings. While its strength greatly exceeded that of wood and its durability equalled that of ordinary concrete its composition was such that a nail could be driven into it and would hold just as well as in wood. The material was called "Nailcrete".

The branch news also tells of a visit of the branch to inspect the new House of Commons which was carried out under the guidance of G. Gordon Gale, chairman of the branch. There were a hundred and thirty-five members in attendance.

In the correspondence section there are several letters dealing with the remuneration of engineers in the Civil Service, both for the province and for the Federal Government. The Institute and the *Engineering Journal* are commended for the active part they have taken in presenting the engineers' case to the employers.

In the Personals there is an announcement that Lieut. Frederic Alport had been decorated recently with the Military Cross for bravery exhibited during the war.

Another personal that is of special interest today states that Boris A. Bakhmeteff, a member of the Institute and Russian Ambassador to the United States was in Paris "with other Russian Diplomats seeking to preserve a United Russia. In an announcement to the Associated Press, Mr. Bakhmeteff stated that Russia has been granted a respectful hearing by the Allies in her request for representation at the peace conference." His Excellency, Professor Bakhmeteff, for many years was engaged as a consulting engineer and as a professor at Columbia University.

Another personal relates to the appointment of F. L. C. Bond to the position of chief engineer of the Grand Trunk Railway. Subsequently Mr. Bond became the vice-president of the company.

## The ASME Boiler Code

Following on the publication of a condensation of the articles written by the late Professor Arthur M. Greene, Jr., on the history of the ASME Boiler Code, it had been intended to commence regular publication, simultaneously with Mechanical Engineering, of Interpretations and Proposed Revisions to the ASME Boiler Code, commencing in this issue. It so happens that there is only a brief announcement to be made at this time, and we will therefore wait until there is further material available before initiating this new service to our members.

## Annual Meeting of C.I.P.A. Held in Ottawa

The Canadian Industrial Preparedness Association held its annual meeting at Ottawa on October 22, marking the Sixth Anniversary of its founding in 1945, as the Canadian Ordnance Association. T. R. McLagan, M.E.I.C., president of Canada Steamship Lines, was re-elected president, as well as four vice-presidents. James Morrow of Stelco was elected vice-president. The present management was returned to office.

President McLagan, recording the original objectives of the Association, recalled that after the war, munitions manufacturers had decided it was advisable to join in a preparedness effort so they could co-operate with the Government in an emergency. Industrial surveys were made of firms, to tabulate the equipment and facilities of each, so the Nation's industrial forces could be quickly marshalled to produce weapons, without duplication.

Today, he said, the work of preparedness is in full swing and the peak of the Country's effort will probably be reached next year. Many agencies had been set up. Today, it was more difficult for the Association to justify itself, than when it was trying to wake people up. A policy had been followed of keeping the industrial community fully informed of what was going on, and of arranging trips to various stations of the Armed Services for actual demonstrations of weapons in action.

In modern war, the Services are useless without properly equipped manufacturing plants behind them, staffed with well trained personnel. The "knowhow" for such manufacturing is vastly different to that for ordinary peacetime products. "What is to be done after the present arms program is completed?", he asked. "If, as after other wars, the personnel is laid off, the "knowhow" will be lost and our defence weakened."

In 1951-52, expenditure for national defence, he reported, was $1.4 billion or 37 per cent of the total. In 1952-53 it was $1.84 billion, or 42 per cent of the total. In 1953-54 the estimate is $2 billion, or 45 per cent of the total. Half of the $2 billion is for equipment, equivalent to the total value of export in 1939. Most of this money is spent in Canada, and affects employment considerably. Only a fraction of it is spent in the prime contractor's plants. Almost any kind of manufacturer participates in this specialized effort. Only some 35 per cent of the cost of a large merchant ship, for example, is spent in the shipyards.

Commending the Government for its decision to build and create all forms of defence projects in our own Country, and warning that we must see we do not undo all that has been done, he told the meeting that the Directors were convinced the Association should be kept alive, for greater service if war should come, or continued preparedness even if we have real peace.

### General Manager's Report

Major General G. B. Howard, executive vice-president and general manager, announced that the Association membership now stood at 52 sustaining members and 236 company members in good standing. He urged manufacturers to give thought now to the safeguarding of their plants, for security from sabotage in the event war should come. At such a time all plants would be engaged in defence work. Materials such as fencing and alarm equipment might be in short supply or even unobtainable.

Sound long-range planning well beyond the current program was called for, he warned. Fluctuations in requirements would call for changes in any industrial mobilization plan, as well as changes in policy regarding the means to make that plan effective. For example, we might be faced with the decision to concentrate production capacity into as few facilities as possible, as seems to be the trend in the U.S.A., or to broaden the base, which is now considered uneconomical. Flexibility is vital, and revision should be a continuing process.

Manufacturers, he concluded, could assist in the preparedness effort, by providing a survey of types of fast-wearing parts and components of certain quasi-commercial types of defence equipment, with a view to standardization. The first step must of course come from the Services themselves, the next would be for industry to overhaul its existing designs and agree on standard parts.

### Defence Research Board

Dr. O. M. Solandt, chairman of Defence Research Board, described in general terms the weapons and equipment being supplied for the Armed Forces, and outlined briefly how research and development is organized and how this affects industrialists and manufacturers for defence. He explained the difference between fundamental, basic and applied research.

The whole progress of science and industry depends, he said, on free interchange of ideas and information between the scientific communities of different countries. While we must keep from potential enemies any information that might increase their ability to attack us, yet secrecy must not be allowed to interfere unnecessarily with the free exchange of scientific information.

Describing the relationship of the

Defence Research Board to the Services and to industry, he illustrated the concept of a weapons system by comparing the problems of air defence in World War I with those of today. The former called for aircraft, weapons and pilots. The latter called for a vastly complex and closely integrated weapons system; radar, radio communication and navigation systems, guns and guided missiles, a vast amount of highly complex equipment and large numbers of skilled and experienced operators.

Scientists, he said, are an essential and integral part of the air defence team. The same sort of concept affects the other services, Army and Navy. With a new weapons system, extensive research may be necessary, with constant collaboration between scientists, the Armed Services and industry, and this takes a lot of time.

While large industries can and should take a longer term view of research, and pursue programs to produce important though not necessarily immediate benefits, Doctor Solandt advised small industries to do only research that applies to their own problems and which pays off quickly.

#### Meeting Addressed by Minister of Finance

The Hon. D. C. Abbott, Federal Minister of Finance spoke on some of the financial aspects of preparedness. Preparedness, he said, was a long-pull proposition. We must be reasonably ready for emergency, yet many methods appropriate for marshalling the resources of industry, the necessary purchasing power and the man power, during war, will work awkwardly and unfairly during a long-pull part-out defence effort.

We were urged from many quarters in 1950, he said, to impose price ceilings and controls. But as we found during the last War, they in time develop awkward strains and stresses, and adjustments are more and more difficult to make without being unfair to someone, and equally unfair to others to make no adjustment.

Thus in 1950 we chose to rely on general financial and monetary policies. The central problem in financing our defence effort is:—how to pay for defence without inflation. During an intense short-term effort, when a great portion of the gross national product must be war goods, we could use taxation, intense savings campaigns and borrowing to direct sufficient purchasing power towards financing war expenditures. But in the long-pull effort this is unwise.

In our post-Korea Budgets, he continued, we have had to find revenue to cover an increase of some 50 per cent in total expenditures. In our tax policy we have had to remember the desirability of increasing national production, encouraging savings and keeping consumption within reasonable bounds.

We had to find a reasonable balance between taxes on earnings and taxes on spending. We applied taxes on spending to bring in 45 per cent of the needed revenue. This was a valuable brake on inflation. Too high taxes on earning might well encourage extravagant expenditure by business and blunt the incentives of both management and labour to produce more.

We have used monetary policy to buttress this budget policy. The Bank of Canada raised its discount rate and suggested to the chartered banks that they should not allow expansion of credit. Their selective policy in making loans prevented considerable non-essential or deferable expenditure. But experience shows that monetary policy cannot do the job alone.

These policies were supported with restrictions on consumer credit and deferred depreciation, which helped prevent an intolerable pressure on scarce materials. Government expenditures needing scarce funds and materials were postponed. We continued the issue of Canada Savings Bonds as part of the policy of restraining inflation.

Many of these policies are already relaxed or withdrawn, he said. As the nature of the long-pull effort has become clearer, we have come to rely almost entirely on general monetary and fiscal policy, and have put aside the more limited direct controls. If we have to retain our present rate and scale of preparedness, further tax reductions can only come from further growth in total output and efficiency. If real progress is made in reducing world tensions, real reductions in defence costs could come our way, perhaps in 1955 an l later.

However you finance preparedness, Mr. Abbott added in concluding, the public will have to pay, — resources will be diverted from investment and consumption to defence expenditure. Inflation is one way of doing the job, but it is grossly unfair and its long-run social effects are most dangerous. Paying by taxation raises some problems, but it makes for greater fairness, as well as for financial and social stability.

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## News of Other Societies

The Canadian Conference on Prestressed Concrete will be held in Hart House Theatre, University of Toronto, January 28 and 29, 1954.

The conference is intended to be a concise review of prestressed concrete for Canadian engineers, architects and builders. The program was announced in the November issue of the *Journal*, page 1482.

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The **Society for Advancement of Management** is a national professional society of management people in industry, commerce, government and education.

The *Journal* has been advised of the 1954 program of the Montreal Chapter:

February 10—Public Relations, a Must for Management, Paul McFarlane, Manager, South District, Bell Telephone Company of Canada, Montreal.

March 10—Industrial Engineer's Contribution to Product Design, H. E. Blank, Jr., Vice-President, Dunlap & Associates, Stamford, Conn.

March 19—The Fifth Annual Industrial Engineering Conference.

April 14—Management Reduces Overhead through Paper Work Simplification, Ben S. Graham, Director, Future Demands Department, Standard Register Co., Dayton, Ohio.

May 12—Annual Business Meeting.

Membership Chairman is Bill Borland at Imperial Tobacco Co. of Canada, Montreal.

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The 10th International Management Congress, will take place at Sao Paulo, Brazil, from February 19-24, under the auspices of the International Committee for Scientific Management (CIOS).

The program of this important international meeting was announced in detail in the *Journal*, September 1953, page 1163, in a letter from the president of the Canadian Management Council, the Canadian affiliate of CIOS.

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The *Journal* corrects an announcement appearing in the December issue, page 1648, as follows: The western meeting of the engineering, sales, and general divisions of the *Canadian Electrical Association* will be held from March 1-3, 1954, at Winnipeg, Man.

# Personals

## News of the Personal Activities of Members of the Institute

**F. G. Ferrabee,** M.E.I.C., was recently elected president of Canadian Ingersoll-Rand Company Limited. He was formerly executive vice-president and general manager of the Company.

F. G. Ferrabee, M.E.I.C.

A Montrealer by birth, Mr. Ferrabee received his education at Lower Canada College, the Royal Military College and McGill University where he graduated in mechanical engineering in 1924.

Upon graduation he was selected to take the students' training course at the Phillipsburg, N.J. works of the Ingersoll-Rand Company, and upon completion of this course he joined the Company's sales organization and was promoted successively to the Huntingdon, W.Va., and Pittsburgh branches, and the General Sales Division in New York.

In 1934 he returned to Canada as general sales manager of Canadian Ingersoll-Rand Company Limited. He was elected a director in 1937, and appointed vice-president of the Sales Division in 1939. Three years later he was elected vice-president and assistant general manager, and in 1943 he became executive vice-president and general manager.

Mr. Ferrabee is also executive head of Sherbrooke Pneumatic Tool Company Limited.

Before leaving Canada in 1924, Mr. Ferrabee was an officer in the N.P.A.M. and on his return, was re-commissioned at the organization of what later became the R.C.E.M.E. During World War II he was appointed senior reserve ordnance mechanical engineer in M.D.4 and commanded the No. 4 Reserve Divisional Ordnance Workshop with the rank of major. During this same period Mr. Ferrabee was director of the Compressed Air and Gas and Refrigeration Equipment Division of the Wartime Prices and Trade Board.

**D. S. Lloyd,** M.E.I.C., vice-president and general manager of Dominion Oxygen Company Limited, has been named president of the Company.

Mr. Lloyd graduated from the University of Toronto in 1925 in electrical and hydraulic engineering, and that same year joined the staff of the Dominion Oxygen Company as a service engineer.

D. S. Lloyd, M.E.I.C.

In 1936 he was named sales manager, and two years later was appointed general manager. He was elected vice-president and general manager in 1941.

Mr. Lloyd is a member of the Association of Professional Engineers of Ontario, past chairman of the administrative board of the Canadian Welding Bureau, and a director of the Canadian Standards Association. He is also a past chairman of the Canadian section of the Compressed Gas Association.

**Walter Hindle,** M.E.I.C., has been appointed manager of the manufacturing department of Canadian Westinghouse Company's Power Products Division.

Walter Hindle, M.E.I.C.

A graduate of the University of Alberta, Mr. Hindle joined Westinghouse in 1937 as a graduate student trainee and spent ten years as an erecting engineer in the apparatus service department.

From 1949 to 1952 he was manager of field installation and in 1953 was appointed general superintendent of the Power Products Division.

During his 16 years with the Company, Mr. Hindle has been engaged in some of the largest projects carried out in Canada. Some of these include the 1941 installation of Canada's first ignitron rectifiers at Alcan; hoists for International Nickel; the 1943 Shipshaw power development where Westinghouse installed seven generators; the installation of 32,000 kva. machines for Consolidated Mining and Smelting in 1944; ignitrons for Consolidated and B.C. Electric Railway; generators of Calgary Power and B.C. Power Commission, and this year, the Westinghouse apparatus for Alcan's giant Kemano job.

**J. H. Smith,** M.E.I.C., general manager of the Wholesale Division of Canadian General Electric Company Limited, has been appointed a vice-president of the Company.

Mr. Smith is a graduate of the University of New Brunswick in electrical engineering, receiving his M.Sc. degree in 1942.

After completing the Canadian General Electric's test training, he held a number of sales engineering appointments in Toronto and Hamilton. In the Toronto district he was Supply Division manager from 1945 until 1948, and Apparatus Division manager from 1948 until 1951.

J. H. Smith, M.E.I.C.

Mr. Smith was elected president of the Association of Professional Engineers of Ontario in 1953. He is a member of the A.I.E.E. and the Toronto Board of Trade.

J. S. Keenan, M.E.I.C.

**J. S. Keenan,** M.E.I.C., general manager of the Industrial Products Division of the Canadian General Electric Company, has been named a vice-president of the Company.

A graduate of the Massachusetts Institute of Technology in electrical engineering, Mr. Keenan joined the General Electric Company in Schenectady in 1923, and a year later transferred to the Canadian General Electric Company where he held a number of appointments in the field of supplies and apparatus.

In 1936 he was appointed manager of the Company's supply department, and in 1952 he was named general manager of the Industrial Products Division.

Mr. Keenan has served as president of the Canadian Electrical Manufacturers Association and the Electric Club of Toronto; also as vice-president of the Electric Service League of Ontario and the Canadian Electrical Council.

**Sidney Hogg,** M.E.I.C., president of Western Bridge and Steel Fabricators Limited in Vancouver, was recently appointed a director of the White Pass and Yukon Corporation Limited, the holding company for the White Pass and Yukon Route in Whitehorse, Y.T.

S. Hogg, M.E.I.C.

**Roy H. Smith,** M.E.I.C., has been appointed technical consultant of North Star Oil Limited.

He has had wide experience in Canada and the United States in all phases of the oil industry including pipe line operations.

Mr. Smith recently retired as assistant manager of the co-ordination and economics department of Imperial Oil Limited with whom he had been associated since 1923.

A graduate of McGill University, class of 1921, Mr. Smith is a Fellow of the Chemical Institute of Canada, and a member of the American Petroleum Institute and the Association of Professional Engineers of Ontario.

**Robert Thistlethwaite,** M.E.I.C., has been appointed surveyor general by the Alberta Department of Mines to succeed B. W. Waugh, M.E.I.C., who has retired.

Mr. Thistlethwaite, who becomes chief of the mines department's legal surveys and aeronautical charts division, was born in Winnipeg and graduated from the University of Manitoba in 1933.

In 1936 he worked for the department in the Northwest Territories, and was later associated with oil companies in Colombia and Ecuador.

He rejoined the department in 1944, working on the development of the Columbia River basin in British Columbia. Later he returned to South America, working this time in Peru.

In 1951 he came back to the Mines Department and became assistant surveyor general, the position he held until his present appointment.

As surveyor general he also will serve as chairman of the Board of Examiners for Dominion land surveyors.

W. K. Wiley, M.E.I.C.

**W. K. Wiley,** M.E.I.C., has been appointed manager of power apparatus sales in the Alberta district of Northern Electric Company Limited.

Mr. Wiley was born in Missoula, Montana, and spent most of his youth in the Maritime Provinces, graduating in electrical engineering from the University of New Brunswick in 1931.

Mr. Wiley's experience in the electrical industry began in Seattle where he worked for ten years before returning to Canada in 1944 to join Northern Electric in Montreal.

After service in the illumination department, Mr. Wiley was subsequently appointed industrial heating supervisor and industrial heating manager.

**E. A. Thompson,** M.E.I.C., has been appointed manager of Canada Creosoting Company Limited, the Creosoting Division of Dominion Tar and Chemical Company Limited.

Before his appointment as manager of the Creosoting Division, Mr. Thompson held a variety of positions with both Dominion Tar and the Creosoting Division, the most recent of which was that of assistant to the president.

E. A. Thompson, M.E.I.C.

J. H. Ingham, M.E.I.C.

J. A. Stewart, M.E.I.C.

**J. H. Ingham,** M.E.I.C., has been appointed district manager of the newly opened Toronto office of Walter Kidde and Company of Canada Limited.

He attended McGill University and before graduation in 1935, was associated with the Beauharnois Construction Company, the Dominion Bridge Company, Chas. Walmsley and Company of Canada Limited, and Dominion Engineering Works.

After graduation, Mr. Ingham served on the mechanical design staff of the Dominion Bridge Company in Lachine, Quebec, until 1941 when he joined the Walter Kidde Company as factory manager.

Three years later he was appointed secretary of the Company, and in 1946 became contract engineer and special assistant to the managing director. In 1948 he was appointed sales manager, which position he held until August, 1953, when he was transferred to Toronto to manage the Toronto district office.

**James A. Stewart,** M.E.I.C., former assistant to the managing director of Walter Kidde and Company of Canada Limited, has been appointed manager of sales and engineering.

Mr. Stewart graduated in mechanical engineering from Queen's University in 1934. After graduation he was employed with Ford Motor Company of Canada Limited until 1937, when he joined International Nickel Company of Canada Limited where he remained until 1941.

During World War II he served overseas with the R.C.E.M.E. and was discharged in 1946 with the rank of major.

Upon his return from overseas he joined Walter Kidde and Company of Canada Limited, and was successively contracts manager, works manager and a director of Cresswell Roll Forming Company Limited, and Cresswell Pomeroy Limited in Montreal and Granby, Quebec.

**Major Malcolm Turner,** R.C.E., M.E.I.C., proceeded to England early in January, 1954, to attend the Staff College at Camberley.

**Denton Massey,** O.B.E., M.E.I.C., has recently joined the Standard Motor Company Limited of Coventry, England, as general manager of the United States Division. He will be located in Beverly Hills, California.

He was formerly president of Denton Massey Motors (Canada) Limited in Toronto.

Mr. Massey is a graduate in general engineering of the Massachusetts Institute of Technology class of 1924.

**Dr. George Sinclair,** M.E.I.C., associate professor of electrical engineering at the University of Toronto, and president of Sinclair Radio Laboratories Limited, has been named a Fellow of the Institute of Radio Engineers. The presentation of his award will take place at the annual convention in New York in March, and the citation accompanying the award will read, "For contributions to the development of radiating systems and model techniques in antenna measurements."

Dr. Sinclair was director of the antenna laboratory of Ohio State University during World War II and for his work was awarded a certificate of appreciation by the United States War Department.

Dr. Sinclair was born in Hamilton. Ont., and lived in Edmonton, Alta. for many years. He received his B.Sc. and M.Sc. degrees in electrical engineering from the University of Alberta, and his Ph.D. degree from Ohio State University.

**G. R. Davis,** M.E.I.C., is now with the Kingston Public Utilities Commission in Kingston, Ont.

He was formerly general manager and chief engineer with the Ottawa Hydro-Electric Commission.

Mr. Davis is a 1927 graduate in electrical engineering of Queen's University.

**H. D. Forbes,** M.E.I.C., is superintendent of the Technical Division at the Shawinigan Falls Works of Aluminum Company of Canada Limited.

He was previously assistant to works metallurgist with the Company in Kingston, Ont.

Mr. Forbes graduated in metallurgy from the University of Toronto in 1943.

**J. B. Eldridge,** M.E.I.C., has accepted the position of chief engineer with Atlantic Sugar Refineries Limited in Saint John, N.B.

He was previously with St. Lawrence Corp. Ltd. in Dolbeau, Que.

Mr. Eldridge is a graduate of the University of New Brunswick in electrical engineering, class of 1936.

**Louis Trudel, M.E.I.C.**

**Louis Trudel,** M.E.I.C., manager of the public relations and advertising department of the Shawinigan Water and Power Company, has been named a vice-president of the Public Relations Society of America at its meeting in Detroit.

**M. W. Koslowski,** M.E.I.C., is water and sewer works construction supervisor with Haddin, Davis and Brown Limited in Calgary, Alberta. He was previously resident engineer with this company.

Mr. Koslowski graduated in mining engineering from the University of Alberta in 1949.

**Jack H. Hole,** M.E.I.C., has been appointed manager of the Alberta District Apparatus Division of Canadian General Electric Company Limited.

Mr. Hole graduated in electrical engineering from the University of Alberta, class of 1938.

**Stefan Mitescu,** M.E.I.C., is now associated with Canadian Petrofina Limited in Montreal.

He was formerly with the Aluminum Company of Canada in Arvida, Que.

Mr. Mitescu is a graduate of the Polytechnical School of Bucharest, class of 1928.

**James Morgan,** M.E.I.C., has been transferred from Montreal to Toronto by The Foundation Company of Canada Limited.

Mr. Morgan is a graduate of Loughborough College, class of 1944.

**G. R. Duncan,** M.E.I.C., is now with Canada Iron Foundries Limited in Montreal.

He was previously general sales manager (electrical) of Electric Tamper Company Limited in Lachine, Que.

Mr. Duncan graduated in electrical engineering from McGill University in 1935.

**Wm. A. Lowe,** M.E.I.C., is now industrial representative with the British Columbia Electric Company in Vancouver, B.C.

He was previously assistant to the sales and merchandizing manager of the Winnipeg Electric Company in Winnipeg.

Mr. Lowe received his B.Sc. degree from the University of Manchester in 1936.

**P. R. Woodfield,** M.E.I.C., is chief staff engineer in the gas turbine engineering department of A. V. Roe Canada Limited.

He was formerly head of the Company's Gas Turbine Mechanical Testing Laboratories.

Mr. Woodfield is a 1939 electrical engineering graduate of the University of Manitoba.

**C. J. Connolly,** M.E.I.C., is with Central Mortgage and Housing Corporation in Edmonton, Alta.

He was previously with the Corporation in Halifax, N.S.

Mr. Connolly is a B.Sc. graduate of St. Francis Xavier University, class of 1936.

**E. G. Mcnutt,** M.E.I.C., is with Maritime Steel and Foundries Limited in Montreal.

He was previously with Canadian Car and Foundry Co. Ltd. in Montreal.

Mr. Mcnutt is a 1937 graduate in mechanical engineering from McGill University.

**W. R. Caron,** M.E.I.C., is now associated with Bedard-Girard Limited of Quebec City. He was previously with McDougall and Friedman of Montreal.

**Francois Paul Rousseau,** M.E.I.C., is now chief engineer of the Power Development Division of the Quebec Hydro-Electric Commission.

He was formerly superintending engineer of construction for Beauharnois Light, Heat and Power Co. Ltd. in Beauharnois, Que.

Mr. Rousseau graduated in architectural engineering from the Massachusetts Institute of Technology in 1927.

**Lt. Cmdr. K. W. Salmon,** R.C.N., M.E.I.C., has been posted to Ottawa. He was previously commercial engineer with the New Brunswick Telephone Company Limited in Saint John, N.B.

Lt. Cmdr. Salmon graduated from the University of New Brunswick in electrical engineering in 1941. Immediately after graduation he joined the Royal Canadian Navy with which he served until the end of the war.

**Chas. D. Borror,** M.E.I.C., is production engineer in the Asbestos Fibre Division of Canadian Johns-Manville Company Limited in Asbestos, Que.

He was previously technical assistant to the Company's mine manager.

Mr. Borror is a 1926 graduate in mining engineering of the University of Illinois.

**John Francis Frisch,** M.E.I.C., is a mechanical engineer in the technical section of the Canadian Pulp and Paper Association in Montreal.

Mr. Frisch was previously with the Canadian International Paper Company in Temiskaming.

He is a graduate of the Technical Institute of Horten, Norway, class of 1906.

**G. T. Hughes,** M.E.I.C., is special lecturer at the College of Engineering at the University of Saskatchewan in Saskatoon.

He received his B.Sc. degree in civil engineering from the University of Alberta in 1951, and his M.Sc. degree from the same university in 1953.

**Bruce F. Booth,** M.E.I.C., is plant engineer with Price Brothers and Company Limited in Riverbend, Que.

He is a 1941 B.A.Sc. graduate of the University of Toronto.

**G. A. Duey,** M.E.I.C., is now employed as services engineer with Canadian Industries Limited in Edmonton, Alta.

He is a graduate in electrical engineering from the University of Manitoba, class of 1946.

**Marian Pona,** M.E.I.C., designing engineer with the Hydro-Electric Commission of Ontario, has recently been named a Member in the Institute.

Miss Pona is a 1951 civil engineering graduate of the Polish University College.

**Mary Ellen Dougherty,** M.E.I.C., has recently been named a Member of the Institute.

Miss Dougherty is secretary-treasurer and general operation engineer for The Valley Gas Co. Ltd. in Turner Valley, Alta.

She is a 1949 graduate in engineering physics of the University of Alberta.

**Capt. W. A. McDill,** R.C.E., Jr.E.I.C., has completed the sixth technical staff course at the Royal Military College of Science, and has been appointed Canadian engineer liaison officer in the War Office at Whitehall.

Capt. McDill received his B.A.Sc. degree in mechanical engineering from the University of British Columbia in 1948, and his B.E. and M.E. degrees from Colorado Agricultural and Mechanical College in 1938 and 1948, respectively.

**Bruce M. Hudd,** Jr.E.I.C., formerly associated with the Ontario Hydro-Electric Power Commission in Toronto, has joined the staff of Abitibi Power and Paper Company Limited in Toronto.

Mr. Hudd is a mechanical engineering graduate of the University of Saskatchewan, class of 1945.

**Donald N. Brockhurst,** Jr.E.I.C., is a trainee at the Cincinnati Milling and Grinding Machine Company in Cincinnati, Ohio.

He was formerly with the General Electric Company in Allentown, Pa.

Mr. Brockhurst graduated in mechanical engineering from McGill University in 1947.

**D. J. Bird,** Jr.E.I.C., is now associated with Cameron Contracting Limited in Halifax, N.S., after his recent return from Inagua, Bahamas, B.W.I.

Mr. Bird is a graduate in civil engineering of the Nova Scotia Technical College, class of 1948.

**W. Nord,** Jr.E.I.C., has been transferred by Canada Wire and Cable Company from Montreal to the Company's head offices in Toronto.

Mr. Nord has been with the Company since graduation from the University of Toronto in mechanical engineering in 1948.

**Cecil Scott McKinley,** Jr.E.I.C., is now district engineer with the New Brunswick Electric Power Commission in Fredericton, N.B.

He was formerly with the Shawinigan Water & Power Company in Shawinigan Falls, Que.

Mr. McKinley is an electrical engineering graduate of the University of New Brunswick, class of 1948.

**J. R. A. Walker,** Jr.E.I.C., has been assigned to the Toronto sales office of Aluminum Company of Canada, Limited.

During the past three years Mr. Walker has been resident engineer of the Arvida-Port Alfred District. His major projects during that period were the construction and installation of a sulphuric acid plant (present capacity 175 tons per day), a 4,000-ton magnesium plant, a bauxite storage building, and the formation of a new "red mud lake" for the disposal of the Company's waste product. This involved the construction of a series of 60-foot high earth dams.

Mr. Walker is a graduate in civil engineering of the University of Toronto, class of 1949.

**E. J. Okins,** Jr.E.I.C., is now employed by H. H. Angus Limited, consulting engineers, in Toronto.

Mr. Okins is a 1949 graduate in mechanical engineering of the University of Saskatchewan.

**F/O E. W. McConnell, R.C.A.F.,** Jr.E.I.C., is construction engineering officer at the R.C.A.F. Station in Claresholm, Alberta.

F/O McConnell is a graduate in mining engineering from the University of Alberta, class of 1949.

**Walter T. Clarke,** Jr.E.I.C., has been elected president of the Committee of Young Engineers of the Corporation of Professional Engineers of Quebec.

Mr. Clarke is associated with Gunite and Waterproofing Ltd. in Montreal.

**George S. Bowes,** Jr.E.I.C., is superintendent of Brantford Felt and Paper Company Limited in Brantford, Ont.

He was formerly plant engineer with Brantford Roofing Co. Ltd.

Mr. Bowes is a 1949 graduate in engineering and business of the University of Toronto.

**H. M. Lapp,** Jr.E.I.C., former assistant agricultural engineering specialist in the Extension Service of the Manitoba Department of Agriculture in Winnipeg, is now assistant professor of the Department of Engineering at the University of Manitoba.

Mr. Lapp graduated in agricultural engineering from the University of Saskatchewan, class of 1949.

**George A. Smith,** Jr.E.I.C., is now associated with Meschino & Associates in Toronto.

He was formerly with Margeson, Babcock & Associates in Toronto.

Mr. Smith graduated in electrical engineering from the University of Manitoba in 1949.

**Michael Hugh Walsh,** Jr.E.I.C., is now field engineer with Pigott Construction Company Limited in Toronto, Ont.

He was formerly with the Ontario Department of Highways.

Mr. Walsh graduated from McGill University in civil engineering in 1950.

**Laurance W. Clark,** Jr.E.I.C., is now assistant superintending engineer with the Department of Transport. Rideau Canals, in Ottawa.

Mr. Clark graduated in civil engineering from the University of New Brunswick in 1949.

**Desmond James Clements,** Jr.E.I.C., has been transferred by Bailey Meter Company Limited from Montreal to Halifax, N.S.

Mr. Clements is a 1951 mechanical engineering graduate of Queen's University.

**Richard M. Cook,** Jr.E.I.C., has joined the staff of the research department of Ferranti Electric Limited in Toronto, and is presently engaged in an electronic project in Ottawa.

Mr. Cook was formerly with the B.C. Research Council in Vancouver, B.C.

He is a graduate in engineering physics of the University of British Columbia, class of 1949.

**R. M. Harry,** Jr.E.I.C., has joined the Montreal staff of Canadian Allis-Chalmers after serving in the Company's training department in Milwaukee, Wis.

Mr. Harry is a 1949 graduate in civil engineering of the University of Saskatchewan.

**Norman Batt,** Jr.E.I.C., has joined the plant maintenance engineering department of the Ford Motor Company in Windsor, Ontario.

Mr. Batt graduated in electrical engineering from the University of Manitoba in 1950.

**M. D. Daunais,** Jr.E.I.C., has been transferred by the Dominion Tar and Chemical Company in Winnipeg, Man., to Calgary, Alta. In his new position he will be assistant works manager.

Mr. Daunais is a 1950 graduate in electrical engineering of the University of Saskatchewan.

**W. R. Cooke,** Jr.E.I.C., is now resident engineer with Central Mortgage and Housing Corporation in Gander, Nfld.

He was formerly with Defence Construction Limited in Halifax, N.S.

Mr. Cooke is a 1950 graduate in civil engineering of the University of New Brunswick.

**Peter J. Waugh,** Jr.E.I.C., is now with de Havilland Aircraft of Canada Limited in Toronto.

Mr. Waugh is a 1951 graduate in mechanical engineering of the University of Manitoba.

**W. L. Hatton,** Jr.E.I.C., research scientist with the radio physics laboratory for the Defence Research Board in Ottawa, is on loan as a lecturer at the Royal Military College of Science at Shrivenham, England.

Mr. Hatton received his M.A.Sc. degree from the University of British Columbia in 1951.

**Nicholas Engelman,** Jr.E.I.C., formerly in the employ of the Canadian Liquid Air Company, is now assistant structural field engineer in the central region of Canadian National Railways in Toronto.

Mr. Engelman is a graduate in civil engineering of the University of Toronto, class of 1951.

**Charles S. Walker,** Jr.E.I.C., has joined the Apparatus Division of Canadian General Electric Company Limited in Toronto after completing a two-year course toward his master's degree in business administration at the Graduate School of Business of Stanford University.

Mr. Walker received his B.A.Sc. degree in electrical engineering from the University of British Columbia in 1951.

**G. J. Maier,** Jr.E.I.C., is with the Hudson Bay Oil and Gas Company in Calgary, Alta.

Mr. Maier graduated in petroleum engineering from the University of Alberta in 1951.

**Jack C. Morris,** Jr.E.I.C., has joined Canadian Copco Limited in Toronto.

He was formerly Ontario sales representative for Sandrik Canadian Limited in Toronto, and with Bailey Meter Company Limited.

Mr. Morris is a 1951 graduate of the University of Toronto.

**J. A. Brenchley,** Jr.E.I.C., is now attending the Graduate School of Business at the University of Western Ontario.

He was previously with the Dominion Engineering Company in Lachine, Que.

Mr. Brenchley graduated from McGill University in mechanical engineering in 1951.

**Georges D. Coates,** Jr.E.I.C., of Vancouver, B.C., is now attending the Harvard University Graduate School of Business Administration.

He is a graduate in civil engineering of the University of British Columbia, class of 1951.

**A. G. Westaway,** Jr.E.I.C., has joined Clayburn Company Limited in Abbotsford, B.C., as assistant plant engineer.

Mr. Westaway is a graduate in mechanical engineering from the University of British Columbia, class of 1951.

**F/O J. L. Bourret, R.C.A.F.,** S.E.I.C., is presently stationed at the R.C.A.F. station in Rockliffe, Ottawa, Ont.

He is a 1952 graduate in civil engineering of Ecole Polytechnique.

**Walter Bloch,** S.E.I.C., previously with W. C. Becker Equipment Company Limited in Toronto, is now on the staff of Chemical Construction (Inter American) Limited in Toronto.

Mr. Block graduated in electrical engineering from the University of Toronto in 1952.

**W. G. Clarke,** S.E.I.C., has joined the staff of Algoma Ore Properties, Helen Mine, Ont.

He was previously contract engineer with International Nickel Co. Ltd. in Creighton, Ont.

Mr. Clarke is a graduate in mining engineering from the University of British Columbia, class of 1952.

**D. G. MacGowan,** S.E.I.C., is now employed with H. G. Acres and Company Limited in Niagara Falls, Ontario.

Mr. MacGowan is a 1952 graduate in mechanical engineering of McGill University.

**George S. Williams,** S.E.I.C., an Athlone Fellow, is now with the Aero Engine Division of Rolls-Royce Limited in Derby, England. In his second year he will study production engineering at the University of Birmingham under Prof. T. U. Matthew.

Mr. Williams is a graduate of McGill University in mechanical engineering, class of 1952.

**Andre Dupre,** S.E.I.C., is an equipment engineer with Northern Electric Company Limited in Montreal, Que. He was formerly with the Company in Hamilton, Ont.

Mr. Dupre is a 1953 mechanical electrical engineering graduate of Ecole Polytechnique.

**James W. K. Moores,** S.E.I.C., has joined Imperial Oil Limited as junior engineer at the refinery in Dartmouth, N.S.

Mr. Moores graduated in mechanical engineering from the Nova Scotia Technical College, class of 1953.

**James Quintard Calkin,** S.E.I.C., has joined A. V. Roe Canada Limited as an engineer in training.

Before graduating from the University of New Brunswick in mechanical engineering in 1953, Mr. Calkin worked during the summers with the Highway Division of the New Brunswick Public Works Department; Shawinigan Engineering Company Limited at La Trench, Quebec; and Canadian National Railways, Atlantic Region, in Moncton, N.B.

James Q. Calkin, S.E.I.C.

**Kenneth G. Clarke,** S.E.I.C., formerly with the Shell Oil Company in Calgary, Alta., is now on the staff of Queen's University as laboratory instructor in electrical engineering.

Mr. Clarke graduated in electrical engineering from Queen's University, class of 1953.

**R. C. Cook,** S.E.I.C., is now employed by Anglo Canadian Pulp and Paper Mills Limited at Forestville, Que.

Mr. Cook is a 1953 graduate in mechanical engineering of Queen's University.

**Victor A. Harvey,** S.E.I.C., is now employed as junior engineer in the design department of the Ontario Hydro-Electric Power Commission in Toronto.

Mr. Harvey is a graduate in civil engineering of the University of Toronto, class of 1953.

**B. L. Burke,** S.E.I.C., is now associated with C. D. Howe Company Limited in Montreal.

He was previously design draughtsman with Eldorado Mining and Refining (1944) Ltd.

**A. W. Dewhurst,** S.E.I.C., is a metallurgical engineer with Aluminum Company of Canada Limited in Montreal.

**F/O Bernard Charbonneau, R.C.A.F.,** S.E.I.C., is air material command headquarters project officer for the flight simulator section in Ottawa.

F/O Charbonneau is a 1953 graduate in mechanical engineering of Ecole Polytechnique.

## Visitors to Headquarters

**Theo. V. Berry,** M.E.I.C., Vancouver, British Columbia, November 25, 1953.

**C. C. Marshall,** M.E.I.C., Toronto, Ontario, November 25, 1953.

**J. N. Franklin,** M.E.I.C., Corner Brook, Newfoundland, December 7, 1953.

**L. J. R. Sanders,** M.E.I.C., Galt, Ontario, December 7, 1953.

**R. O. Darling,** M.E.I.C., Victoria, British Columbia, December 7, 1953.

**S. J. Carew,** M.E.I.C., St. John's, Newfoundland, December 12, 1953.

**C. H. Conroy,** M.E.I.C., St. John's, Newfoundland, December 14, 1953.

**John Reed,** M.E.I.C., Saint John, New Brunswick, December 15, 1953.

**Alex J. Grant,** M.E.I.C., Montreal, Quebec, December 28, 1953.

**James A. Ogilvy,** M.E.I.C., Toronto, Ontario, January 4, 1954.

# Obituaries

*The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.*

**Alfred Swatton Mansbridge,** M.E.I.C., project engineer with Pacific Mills Limited at Ocean Falls, B.C., died on March 12, 1953.

Mr. Mansbridge was born at Manchester, England, on December 17, 1886. He received his early education there after which he served his apprenticeship for five years in a machine shop in Scotland. Upon his arrival in Vancouver, British Columbia, he served two and a half years as rodman.

In 1909 he joined the staff of the British Columbia Electric Railway as draughtsman and engineer and four years later entered the employ of Pacific Great Eastern Railway as assistant to the chief draughtsman.

Mr. Mansbridge enlisted as a gunner in the Canadian Field Artillery in July, 1915. After service in France, he was discharged in April, 1919, with the rank of lieutenant.

Upon his return to Canada in 1919 he joined the Trussed Concrete Steel Company of Canada Limited as a draughtsman in Walkerville, Ontario, and was transferred to the Vancouver, British Columbia, office in 1923. In 1931 he was for a time structural engineer with the Powell River Company at Stillwater and Powell River, British Columbia, and later was attached to the engineering department of the West Kootenay Light and Power Company at South Slocan, British Columbia, and in 1936, entered the engineering department of the Consolidated Mining and Smelting Company at Tadanac, British Columbia.

In 1945 he joined the engineering department of the pulp division of Bloedel, Stewart and Welch Limited, as designer for their sulphate plant at Port Alberni, British Columbia, and a year later became designing engineer for Pacific Mills Limited in Vancouver, B.C. He returned to Bloedel, Stewart and Welch Limited as chief designing engineer in 1948, and in 1950 became project engineer with Pacific Mills Limited at Ocean Falls.

Mr. Mansbridge joined the Engineering Institute of Canada as a Junior in 1920, transferring to Associate Member in 1922, and to Member in 1940.

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**Wilfrid Arthur Winfield,** M.E.I.C., former president and chairman of the board of directors of the Maritime Telegraph and Telephone Company Limited in Halifax, Nova Scotia, died in Guelph, Ontario, on December 3, 1953.

Mr. Winfield was born at Derby, England, on February 11, 1880. After completing his high school education, he studied mechanical and electrical engineering through the International Correspondence School.

He entered the telephone industry in 1896 as a night operator with the Nova Scotia Telephone Company. Seven years later he became local manager of the Company at Windsor, and, subsequently, superintendent at New Glasgow. In 1903 he was appointed general manager of the Telephone Company of Prince Edward Island, a position he held until 1917, when he was named superintendent of the Cape Breton Division of the Maritime Telegraph and Telephone Company at Sydney. That same year he was appointed plant general superintendent in Halifax.

He became general manager of the Maritime Telegraph and Telephone Company in 1935, and its managing director in 1941 Three years later he was elected president. He then became chairman of the board of directors, and retired from that position in 1952 .

Mr. Winfield was a governor of King's Collegiate School, and of the University of King's College. He was a member of the board of the Halifax Ladies' College and the Halifax Conservatory of Music. Keenly interested in music, he served as a member of the choir of the Cathedral of All Saints and the Temple Choir and as vice-president of the Halifax Musical Festival.

Mr. Winfield joined the Engineering Institute as a Member in 1920 and was granted Life Membership in January, 1951.

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**Edward Walter Wall,** M.E.I.C., former vice-president and general manager of The Atlas Construction Company Limited, died in Montreal on October 8, 1953.

Mr. Wall was born at Easthampton, Massachusetts on August 28, 1888. He graduated with a B.Sc. degree in civil engineering from Brown University in 1910.

Previous to joining The Atlas Construction Company Limited in Montreal as construction engineer in 1911, Mr. Wall had been employed in general engineering work with the Town of East Providence, Rhode Island; with Frank T. Westcott in North Attleborough, Massachusetts; and with the New York, New Haven and Hartford Railroad in Providence and Westerley, Rhode Island.

After a year's association with The Atlas Construction Company, Mr. Wall was named construction superintendent in 1913. In this capacity he was in full charge of the laying out and construction of such works in Montreal as the Southam Building, the Grey Nun's Orphanage and Old People's Home, the British Munitions Building and Loew's Theatre. In March, 1914 he was appointed general superintendent of the company. He was responsible for the erecting of numerous structures, including the Thompson-Norris, Capitol Theatre, Dawes Brewery, Dow Brewery and Court House buildings in Montreal, the Dominion Tire Building in Kitchener, Ontario, and the Protestant School in Three Rivers, Quebec.

Mr. Wall was subsequently appointed general manager and vice-president of the company.

He retired from active work in the engineering field in 1932 because of ill health.

He was a member of the American Society of Civil Engineers and the Association of Professional Engineers of Quebec.

Mr. Wall joined the Engineering Institute of Canada as a Member in 1923.

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**Oliver Gauf Kelly,** M.E.I.C., district airway engineer of Alberta for the Department of Transport, died on November 19, 1953.

Mr. Kelly was born at Namao, Alberta, in 1905. He received his early education at Namao and Edmonton public schools and Portland, Oregon, Private School. In 1926 he attended the University of Alberta for a year and then entered the Oregon State College in 1927, graduating with a B.Sc. degree in mining engineering in 1932.

From 1920 until 1924, Mr. Kelly served as a coal mining labourer. Four years later he was employed with the Britannia Mining and Smelting Company at Britannia Beach, British Columbia, and during the following year as junior engineer with Atlin Ruffner Mines Limited in Atlin, British Columbia. From 1932 until 1936 he was engaged in coal mining in Edmonton, Alberta, and in field and prospecting work in the North West Territories.

From 1937 until 1942, Mr. Kelly was associated as junior engineer with the Palaris Taku Mining Company at Julsequah, British Columbia, and with Hedley Mascot Mines Limited at Hedley. He then became assistant survey engineer for the Alaska Highway under the United States Public Roads administration, and was engineer on location and resident engineer for Contractor Mile 108 Fort Nelson. He was also employed as engineer with Metcalf-Hamilton and the Kansas City Bridge companies on airport construction on the Northwest staging route.

Mr. Kelly joined the Department of Transport, Civil Aviation, Air Services Branch, in 1943 as assistant to the district airway engineer in Alberta. He was subsequently appointed district airway engineer, the position he held at the time of his death.

Mr. Kelly was a holder of the mine surveyor's certificate No. 2 of the Alberta Coal Mines Regulator Act. He was a member of the Association of Professional Engineers of Alberta, and formerly a member of the Edmonton Branch executive of the Engineering Institute of Canada.

Mr. Kelly joined the Engineering Institute as a Member in 1946.

D. E. Hebb, M.E.I.C.

**Donald Eugene Hebb,** M.E.I.C., engineer at Elder Mines Limited, Rouyn, Quebec, died on September 3, 1953, as the result of falling timbers at the bottom of a shaft.

Mr. Hebb was born at Bridgewater, Nova Scotia, on June 13, 1925. After receviing his early education at the Bridgewater schools, he entered Dalhousie University in 1942. Interrupting his university course, he served with the Canadian Army for two years. At the end of the war he returned to Dalhousie and graduated with a B.Sc. degree in 1947. Two years later he received his B.Eng. degree in mining engineering from the Nova Scotia Technical College.

Immediately after graduation, Mr. Hebb joined National Gypsum Canada Limited as plant engineer at Dingwall, Nova Scotia. In 1951 he accepted the position of production and methods engineer in Stadacona Mines Limited at Rouyn, Quebec, and in 1953 was appointed engineer of Elder Mines Limited in Rouyn.

Mr. Hebb was a member of the Association of Professional Engineers of Nova Scotia, and a member of the Canadian Mining and Metallurgical Association.

He joined the Engineering Institute of Canada as a Student in 1947, transferring to Junior in January, 1951 and to Member in December, 1951.

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**Murray Brettschneider,** S.E.I.C., of the Ontario Department of Highways in Toronto, died on July 31, 1953.

Mr. Brettschneider was born in Montreal on December 23, 1930. He obtained his general education at Strathcona Academy and entered McGill University in 1948, graduating with a B.Eng. degree in civil engineering in 1953.

During the summer months of his university course, Mr. Brettschneider was employed as assistant to the town engineer of Pointe Claire, Quebec.

After graduation from McGill, he joined the Department of Highways of Ontario and was engaged in survey work in Toronto.

Mr. Brettschneider joined the Engineering Institute of Canada as a Student Member in 1952.

# Employment Service

**THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.**

**NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.**

**REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.**

**INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.**

## Situations Vacant

### CHEMICAL

KEY POSITIONS in a new expanding, research lab. are open to competent scientists. Must have sound theoretical background, and at least five years practical experience in (a) natural and synthetic fibers—paper (b) high polymers—adhesives. Applicant should have M.Sc. or Ph.D. degree in chemical engineering or physical chemistry. Must be qualified to organize, plan and supervise the work of a group of men. In reply please submit personal resume, education and experience which will be held confidential. Remuneration to be negotiated. File No. 4725-V.

CHEMIST OR CHEMICAL engineer with experience in the pulp and paper industry, to supervise control work in a section of the technical department. Applications will be held confidential. File No. 4729-V.

### CIVIL

CIVIL GRADUATES, 1954, required by paving company in Province of Quebec. Applicants should be preferably bilingual. File No. 4726-V.

FULLY EXPERIENCED structural steel checker required in middle west organization. Applicant should have about fifteen years or more experience in structural steel and have previous checking experience. File No. 4727-V.

YOUNG GRADUATE ENGINEER PREFERABLY CIVIL or mining, required by manufacturer of drainage and all kinds of metal products. Applicant should not have more than two years experience and have a definite interest in sales work. Location Ontario. File No. 4733-V.

APPLICATIONS ARE INVITED for the position of a planning engineer. Applicants should have university graduation in civil engineering or architecture or related field preferably including or supplemented by courses in municipal planning. Considerable professional experience in municipal planning desirable, including some supervisory responsibility or an equivalent combination of training and experience. Applicants to state age, marital status, education qualifications and experience history. File No. 4736-V.

ASSISTANT TOWN ENGINEER required in Ontario. Graduate with 2 to 4 years experience and with some construction experience. Municipal experience is preferred but not essential. Work involved is the supervision of surveys and the inspection and control of various municipal engineering projects. Salary open. File No. 4742-V.

CIVIL ENGINEER with good experience in field layout and draughting required by pulp and paper company in the Maritimes. File No. 4743-V.

CIVIL ENGINEER University graduate and registered Professional Engineer required for sales promotion work by large company with Canada-wide interests. Applicants should have at least 5 years' experience in reinforced concrete structural design, should be in the twenty-five to thirty-five age group and should be prepared to do considerable travelling. Please apply giving full details of academic training and professional experience, references and salary requirement. File No. 4749-V.

APPLICATIONS WILL BE received for the position of Township Engineer and road superintendent for the Township of Sandwich West, Ontario; population now 13,000. Applicants must be qualified civil engineers and should be prepared to handle all problems in connection with roads, water works, etc., in a growing municipality. We employ a work supervisor. Applicants should state age, qualifications, past experience, references and salary expected. File No. 4751-V.

### ELECTRICAL

ELECTRICAL ENGINEER, registered professional engineer with five years experience in industrial design in Canada or U.S.A., must be familiar with industrial power distribution, automatic controls, switch gear (high and low voltage), lighting. Must be able to make detailed designs and undertake supervision of draughtsmen. Required by firm of consulting engineers located in West Ontario. File No. 4718-V.

APPLICATIONS ARE INVITED for the position of assistant professor dept. of electrical engineering University of British Columbia, Vancouver, Canada. Candidates should have post-graduate training preferably at the Doctor's level in electronics and servo-mechanisms. Duties include teaching under graduate courses in electrical engineering, post graduate studies in some phase of servo-mechanism or electronics. Starting salary $4.500 to $5,000 per year. Date of appointment July 1, 1954. Further information may be obtained by writing to the head of the department. File No. 4720-V.

GRADUATE ENGINEER preferably electrical with one to four years experience and a desire for sales engineering is required by small nationally recognized electrical manufacturer. Six months to one year orientation at Toronto factory then sales engineering work in Montreal office on salary plus commission basis. File No. 4721-V.

ELECTRICAL ENGINEER for system planning division. Should have at least ten years' experience in the designing and operation of hydro and/or thermal generating plants and transmission systems, with particular qualifications as follows: Application of the method of symmetrical component to the solution of unbalanced conditions on A.C. systems, experience in the use of the A.C. net work analyser on load flow studies, relay problems and stability studies, both transient and steady state. Familiarity with problems associated with the operation of a power system such as fluctuating loads, and methods used to mitigate the effect of some; also some knowledge of the operation problems associated with the inter-connection of two or more systems. Experience also desirable in A.C. system operation with particular regard to the maintenance of voltage levels, reactive and real power flow and speed covering problems. Address all applications giving full details of qualifications and experience and salary required. File No. 4723-V.

REPRESENTATIVE REQUIRED for Quebec and Ontario areas by electrical manufacturer to contact architects, consulting engineers and electrical contractors covering lighting equipment and wiring devices. Reply in handwriting stating qualifications and experience. File No. 4724-V.

ELECTRICAL ENGINEER required to design and develop rectifiers and communication equipment. Applicant should have better than two years experience in this field. Starting salary depends on qualifications. File No. 4728-V.

WANTED JUNIOR ENGINEER as estimator with large electrical manufacturing company. State full details technical and practical training and experience. Location Montreal. File No. 4730-V.

THREE GRADUATE ELECTRICAL engineers interested in design development, technical control on application engineering. The duties include: learning and preparing specifications for internal use of electrical conductors, the study of insulants and dielectric behaviour, the preparation of calculations and line design, assessment of the quality of raw materials, designing cables developing new products, and writing technical brochures and catalogue sections. Locat.on Ontario. File No. 4738-V.

YOUNG GRADUATE ELECTRICAL engineer, bilingual, required by manufacturer of vacuum tubes and fluorescent and incandescent lamps. The plant of this company is located at 60 miles from Montreal. The position offered would involve work in production engineering, quality control, testing. Please state salary expected and full details of qualifications and experience. File No. 4740-V.

### MECHANICAL

GRADUATE MECHANICAL ENGINEER wanted, experience in heater coil manufacture or design required. To assist also in technical sales. Salary commensurate with qualifications and experience. Location Montreal. File No. 4732-V.

SALES ENGINEER REQUIRED by large manufacturer of industrial equipment for sales and service of pulp and paper mills on west coast. Previous mill experience desirable. Excellent opportunity. File No. 4735-V.

GRADUATE MECHANICAL ENGINEER required to take over the preventive maintenance program of a fleet of transport vehicles operating interprovincially in Western Canada. Applicant should be prepared to spend some two to three months in the U.S.A. then put into operation a preventative maintenance program for this organization. File No. 4739-V.

MECHANICAL ENGINEER with at least five years experience for expanding Canadian organization to supervise the design and marketing of a specialized line of construction equipment. This opening will interest you if you have a flair for design and business administration. Salary open. File No. 4750-V.

### MISCELLANEOUS

AN ASSISTANT CHIEF, Water Resources Division, at Ottawa. Salary $7,500 to $8,100. Details and application forms at your nearest Civil Service Commission Office, National Employment Office and Post Office. File No. 4716-V.

YOUNG MECHANICAL (or civil) engineer bilingual, with sales experience in—or good knowledge of diesel engines, road-building and municipal equipment required by important company for its Montreal sales staff. This position provides an ideal opportunity for an engineer seeking a future in the heavy equipment sales field. File No. 4717-V.

APPLICATIONS ARE INVITED for the following positions: 1. Research officer, to engage in theoretical and experimental studies relating to building acoustics. Duties may include supervision of standard acoustical testing, field measurements and laboratory research in acoustics. 2. Research officer, to engage in studies of soil vibrations and their effect on buildings. Duties may include theoretical and experimental studies of wave propagation in soils and design of suitable apparatus for vibration studies in both field and laboratory. General qualifications: University degree in physics or engineering and at least two years of post graduate training or pertinent industrial experience. File No. 4719-V.

GRADUATE ENGINEER with degree preferably, but not necessarily, in mechanical, plastics experience useful, for position of assistant superintendent in a medium sized plant location in Hamilton. File No. 4722-V.

STREET LIGHTING sales engineer required by a long established manufacturing company in the field of scientific illumination. Duties after a specific training program will involve the sale of light directors to municipalities and public utilities chiefly. Diligence, dependability, an agreeable personality, and determination to make a career in this field are of highest importance. File No. 4731-V.

AUTOMOTIVE INDUSTRY IN ONTARIO requires work standards men to be employed on time study and methods work. File No. 4734-V.

LAND SURVEYORS salary $4,680 to $5,400 required by the Department of mines and technical surveys, Ottawa. Details and application forms at nearest Civil Service Commission, and National Employment Office. Apply before February 26, 1954. File No. 4737-V.

POSITIONS BECOMING available at Winnipeg in Air Line for graduate engineers having comprehensive experience in aircraft structures, mechanical, electrical and radio systems. Also senior draughtsmen with experience in aircraft structural or mechanical engineering. File No. 4741-V.

APPLICATIONS ARE INVITED for the position of assistant professor, Department of Civil Engineering, University of British Columbia, Vancouver, Canada. Candidates should have had post-graduate training preferably at the Ph.D. level in fluid mechanics. Duties include teaching fluid mechanics and other courses in the under-graduate school and teaching one post-graduate course in some phase of fluid mechanics. Starting salary from $4,500 to $5,000 depending on experience, with the possibility of augmenting income with summer work on hydraulic models or other hydraulic projects. Date of appointment is July 1, 1954. File No. 4744-V.

POWER PLANT ENGINEER for large industrial concern near Montreal to take charge of high pressure steam plant turbo-generators and refrigeration. Only those having both practical experience and technical knowledge need apply. Young graduate engineer preferred. State age, experience and salary expected. File No. 4745-V.

PLANT LAYOUT AND material handling engineer required by automotive industry in Ontario. Applicants should have either specific experience in these particular fields or with plant or maintenance engineering experience, such as construction, piping, conveyors, etc. File No. 4747-V.

TWO GRADUATE ENGINEERS required for large plant manufacturing various types of explosives, situated in P.Q. Duties required would be in maintenance department as project engineers and some design and alteration projects. Mechanical engineer required with from five to seven years experience. Other position requires chemical and mechanical engineer with two or three years experience. File No. 4748-V.

PLANT LAYOUT ENGINEER—Large U.S. manufacturer with plants located in Latin America requires capable Plant Layout Engineer for work in consulting office located in New York State. Must have experience in metal working industry in plant layout work with sound knowledge of building design and manufacturing methods. Please send complete resume covering education, experience and family, including recent photograph. File No. 4752-V.

MOTOR DESIGN ENGINEER—Large U.S. manufacturer with factory in South America needs experienced induction motor design engineer with sound knowledge of manufacturing methods. Motor sizes to range from small fractional horsepower through 50 HP. Please send complete resume covering education, experience and family, including recent photograph. File No. 4752-V.

*The following advertisements are reprinted from last month's Journal, not having yet been filled.*

### CHEMICAL

CHEMICAL ENGINEER with experience in production, or allied engineering services is required as technical representative of manufacturer of centrifugal separators, heat exchangers, special process equipment and plants. Wide field of inquiry is afforded since such equipment finds application in virtually all types of industry. In reply please outline personal and technical history. File No. 4682-V.

CHEMICAL ENGINEER, recent graduate required by Montreal firm in the chemical construction and lining field. This opening includes designing, estimating and recommending for specific chemical problems, the handling of some technical correspondence as well as field supervision. Replies should include age, marital status, salary expected and if possible, a recent photograph. File No. 4688-V.

### CIVIL

CIVIL ENGINEER preferably college graduate and registered professional engineer with at least fifteen years practical experience in a supervisory capacity, specializing in design of structural steel and reinforced concrete buildings, to supervise group of engineers and draughtsmen in consulting engineer's office in Windsor. Please write giving full details including experience, age, salary requirements, references, etc. Interview will be arranged. File No. 4649-V.

FOUR GRADUATE CIVIL engineers are required by the Department of Public Works of Newfoundland for surveying, planning, estimating and supervising construction of highways and two others to assist in design and to supervise construction of reinforced concrete bridges. Salary range $3,400 to $6,000 per annum depending upon qualifications and experience. Apply by letter giving full information and salary expected. File No. 4685-V.

STEEL MAN experienced in structural detail design and estimating required for engineering and sales work with steel fabricator located in Niagara Peninsula. Apply stating age, experience and salary expected. File No. 4690-V.

CIVIL ENGINEER, age 35 to 40, for a position in the Steel work section of the Engineering Structural Division. Applicants should be either registered professional engineers in the Province of Ontario or capable of being so registered. They should have a wide experience in the design and fabrication of structural steel preferably for power developments and experience in tower design would be an additional qualification. They should be capable of writing reports and handling correspondence, and also capable of handling

# Planning Engineer

**Applications are invited and will be received by the undersigned for the position of a Planning Engineer. Applicants should have university graduation in Civil Engineering or Architecture or related field; preferably including or supplemented by courses in Municipal Planning. Considerable professional experience in Municipal Planning desirable, including some supervisory responsibility or an equivalent combination of training and experience. Applicants to state age, marital status, educational qualifications and experience history.**

**E. A. FOUNTAIN,**
**Personnel Director,**
**Corporation of Burnaby,**
**1930 Kingsway,**
**South Burnaby, B.C.**

**Salary commencing at $4,284.00 increasing to $5,136.00 per annum over a four year period.**

personnel. The salary will be dependent upon qualifications. Location Ontario. File No. 4715-V.

ELECTRICAL

ELECTRICAL SALES ENGINEER wanted in Toronto by manufacturer of low tension signalling equipment. Preferably with experience in contracting or electrical distributing. Salaried position. Car supplied. File No. 4679-V.

NATIONAL SERVICE MANAGER required by manufacturer in Ontario. Applicant should be graduate engineer, with communications option, from a recognized University. He should have administrative ability and experience in radio communications in the frequency modulation field. File No. 4684-V.

TWO PRODUCT managers required by manufacturer of radio communications and electronic equipment. Graduate in engineering with experience in sales and marketing. Applicants will be expected to plan and organize a sales programme. on a country-wide basis. File No. 4684-V.

ELECTRICAL ENGINEER required by large paper company located in the Quebec City area. Graduate with two or three years experience preferred. In reply, please give complete details of experience and personal history. File No. 4686-V.

ELECTRICAL ENGINEER with one or two years experience in distribution planning, which eventually could lead to the position of Superintendent of distribution. The immediate work would consist of making up maps of our distribution system, planning and layout in the field, any new extensions or reconstruction of present facilities, voltage and load studies, substation design and layout, with a gradual breaking-in to supervise of operating and maintenance personnel. Location Ontario. File No. 4695-V.

RECENT ELECTRICAL ENGINEERING graduate required by large Canadian electrical manufacturer for sales and engineering work in Western Canada. Applicant should provide information in respect of educational qualifications and background in sales work, past experience, etc. File No. 4697-V.

ELECTRICAL ENGINEER required by large public utility in Brazil. Recent graduates having test course experience with large electrical manufacturer. Applicants must be single. Excellent pension plan. Apply in writing with complete details of past experience. File No. 4698-V.

JUNIOR ELECTRICAL ENGINEER required by large transportation company in Montreal in the motive power department staff. Duties will entail the designing and draughting of building and yard power supply equipment. File No. 4700-V.

SENIOR ELECTRICAL ENGINEER required in Ontario, preferable with at least 6 years experience in 2.3 K.V. and 4.0 K.V. distribution construction and maintenance. Please state age, education, experience and salary expected. Replies will be held strictly confidential. File No. 4705-V.

SALES ENGINEER required by the Canadian organization of a very prominent United States manufacturer of electric controls for heating, refrigeration, and air conditioning. Some experience with electric controls preferred. Would be located in Toronto area. Good opportunity to grow with a new Canadian company. Salary commensurate with ability. Not absolutely necessary that the applicant be a graduate engineer. File No. 4708-V.

ELECTRICAL ENGINEER required in junior capacity, in utility located in Prairie City. Experience not necessarily required but desire to learn all aspects of civic electrical utility will be decided asset. State salary required and full details of qualifications and experience. File No. 4710-V.

MECHANICAL

CHIEF ENGINEER HOME APPLIANCES. A well known Canadian manufacturer of refrigerators, ranges, washing machines, furnaces and other home appliances requires a chief engineer to head up their engineering department for home appliances. Should have proven ability to run a creative design department including basic development mechanical design, styling, standardization, lab., etc. Canadian engineer with experience in home appliances, design, age 35 to 40 preferred. This is is an excellent opportunity for creative engineering since this company is Canadian owned and wishes to produce Canadian designs for the Canadian market. Location Ontario. File No. 4616-V.

MECHANICAL ENGINEER, bilingual, single man with a desire to travel to conduct a diesel service training sessions in distributor territories throughout Canada. This position is an ideal opportunity for an engineer desiring to advance in the diesel field. File No. 4676-V.

JUNIOR SALES ENGINEER, graduate with sales experience, technical knowledge of diesel engines and their application an asset. There is a definite future to this job with possibilities leading to executive levels. File No. 4676-V.

JUNIOR MECHANICAL ENGINEER to work under the direction of a senior engineer in a research branch to develop, test and modify remote control equipment, instruments and techniques. Recent graduate in mechanical engineering with some training in shop or instrument work. Should be fond of gadgeteering. Salary according to qualifications. State particulars including age, marital status, education and experience in 1st letter. File No. 4693-V.

GRADUATE MECHANICAL engineer, preferably with sales experience to handle complete line of mechanical power transmission and materials handling equipment. Location Montreal. Age 35 to 45. Substantial income possible for qualified person. File No. 4699-V.

SALES ENGINEER, graduate mechanical, required by steel fabricating shop located in Montreal. Applicant should have 4 or 5 years shop experience. Salary open. File No. 4702-V.

MECHANICAL ENGINEER preferably college graduate and registered professional engineer with at least 5 years experience in design of pressure vessels, pressure piping and steam plant design. Also design experience in piping, heating, plumbing and boilers for industrial installations is desired. Please write giving full details, including experience, age, salary requirements, references, etc. Interview will be arranged. File No. 4707-V.

MECHANICAL ENGINEER required to assist mill engineer in large paper company in Province of Quebec. Duties would involve mechanical maintenance, construction and repair work. Starting salary would depend on past experience. A low rental company house available. File No. 4711-V.

MECHANICAL ENGINEER REQUIRED as assistant in the materials handling department of leading paper manufacturer in Eastern Canada. Applicant should have experience and the ability to take over the responsibility of entire department. Good salary to successful applicant. File No. 4712-V.

THREE GRADUATE MECHANICAL ENGINEERS TO ACT as sales engineer for large coal mining company with offices in Montreal and the Maritimes. One should be bilingual to cover Montreal and surrounding area, other to locate in Maritime office. File No. 4713-V.

MISCELLANEOUS

RECENT GRADUATES ('51, '52, '53) required for positions open in design, technical sales, technical service, process development, process supervision. Location Ontario. File No. 4672-V.

A CO-ORDINATOR of basic material practices. $6,420-$7,200. Competition 53-583 and an assistant co-ordinator of basic material practices $5,640-$6,360. Competition 53-584 for the Department of National Defence at Ottawa. Full particulars on posters displayed at your nearest Civil Service Commission office, National Employment Office and Post Office. Application forms obtainable thereat, should be filed immediately with the Civil Service Commission, Ottawa. File No. 4683-V.

THE PAKISTAN INDUSTRIAL Development Corporation invites applications for position of Works Manager for a paper mill to produce 100 tons per day of fine and superfine papers, utilizing bamboo as raw material. Also position of Works Manager for a high grade board mill and Works Manager for a straw board mill, utilizing cereal straws. Qualifications a degree in mechanical or chemical engineering or at least 10 years practical experience of management of a comparable mill and for board mill jobs a degree or at least 5 years practical experience of management of a comparable mill. Salary in accordance with qualifications and experience. File No. 4687-V.

QUALIFIED MINING ENGINEER to take care of development in N. Saskatchewan. Applicant must be prepared to live on site and devote entire time to one project and be capable of handling the entire project. Excellent salary to applicant with ability and good record. File No. 4692-V.

YOUNG GRADUATE ENGINEER urgently needed for new expanding oil company in Quebec and Eastern Ontario, with headquarters in Montreal. Work will include field inspection and contract control of construction of all service stations, bulk plants and larger petroleum handling installations. Position will also involve some travel and responsibility. Applicant should have necessary qualifications for membership in the Corp. of Professional Engineers. Previous experience is an asset but not absolutely essential. Replies should state age, qualifications and salary expected. File No. 4694-V.

ENGINEERING CO-ORDINATOR to supervise sales for organization in Montreal, representing leading American manufacturers in power plant process and industrial equipment field. File No. 4701-V.

EXPERIENCED CONTRACTING engineer to organize contracting department for old established firm specializing in brick floors, tank linings and tile setting. Headquarters in Montreal. Jobs throughout Eastern Canada. File No. 4703-V.

ELECTRICAL OR MECHANICAL project engineer required by electrical manufacturer in Ontario, a young graduate engineer to supervise the development of special prototypes through laboratory to production stage. This is a rapidly growing company and men with initiative should progress favourably. File No. 4709-V.

LONG ESTABLISHED company located in Toronto area has interesting vacancies for sales engineers preferably experienced on pumps and compressors or would consider men with a good knowledge of heavy machinery or power plant equipment. All replies in strictest confidence. File No. 4714-V.

## Situations Wanted

PIPING ENGINEER: nine years piping experience including gas and water. Presently completing $1½ million piping project including supervision of design, purchasing, construction. Canadian, aged 40, married. B.A.Sc., C.E., M.E.I.C., P.Eng. Present contract expires early 1954. Desires position as gas project engineer or superintendent anywhere in Canada. File No. 2466-W.

MECHANICAL ENGINEER, McGill 1944, single, age 34, with industrial eng. background. Wide experience in administration and supervision, production control, maintenance, plant eng., personnel work, wage incentives, time-study, cost study, welding, fabrication. In welding industry, heavy equipment, production, printing. Seeks opportunity to join progressive firm in engineering, production, or sales. Will relocate or travel. File No. 2920-W.

MECHANICAL ENGINEER, age 30, graduate. Experience in design and development, machinery, heat transfer, heating and ventilating, aircraft. Location immaterial. Available immediately. File No. 3012-W.

CIVIL ENGINEER, M.E.I.C., P.Eng., B.Sc. (Alberta) 1949, married, age 34, with administrative experience in handling contracts, contractors and purchasing of construction materials for government work. Experience in hydraulics and hydrologic investigations. Desires change with responsibility and a future. File No. 3223-W.

PHYSICO METALLURGIST, M.E.I.C., P.Eng., specialized in statistical elucidation of production data toward solution of workshop problems in metallurgy, specially in quality and process control in steel making-shaping-heat treating. As a statistical analyst experience second to none in sinchronization of production factors so that optimum conditions for the lowest occurrence of pipe in steel ingot, of segregation in steel can be attained, and maintained for a predictable length of time. Also in sinchronization of factors toward highest capacity of Bl.Fce. at lowest coke rate. File No. 3521-W.

GRADUATE ENGINEER, B.Sc., St. Francis Xavier University 1947, B.E. in Mechanical Engineering N.S.T.C., 1949, Jr.E.I.C. Age 29, married, one child. Two years as engineer in charge of machine and maintenance workshops for a research establishment. Two years as tool engineer and technical assistant to superintendent of a manufacturing division of a machinery manufacturing plant. Desires position with opportunities for advancement, where experience would be valuable. File No. 3547-W.



ADMINISTRATIVE EXECUTIVE post desired by civil engineer, B.Sc., M.E.I.C., with ten years of varied consulting and construction experience. Experienced in design of steel, reinforced concrete, earthworks, the preparation of contract documents, specifications, and estimates; also in the site supervision of construction of an industrial plant, hydro - electric installations, bridges, roads, and railways. File No. 3796-W.

CIVIL ENGINEER, B.Sc., University of Manitoba, 1939, M.E.I.C., P.Eng., age 36, married, 3 children, veteran R.C.A.F. 10 years experience in all phases of construction and management, mechanical superintendent. At present managing construction company. Desires position with progressive company offering responsibility and sound future. File No. 3831-W.

MANAGEMENT ENGINEER, specialized in industrial engineering and management techniques, married, bilingual, wants to find suitable position. Has had wide experience in various phases of industrial engineering as investigator, organizer, production planning supervisor, management consultant, etc., in companies of all sizes and in various fields, such as: automobile industry, foundries, electric cable and wire, machine shop, rubber, sheet metal, mining, etc. Expert in improving efficiency, methods and productivity, increasing output, cutting down of costs, materials handling, plant reorganization, survey analysis. File No. 3981-W.

CIVIL ENGINEER (European) graduate from McGill and Master's degree from Toronto (52) wishes to work on design and construction of buildings. Possessor of professional engineers certificate and experience on highway construction, surveys, soil borings and soil testing. Age 26, single, available in two weeks notice. File No. 3988-W.

CIVIL ENGINEER, N.S.T.C. 1952, age 28, married. Have had some highway construction experience. Presently employed in job requiring very little engineering training. Would like to obtain experience along any line of engineering. Present location Nova Scotia. File No. 4070-W.

SENIOR MECHANICAL ENGINEER (34), M.E.I.C., A.M.I., MechE., seeks responsible post in Toronto or district. 10 years experience in design and construction of medium and heavy machinery, rolling mills, chemical plant, hydraulic equipment. 3 years experience research and development in noise and vibration science. Also administrative experience, personnel and purchasing. Good knowledge French and Italian. File No. 4091-W.

GRADUATE CIVIL ENGINEER with B.A. (honours in mathematics) B.Sc. (civil eng.) degrees and post graduate work for Master's degree at McGill university seeks diversified work in connection with dam design and construction and other hydro works. Past experience for 1½ years includes work on dam design, dewatering of foundations and mass concrete for a big power house and bridge erection work. Presently working as a field engineer supervising earthern dyke construction. Location of job site and salary no consideration if job offers interesting technical experience in design office or in the field. Married, one child. Age 25. Highest references and outstanding academic record. File No. 4108-W.

CIVIL AND INDUSTRIAL ENGINEER, B.Eng., M.E.I.C., age 29, married, small family. Experienced in planning of major expansions and plant improvements for pulp and paper industry, including reports, costs, and design (civil and some mechanical). During 5 years in pulp and paper, reaching supervisory capacity, have obtained broad field and office experience in structural design, plant engineering, materials handling. Spent 1 year on design of power plants with hydro-electric consultants. Seek responsible position with industrial organization anywhere in Canada. File No. 4171-W.

MECHANICAL - CHEMICAL ENGINEER, (M.Eng. Dresden Karlruhe) M.E.I.C., P.Eng. Former lecturer at McGill. 15 years experience as plant engineer and assistant manager in heavy industrial and chemical plants. Process and design for chemical plants. Bilingual. Single. Location anywhere. File No. 4183-W.



MECHANICAL ENGINEER, graduated, married, over 20 years experience in piping, heating, plumbing, ventilating, air conditioning, refrigeration, waterwork and sewer installations, experience in process industries, steam-power plant, boilers, pumps, valves and layouts related to steel and reinforced concrete structures, desires adequate position with possibilities for advancement. Experience includes, design, construction, maintenance, planning. Qualification for administration, organizing, sales, has been used too. Location with preference for Montreal. Available 1st December. File No. 4211-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (Queen's 1948), veteran age 32, married, 1 child, over five years experience on layouts, steel and concrete design in a chemical plant. Ability to supervise projects and some knowledge of estimating and costs. Desires a responsible position where above experience would be an asset. Available on one month's notice. Preferable location southern Ontario. File No. 4238-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.E. (mechanical) Nova Scotia technical College 1949. Several years experience in machine shop practice, some experience in the design and installation of mechanical drying systems, three summers experience on survey parties, desires an engineering position, not necessarily in the mechanical field, in or in the vicinity of St. John's, Newfoundland. File No. 4255-W.

GRADUATE MECHANICAL ENGINEER, married, with family, requires employment. Diversified industrial experience. Purchasing, maintenance and machinery shop practice. Sound business training. Experience includes heating, sheet metal industries and general machinery equipment. Bilingual. Has good personality, enthusiastic, keen business acumen. Desires employment on production, sales or engineering administration. Location Montreal area. Available immediately. File No. 4300-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.Eng., McGill 1950, age 29, married. Completed Canadian General Electric test course after graduation and am presently employed as mill superintendent of a small textile mill. Would consider a position with a textile company. Would also consider production or service engineering in other fields. File No. 4309-W.

YOUNG MAN, ENGINEERING PHYSICIST, S.E.I.C., B.C.S., Georgia, 1950 (psychology with chemistry), B.Eng., North Carolina, 1953 (physics with mathematics), English and French languages. Two years general practical electromis, three years university teaching experience. Canadian Army veteran. Desires permanent position with opportunity of furthering interests in research organization. Location anywhere in Canada. File No. 4321-W.

CIVIL ENGINEER, O.L.S., Jr.E.I.C., P.Eng. (Queens 1951), desires to extend his experience in the municipal engineering field. Has worked since graduation with a consulting civil engineering and Ontario land surveying firm. Experience includes consulting for local improvements (field work, design and report writing), farm drainage, small concrete bridge design, filtration plant design, and all types of land surveys. Married. 1 child, has a car. Available on approximately 1 month's notice. File No. 4342-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Eng., power option, McGill 1950. Age 32, bilingual, single. Post graduate experience includes two year industrial training course and engineering sales work with large electrical manufacturing company. Also possesses B.Sc. in physics and background of diversified experience. Presently following evening courses in business administration. Desires position with responsibility. File No. 4343-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., 31, married and presently employed by a consulting engineering firm. Experience consists of over 4 years in reinforced concrete design, structural design, and some field work. Desires a position with complete supervision of design and/or field work with a real opportunity for advancement. Locality is no barrier. File No. 4347-W.

CIVIL ENGINEER, P.Eng. (Ontario), D.L.C. Hons (civil engineering), S.E.I.C., age 22, single. Seeking a position entailing responsibility with a consulting or contracting firm dealing with hydro-electric power developments, oil fields or construction. Interests: economic studies design, construction, sales and research. Fully familiar with office procedure. Past experience with highway and general construction in England. Party chief on location surveys with department of highways of Ontario, and at present with consulting engineers on a hydro-electric power project. Prefer position offering advancement to an ambitious engineer. Excellent references. File No. 4348-W.

ELECTRICAL ENGINEER, U. of Alberta 1951. Have 4 years communications and commercial radio experience prior to graduation; 2 years in heavy electrical manufacturing since. Graduate, Westinghouse Graduate Student Course. Have supervised assistants varying in number from one to three. At present manufacturing engineer in an industrial engineering department. Desire work of professional calibre in Edmonton district. Hard work and responsibilities taken for granted. Can speak and write well. Salary desired: $5,000 or equivalent. File No. 4349-W.

ENGINEERING EXECUTIVE, B.Sc. (Zurich, Switzerland), M.E.I.C., 35 years old, presently employed, having 12 years diversified industrial experience in Switzerland, Great Britain, United States and Canada which includes design of machinery, research work, development of domestic appliances, works management and general management including control of sales. Particularly interested in a position of chief engineer or works manager in machine, metal or appliance industry. Hard worker, energetic, accustomed to assuming responsibility. Location preferably Toronto area. File No. 4355-W.

QUALIFIED MANAGER, M.E.I.C., A.M.I. Mech.E., A.M.I.P.E., 16 years experience in U.K. Full apprenticeship tooling and production. Planning and control, plant and design. Sales and service. Bilingual. Managerial appointment sought in Montreal area. Minimum salary required $7000 p.a. File No. 4356-W.

CIVIL ENGINEER, Jr.E.I.C., B.Sc. U. of A. 1951, married age 29, experience in municipal engineering, also highway construction and some reinforced concrete. Would like permanent position in municipal engineering anywhere in Western Canada. File No. 4357-W.

CIVIL ENGINEER McGill 1953, S.E.I.C., considerable construction experience seeks position in the construction field. Presently employed in non-construction work. Single, willing to work anywhere. File No. 4358-W.

CHEMICAL ENGINEER, 1945 graduate, M.E.I.C., P.Eng. (Ont.) with several years work in anodizing, lacquering, plating, plastic and metal-spraying, phosphatizing, electropolishing. Particular consideration of corrosion problems in the chemical, beverage, textile industry. Has practical experience in managing, as well as laboratory work in the field of analizing and material testing. Did extensive research on chemical durability of lacquers and on adhesion of metals and paints on aluminum and steel. Desires a position in a plant or in a developing and research laboratory. File No. 4359-W.

CIVIL ENGINEER, M.E.I.C., with two years experience in Canadian structural design and detailing for industrial plants. 15 years broad and varied European experience as designer in structural, reinforced concrete and steel. Field and project engineer on foundations, bridges, harbour work, power and industrial plants, residential buildings, also cost estimating. Desire position where any past experience could be best utilized with contracting, consulting or operating company, preferably in Quebec, Ontario or Alberta. File No. 4360-W.

CIVIL ENGINEER, graduate 1950, Jr. E.I.C., married with one child, age 29. 3½ years of experience with a structural steel fabricating firm estimating material and labor for structural steel and miscellaneous iron for buildings and also platework. Desires work with a firm with a future and opportunity for advancement. Available on one month's notice to present employer. File No. 4361-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng. (Ont.), B.Sc. (Eng.) Man. 1949, age 25, single. Experience in steel fabricating design, welding and estimating. Complete familiarity with ASME and APJ codes. Desires responsible position preferably with petroleum industry in Winnipeg or immediate vicinity. Presently employed in Ontario. File No. 4362-W.

ENGINEER DESIRES design, development, or research work requiring limited travel. Experience with Dominion Government 4½ years on flood control, drainage, report writing; plus field experience, design and construction of small dams and sprinkler irrigation systems. B.S. degree in Agricultural engineering, 1949, University of Saskatchewan. Age 25. Married. File No. 4363-W.

CIVIL ENGINEER, S.E.I.C., P.Eng. Que., B.A.Sc., Toronto, age 28, married, presently employed. Seeks advancement, preferably in Southern Ontario. Have had limited experience in municipal surveys and planning, sewer design, construction and production. Also experienced in general plant engineering, structural steel and reinforced concrete design. Available on 30 days notice File No. 4364-W.

CHEMICAL ENGINEER, M.E.I.C., M. of Sc., 1946, Denmark. Age 30. Canadian wife. Have worked in Canada since January 1952, presently employed. Experience in petroleum products, and in vegetable oils for paint and varnish. Desires position with opportunities in product development or research. File No. 4365-W.

PRODUCTION ENGINEER, M.E.I.C., age 35, 1938 graduate, with successful record in plant management field. Extensive experience at responsible level in labour negotiations and all details connected with the operation of an independent production unit employing over 350 men, with special emphasis on the development of new production methods and machines to maintain maximum plant effort. Interested in position where creative ability and imagination coupled with a sound engineering background are required. File No. 4366-W.

ELECTRICAL ENGINEER, B.Sc. (Hons.). 1941, St. Andrews University, Scotland, A.M.I.E.E., P.Eng., married. R.N. veteran. 3 years major oil company supervision maintenance and installation, 1½ years Canadian municipal utility in charge all electrical aspects. 2 years major electrical manufacturer in Ontario as applications engineer. Linguist, versatile, teaching experience, sound background electronics and instrumentation, experienced in all aspects distribution, system studies, etc. Seeks job with greater responsibility, location secondary, available reasonable notice. File No. 4371-W.

MECHANICAL ENGINEER, 1950 graduate Polish University College, London, age 31, married, two years experience in diesel engine design and development, one year in water-tube boilers, and one year in industrial furnaces design. Also two years general machine shop experience prior to university studies. Seeks employment in Toronto in any engineering field, which offer a good opportunity for advancement. File No. 4372-W.

CIVIL ENGINEER, Man. 1948, Jr.E.I.C., age 29, married, 2 children, veteran. One year surveying. For past 5½ years worked on large diversification of milling and refining equipment and buildings for mining and smelting company whose plant has undergone expansion. Experience in layout, design and detail of refining plants, small mines, shops, warehouses, townsite and other works required for isolated location; estimating and preparing specifications. Could supervise drafting office but would prefer position offering responsibility and advancement to intelligent and personable engineer. Will accept position anywhere in Canada. File No. 4373-W.

YOUNG ENGINEERING EXECUTIVE, Mechanical engineering graduate, M.E.I.C., P.E. of Alberta, age 33. Engineering experience, tool designing, design of pressure vessels, plate weldments, processing vessels and equipment. General experience; shop and field inspection, purchasing and sales. Executive experience, director and general manager of small steel fabrication plant (70 employees), located in Western Canada. Desires position requiring initiative, organizing, and supervisory ability. Anything offering future advancement in responsble position. File No. 4374-W.

ELECTRICAL ENGINEER, Jr.E.I.C., 28 years old, married, B.A.Sc. (E.E.) 1951-U.B.C., 2½ years practical machine shop experience, 2 years radio and radar R.C.N.V.R., 8 months preparing specifications for telephone power equipment, 2 years steel mill experience—design and layout of conduit and cable for strip mill equipment including the devising of electrical control and interlock circuits—design of power distribution system including main substation and low voltage distribution transformer vaults. Complete resume on request. Location no object. File No. 4377-W.

CHEMICAL ENGINEER, Jr.E.I.C., war veteran, 34, married. Experience includes two years supervision in a large chemical plant in Quebec. Desires employment on production or sales. Location preferred Southern Ontario. File No. 4383-W.

CHEMICAL ENGINEER, B.A.Sc., P.Eng. Graduated in 1950 from University of Toronto. Age 25, married with one child. Have excellent experience in time and motion study, methods study, cost control, and all phases of production. Presently employed as assistant plant superintendent in a small manufacturing concern in Ontario. Desires permanent responsible position with good prospects for the future. Location anywhere in Canada. Available on reasonable notice to present employer. File No. 4384-W.

CHEMICAL ENGINEER, Jr.E.I.C., B.A.Sc., 1952, war veteran, 31, single; experience in production and instrumentation. Desires new position in engineering, development or instrumentation. Location: Ontario, Quebec. File No. 4385-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.A.Sc., 1948, 6 years pulp and paper and heavy industrial equipment experience before graduation as project designer and 2 years after graduation. For several years engaged in the combustion engine field mainly diesel equipment. Desires position in either field with more responsibility. File No. 4386-W.

CIVIL ENGINEER, M.Sc., Technical University Danzig 1935, D.Sc. Technical University Munich 1947, M.E.I.C., age 40, bilingual. 17 years experience in Europe and Near East in architectural and structural design of residential, industrial, hospital buildings and in town-planning. One year Canadian experience in Toronto in residential, industrial, and theatre design. Seeks responsible position with firm of engineers or architects. File No. 4387-W.

MECHANICAL ENGINEER, D.I.C., G.I. M.E., 27, single, bilingual, three years experience in design office and manufacturing of fabricated steel and structural steel, 1½ years research experience, sound knowledge of shop procedure, electric and electronic bias, seeks permanent position in Montreal area but willing to travel. Presently employed below technical ability. Loyal, responsible and willing to start at junior level if opportunity for advancement is provided after ability has been shown. File No. 4388-W.

MECHANICAL ENGINEER and Chemist, B.A.Sc.—1952; B.Sc. (Chemistry and Physics) 1946 M.C.I.C.; Junior A.S.M.E age 28. Married, with two years experience in all phases of instrumentation in pulp and paper industry, also one and one half years work as junior chemist in the petroleum industry. Desires job with definite opportunity for advancement. Presently employed, but available on reasonable notice. File No. 4390-W.

CHEMICAL ENGINEER, P.Eng., B.A.Sc (Toronto '50), Jr.E.I.C., M.C.I.C., 32, married, 1 child, veteran 3½ years R.C.N., four years general office work, four years development control and supervisory experience in chemical process industry. Working knowledge of French, some German. Desire more responsible position in technical service, development or similar work, Canadian or foreign. All replies acknowledged. Resume on request. File No. 4391-W.

ELECTRICAL ENGINEER, Canadian, M.E. I.C., B.Sc. (Alta., 1944), M.S. (Carnegie Institute of Technology, 1952), expecting Ph.D. Carnegie Tech. 1954. Married, 1 child. 4½ years with large Canadian electrical manufacturer including test course and design experience. 3 years in electrical sales. Desires teaching position in power field, or research and development in servomechanism and control field. Doctoral thesis being written on fundamental study of magnetic amplifiers. File No. 4392-W.

JR. E.I.C., Graduate Polytechnique 1950, fully bilingual. Has been working for 2 years as estimator and construction engineer. Had 1 year experience in construction works in Europe. Position wanted in Montreal or surroundings, but would consider going anywhere in Canada. File No. 4398-W.

EXECUTIVE ENGINEER, M.E., M.E.I.C., P.Eng. (Ont.), twenty-three years varied design-manufacturing and management experience of which eleven years chief engineer with equipment manufacturing concern. Since 1946 practising privately and activities consisted mainly of larger engineering assignments including project development and execution, also extensive consulting with steel, pulp and paper industries as well as equipment manufacturers. Interested in an association with a really progressive organization offering appropriate opportunities preferably in connection with larger scale Canadian and/or foreign developments, or other responsible activities requiring engineering background, leadership qualities, a realistic approach to problem and analysis, diplomacy, practical imagination and acknowledged design talent. Present income considerably above average but would consider reasonable compromise if proposition otherwise attractive. File No. 4399-W.

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# *Attention, Members*

Please telephone in advance and make an appointment if you propose using the Institute's Employment Department.

This will result in a better service to everyone concerned.

**TELEPHONE PLATEAU 5078**

**Except in special cases all interviews will be arranged between the hours of 9 and 12.**

# News of the Branches

**Activities of the Forty-six Branches of the Institute and abstracts of papers presented at their meetings**

## Belleville

C. H. Lusk, Jr.E.I.C.,
*Secretary-Treasurer*

**Steel Manufacturing Is Meeting Topic**

The Belleville Branch held its regular meeting at the Masonic Temple in Belleville on November 9, with 35 members present.

C. R. Whittemore, chairman of the Branch, presided. Mr. Whittemore noted that unfortunately the speaker for the evening, C. A. Robinson of the Steel Company of Canada Ltd., was unable to be present due to a death in his family. The chairman then outlined the proposed agenda for future meetings of the Branch.

The members were advised that the president, R. L. Dobbin, would visit the Peterborough Branch on November 27. The chairman hoped that as many as possible from Belleville would attend this meeting.

Mr. Whittemore advised that he had received a letter from G. E. Currie, principal of the Belleville Collegiate thanking the Branch for its $25.00 prize presented to the Grade XIII student, planning to take engineering, who had the highest standing in English, Algebra, Trigonometry, Geometry, Physics and Chemistry. This prize was won by William M. Campbell and was presented by C. R. Whittemore at the commencement exercises.

E. G. Gurnett made a few remarks regarding the forthcoming campaign of the Belleville General Hospital to raise funds for the construction of a new wing. He pointed out the responsibility of engineers as professional men in this request for funds.

A film entitled "Steel for Canadians" was shown. This film, produced by the Steel Company of Canada Ltd. and narrated by John Fisher, depicted the processing of steel from the ore to the ingot and steel bars. In view of the fact that C. A. Robinson of the Steel Co. of Canada could not be present, the chairman, C. R. Whittemore, elaborated on the steel manufacturing process and ably described the various procedures which were followed in securing a high grade steel.

Refreshments were served at the conclusion of the meeting.

## Calgary

Wm. E. Hawkins, M.E.I.C.,
*Secretary-Treasurer*
R. F. Bailey, M.E.I.C.,
*Branch News Editor*

**Dr. Hugh Beach Is October Speaker**

The speaker of the evening at the October meeting of the Calgary Branch was Dr. Hugh Beach of the Texaco Exploration Company who was introduced by W. C. Gussow.

Dr. Beach's paper, "The Heritage of Western Canadian Exploration", dealt with the past 200 years of exploration in Western Canada from the time that the first white man entered the Calgary-Edmonton region in 1754.

Dr. Beach, who has made an intensive study of early Western Canadian history, traced the development of geologic exploration from the time of Alexander McKenzie and David Thompson to the present. He said that the exploration of Western Canada was among one of the most orderly developments in the world. Dr. Beach illustrated his talk by many interesting slides of early days.

H. H. Hunter expressed the appreciation of the meeting to the speaker.

**Television Demonstration, November 5**

The speaker of the evening on November 5 was W. K. Allan who was introduced by W. E. Hawkins, secretary-treasurer of the Calgary Branch.

Mr. Allan gave a paper on "Television" which was demonstrated by a unique working model of a television receiver. He traced a picture signal from its origin in the camera tube through the transmitter, into the receiver and thence to the picture tube. He discussed such items as antennas for television reception and tuned circuits with the aid of interesting water analogy diagrams. With the aid of considerable wit and humour Mr. Allan made an unusually technical subject one which was very enjoyable.

Mr. Allan made several predictions for the future. He anticipated the general use of colour television by next year. He also believed that developments in transistors would revolutionize the radio-frequency field. Since the thought processes of the human brain are now being explained, as electromagnetic waves of incredibly high frequencies, Mr. Allan predicted the day when "tuning in" on human thoughts and ideas would be a reality.

After a question period, the speaker was thanked by W. C. Gussow, program chairman of the Calgary Section.

**R. A. H. Hayes Is Calgary Branch Speaker**

The speaker of the evening on November 19 was R. A. H. Hayes, chief electrical engineer for H. G. Acres and Company Limited, Niagara Falls, who was introduced by W. C. Gussow, program chairman of the Calgary Branch.

Mr. Hayes gave a paper entitled "Influence of Future Power Requirements on the Science of Transmission". He stated that on the basis of increase in power requirements between 1920 and 1954, by 1975 Canada would have a deficit of some 13 million kw. This assumes full development of the remaining power sites located mainly in British Columbia, Manitoba and Northern Quebec, all of which lie between 150 and 300 miles north of the present population concentration boundary of Canada. This deficit Mr. Hayes said, could be made up by steam and other thermal generation. Since thermal efficiencies in modern plants are now reaching the 40 per cent figure, the speaker felt that at least 30 per cent of the total generating capacity in Canada could be justified by thermal generation.

Because of the location of the remaining power sites and also since the power requirements of Canadians lie in an east-west direction, the problem of transmission is a major one. Mr. Hayes envisioned the day when all power companies in Canada would be interconnected in a pool. Because of the distances involved, the problem of stability becomes great in an a-c. system and this would lean toward the use of high-voltage d-c. transmission. The problems of such transmission have now been solved and a d-c. bus across the entire length of Canada would be possible.

Mr. Hayes concluded that the problem of increasing the present capacity three times in the next twenty years must be met by well thought-out stable transmission systems supplemented by strategically placed thermal plants.

After an active question period, Mr. Hayes was thanked by J. McMillan.

## Cornwall

L. Snelgrove, M.E.I.C.,
*Secretary-Treasurer*
John E. Pescod, Jr.E.I.C.,
*Branch News Editor*

**Film Showing, November 9**

The November general meeting of the Cornwall Branch was held on the evening of November 9 in the assembly room of Courtauld's (Canada) Limited.

Mr. Aitken of the Combustion Engineering Company presented two films. The first film, "Steam Progress", outlined the development of commercial steam boilers from the early low output, low pressure boilers of the late 19th century, to the modern, efficient, high pressure, high output ones of the present day.

The second film, "Walls Without Welds", showed the stages of manufacture of seamless steel pipe of various diameters up to 26 inches. This type of pipe is used extensively in the chemical, steam generation and oil refining industries.

Mr. Aitken was introduced by G. B. Stidwill and thanked by D. Ross-Ross.

280 feet from stem to stern, the 2500-ton "Hydro-Quebec" is shown in a rore idle moment. Over o period of several yeors of dredging, the 26-ton cutter will chew out an estimated 50 million tons from the 3,300 feet wide and 15 mile long canal, deepening the whole conol to 35 feet. Submarine cable supplies 13,800 volts for the vessel's electrical equipment.

# How the world's largest dredge

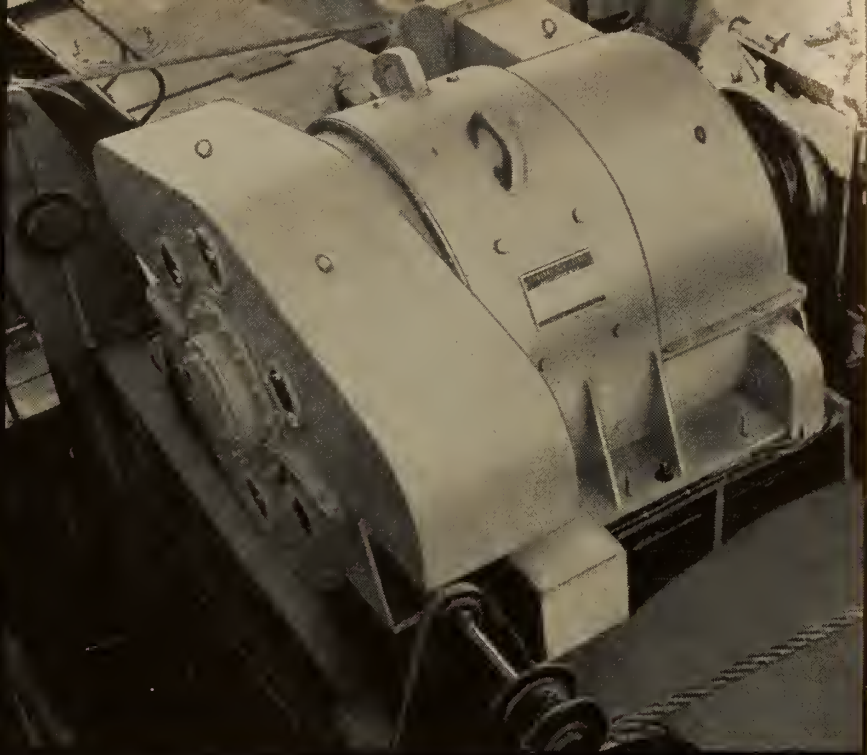
G-E three-unit mg set provides current for the adjust-oble-voltage cutter drive. This unit is mode up of o 1200-hp 900-rpm synchronous motor, on 800-kw 600-volt generator and o 20-kw 125-volt d-c exciter.

The dredge's switchgear—15-kv vertical-lift drowout metal-clad type—is built for ol weather duty. It consists of a 1200-hp synchronous motor starter, an 8000-hp motc starter, a 600-kw tronsformer feeder, a 600-hp synchronous motor storter, a com bination bus entrance and auxilliary comportment, and a set of metal-clod accessorie

Dredging unblasted clay and three-quarter ton boulders from the Beauharnois Canal, the "Hydro-Quebec" is equipped to take a lot of punishment. The precision-engineered C-G-E equipment that powers and controls its operation is built to stand the strain of operating twenty-four hours a day. C.G.E.'s 61 years of experience in the manufacture and use of electrical equipment is available for your applications—large or small—through a nation-wide system of sales and engineering offices.

Apparatus Division

CANADIAN GENERAL ELECTRIC COMPANY LIMITED • HEA



: transformer in the foreground—one of four on the ydro-Quebec"—delivers current at 600 volts to the /-voltage distribution panel (background) which relays wer to points all over the dredge.

This 1000-hp motor, mounted on the cutter ladder, is built to withstand the shuddering impact of dredging at an axial tilt of 45 degrees, boring through the boulder-strewn bottom of the Beauharnois Canal. The motor has its own electrically-operated blower and feed and load regulator.

# keeps working round-the-clock...

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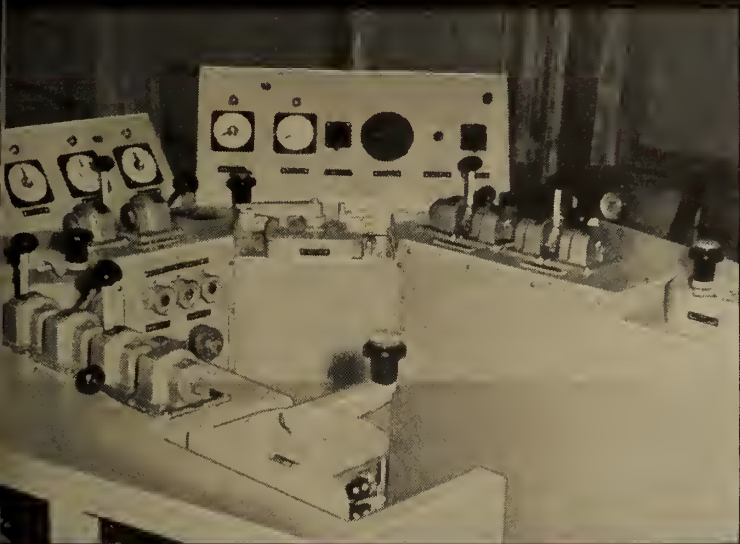

/ith these master switches the pilot house operator controls everything om manoeuvring the cutter head and maintaining an even flow through e discharge pipe, to haisting and lowering of spuds about which the edge pivots while working.

Powerful as 100,000 men, this 8000-hp G-E Motor—18 feet in diameter—was custom-designed to power the dredge's unprecedented digging job. The world's largest dredge motor, it requires a power supply of 13,800 volts.

For information contact the Canadian General Electric Company's Apparatus Division, Head Office, 212 King Street West, Toronto, or get in touch with your nearest C-G-E sales office.

**GENERAL ELECTRIC**
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**President Ross L. Dobbin visited Sherbrooke on December 7. Photographed at the meeting were: Front row, left to right, Hon. John S. Bourque, Mrs. J. Critchley, the president, John Critchley, Mrs. Bourque, Gaston Massé. Standing, Colonel Gaetan J. Côté, Mrs. Massé, George Dick, Mrs. Antonin Deslauriers, Mrs. George Dick, Colonel H. G. Thompson, Mrs. Côté, Antonin Deslauriers.**

J. Morris, vice-chairman of the Branch and acting chairman for the evening, announced that the next meeting would be a combined presidential visit and annual meeting, to be held on December 19.

## Eastern Townships

W. J. Sutherland, Jr.E.I.C., *Secretary-Treasurer*

Jacques Brisson, Jr.E.I.C., *Branch News Editor*

***President Dobbin Visits Sherbrooke***

President Ross L. Dobbin was the guest speaker at the annual Ladies' Night of the Eastern Townships Branch held at the New Sherbrooke Hotel on December 7.

The major part of the president's address was devoted to the description of some engineering aspects of the Coronation ceremony at which President Dobbin represented the Institute last May. He also gave enlightening information on the industrial development and the labour conditions in the United Kingdom.

Colonel Thompson, assistant general secretary, who was also present, outlined briefly the development of the Institute across Canada. He also spoke about the tremendous task undertaken by the Headquarters staff in the publication of the new directory.

The guests were introduced by Gaston Massé, vice-chairman of the Branch and they were thanked by George Dick, immediate past-chairman.

Hon. John S. Bourque, Quebec Minister of Lands and Forests and Natural Resources, presented Provincial greetings. He declared himself against the bill presented in Quebec by the Corporation of Architects whereby engineers would not be allowed to prepare plans for engineering structures such as power dams and power houses.

Antonin Deslauriers, Sherbrooke city clerk, representing His Worship Mayor Emile Levesque, greeted and welcomed guests and members in the Queen City of the Eastern Townships.

The banquet was presided over by John Critchley, chairman of the Branch.

**Manning K. Ells addressed the Halifax Branch on October 22. Left to right, R. M. Barteaux, Dr. F. H. Sexton, A. R. Harrington, Manning K. Ells, guest speaker, G. F. Bennett, chairman.**

## Halifax

W. A. Logan, M.E.I.C., *Secretary-Treasurer*

W. A. Devereaux, M.E.I.C., *Branch News Editor*

***M. K. Ells at Wolfville Meeting***

On October 22, 1953, the monthly meeting of the Branch was held at Wolfville, Nova Scotia in the Annapolis Valley. This was one of the first meetings to be held out of town so that out-of-town members of the Branch might have a better opportunity to attend. More such meetings have been planned for the future. Approximately 40 students in pre-engineering at Acadia University, Wolfville were at the meeting. G. F. Bennett, chairman of the Branch, welcomed the students and expressed a hope that they would have an opportunity of attending more meetings in the future.

The guest speaker for the occasion was Manning K. Ells, President of Cyrus & Manning Ells Limited, one of the largest commercial producers of poultry and eggs. The guest speaker was introduced by W. Ralph Lewis of Kentville who is a member of the Branch executive.

Mr. Ells pointed out that in the past 15 years the poultry branch of farming in the Valley had increased considerably and is now playing a very important part in its economy. Prior to this period, practically all poultry and eggs for Nova Scotia were imported from Western Canada. It is only recently that egg production passed the total of six thousand (6,000) cases per week which the people of Nova Scotia now consume; he predicted that consumption this year would rise to seven thousand five hundred (7,500) cases per week. At present eggs are being exported to Newfoundland, Bermuda, and other countries.

The speaker gave some interesting statistics on this type of business. Ten years ago 9 lb. of feed were required to produce a dozen eggs whereas today less than 4.5 lb. is required. A poultryman may have an investment of $7.00 per bird. It costs from 75 cents to $1.00 per month to feed and keep a laying bird. Mr. Ells' organization has one of the largest individual hatcheries in Canada consisting of five units, each with a capacity of 66,000 eggs.

There has been a 29 per cent increase in the use of eggs since 1939. In 1951 Canadians consumed eighty-two thousand (82,000) cases a week and in 1953 this number increased to ninety-two thousand (92,000) cases per week.

Although the talk was not exactly on an engineering subject, it was most interesting to all who attended.

The members at the meeting were pleased to hear a few words from Dr. F. H. Sexton, president emeritus of Nova Scotia Technical College, who is now living in Wolfville.

***President Dobbin Visits Branch***

On November 12, the Branch was honoured by a visit from President Ross L. Dobbin. A dinner meeting was held at the Nova Scotian Hotel in Halifax and many members of the Branch were on hand to greet the president and Dr. L. Austin Wright, general secretary. President Dobbin gave a very interesting and humorous talk on his trip to England as a guest at the Coronation. Dr. Wright outlined some of the current business matters with which the Institute is now dealing.

## Huronia

L. Morgante, jr.e.i.c.,
*Secretary-Treasurer*

***Engineers Make Tour of Plant***

The second meeting of the Huronia Branch, with headquarters in Orillia, was held at the plant of E. Long Limited.

Two very interesting films were shown. One of these was obtained on loan from the Consolidated Mining and Smelting Company of Canada, and was entitled "No Man is an Island". This excellent film in technicolor showed the various operations of the Consolidated Mining and Smelting Company in British Columbia.

The second film was submitted by E. Long Limited and illustrated the production and engineering features of Meehanite metal. E. Long Limited has the first Meehanite foundry in Canada. The metal produced is a special close-grained iron which combines some of the properties of steel with some of the properties of cast iron. Following the film, a very interesting discussion period took place and Bert Lamble, foundry metallurgist of E. Long Limited, gave a short address on Meehanite, and answered questions.

There were some 30 engineers at the meeting and there were a considerable number of out-of-town guests from Owen Sound, Barrie, Midland, Collingwood, Toronto and one from Detroit, Michigan.

***Seek New Members***

The Huronia Branch embraces a considerable district including Barrie, Stayner, Collingwood, Beaverton, Owen Sound, Midland, Orillia, Gravenhurst, Bracebridge, Huntsville, Parry Sound and Nobel. A drive is on for new members for the year 1954, and it is anticipated that the Branch will be a very successful one.

Following the meeting, the guests were escorted through the plant of E. Long Limited where they observed equipment under construction, such as vacuum filters, mine skips and cages, overhead cranes, etc.

This was the second meeting since inauguration. The meeting a month ago was held in Barrie, where the Huronia Branch were the guests of J. A. Muchison, general manager of the Canadian General Electric Company Limited.

## Hamilton

J. A. Reid, jr.e.i.c.,
*Secretary-Treasurer*

F. S. Gue, jr.e.i.c.,
*Branch News Editor*

***J. L. Gray Describes NRX Reactor Repair***

On October 22 the Hamilton Branch was privileged to hear an address by J. L. Gray, general manager, Atomic Energy of Canada, dealing mainly with the repair and rebuilding of the NRX reactor at Chalk River.

Mr. Gray's talk dealt with many of

PUGWASH

HALIFAX

Launching one of the concrete cribs built for the Seaward project at Halifax.
Owner: Department of National Defence.
*General Contractors:* Foundation Company of Canada Limited.

At Pugwash, N.S., a total of 27 concrete cribs, requiring 32,000 barrels of cement, was used in wharf expansion.
Owner: Department of Transport.
*General Contractors:* Angus Robertson Limited, Montreal.

# NEW WHARVES FOR THE MARITIMES..

# CONCRETE

***REPLACES LESS PERMANENT MATERIAL AT HALIFAX AND PUGWASH, N.S.***

IN BOTH of these dock jobs, concrete was used to replace less dependable material. For in wharfage work, as in other forms of construction, concrete provides the utmost in rugged strength, durability and economical over-the-years service.

***Send for free booklet describing concrete crib work in detail.***

**Canada Cement Company Limited**

*CANADA CEMENT BUILDING, PHILLIPS SQUARE, MONTREAL*

*SALES OFFICES: MONCTON, QUEBEC, MONTREAL, OTTAWA TORONTO, WINNIPEG CALGARY* the points brought out in his paper published in the November issue of the *Journal*. In addition, members who attended the meeting had the added advantage of hearing a good deal which could not be published and of questioning Mr. Gray closely on many of the details with which he proved himself to be very capably, and frequently, whimsically, familiar.

#### Hamilton Branch Receives the President

The day of the national president's visit to Hamilton — Thursday, November 19—was a busy one for the Hamilton Branch executive. Mr. R. L. Dobbin and his party joined the Executive for a meeting held in the Thistle Club during the afternoon, during which a valuable exchange of opinions on national and local matters took place.

A well-attended meeting of the Branch, in the form of a buffet supper at the Wentworth Arms Hotel, followed the executive meeting.

Mr. Dobbin, introduced with the familiarity of long association by Dr. L. A. Wright, spoke briefly and entertainingly upon his experiences as the representative of Canada's engineers at the Coronation, emphasizing the magnitude of the engineering problems involved in the successful functioning of this piece of modern pageantry.

After Mr. Dobbin's remarks, G. L. T. Vollmer introduced the speaker of the evening, T. B. Doherty, of Imperial Oil Limited, who spoke on "Oil Refineries".

Mr. Doherty, using skilfully a blend of oral, pictorial, diagrammatic and practical illustration presentations, brought his listeners in a short time to a surprising degree of familiarity with the complex functions of a modern refinery. His audience was, however, good-naturedly disappointed when, he smilingly declined to commit himself concerning how often the oil in the family car should be changed.

Mr. Doherty was thanked by N. Metcalf.

On the evening of December 3, three representatives of the Hamilton Branch journeyed to Toronto at the invitation of the Toronto group and were well rewarded by the address of F. G. Gardiner, chairman of the Metropolitan Commission, who delivered a worthwhile discussion on the problems of the Toronto Metropolitan area.

W. A. Dawson, in his remarks to the Toronto branch, extended an invitation for a reciprocal visit and a challenge to a curling match which was promptly accepted by the Toronto executive.

Those accompanying Mr. Dawson, the Hamilton Branch chairman, on his Toronto visit were F. E. Milne, vice-chairman elect, and F. S. Gue, Branch news editor.

## Kingston

G. D. Burwash, Jr.E.I.C.,
*Assistant Secretary*

#### November Meeting

The monthly meeting of the Kingston Branch was held on November 17 at the Royal Military College.

The guest speaker of the evening was Lt.-Col. P. C. King of the Royal Military College who was introduced by Lt.-Col. J. E. Styles of Queen's University.

Col. King spoke on the development of an underseas search craft which he has conducted at R.M.C. over the past year and a half. The idea stemmed from a meeting in June of 1951 between the Historical Society and a group of naval officers with a view to recovering certain relics from Navy Bay by use of a diver. After some discussion it became evident that it would be advisable and advantageous to have a means of underwater propulsion entirely free from surface craft. Other uses were foreseen, such as the defence of harbours from mines in wartime and the examination of the submerged portion of vessels. It was also decided that it should be possible for a diver to enter and leave the craft while it was submerged.

Approval was obtained from Ottawa to design and build the vessel, and work began in March 1952. Shortly after this Lt.-Col. Styles became associated with the project. The first trial was on October 15, 1953. As a result of data collected on this run modifications were made and a successful trial was conducted on August 6, 1953.

Col. King showed details of the craft by means of slides and sketches. The vessel was designed for two persons and utilizing equalized pressures or the diving bell principle. The source of energy is compressed air fed to radial engines built at R.M.C. It was stressed that with one or two exceptions all parts were made there. The engines drive pumps, forcing water through eight jets, placed around the outside of the shell, enable the vessel to be manoeuvered quite readily in all directions.

An extremely interesting movie was presented to show the search craft in action. At the conclusion of the talk Col. King was thanked by Philip Roy.

Refreshments were afterwards served at the Faculty Club.

**The president at Kitchener. Front row, M. A. Montgomery, councillor, President R. L. Dobbin, Chairman A. J. Girdwood. Back row, W. R. Roberts, past-chairman; J. F. Runge, secretary; B. Nichols, director; L. J. R. Sanders, director.**

## Lakehead

G. E. Cook, Jr.E.I.C.,
*Secretary-Treasurer*

H. Penner, Jr.E.I.C.,
*Branch News Editor*

#### Dryden Paper Company Hosts to Branch

Acting on a decision made in the autumn of 1952, the Lakehead Branch held its second out-of-town meeting within a year. At that time it was decided to help out-of-town members to keep in closer contact with their Branch. The first meeting took place in May of this year when a group of engineers motored to Dryden, Ontario, where the Dryden Paper Company played host to the group. Members from Kenora and Fort Frances were invited to this meeting.

#### Engineers Visit Marathon Paper Mill

On October 17 a motorcade left the Lakehead stopping en route at Red Rock and Terrace Bay where they were joined by more members. About 24 in all reached Marathon that afternoon, and were taken through the Marathon Paper Company mill. All technical personnel of the mill were invited to attend the evening meeting. Col. L. F. Grant, Field Secretary, was present at this, as well as the Dryden meeting and spoke on the topic "Engineers in Architecture". This was followed by a general discussion.

#### Joint Meeting at Thunder Bay Mill

On November 6 the Lakehead Branch of the E.I.C. and the Midwest Branch of the Technical Section of the Canadian Pulp and Paper Association held a joint meeting at the Thunder Bay Mill of the Abitibi Paper Company. A formal paper was presented by W. Kozny of Red Rock on "The Dorrco Fluosolids System". The group then proceeded to the Thunder Bay Mill to inspect the new pyrite plant. At 9:45 everyone returned to the engineering department where they were served a very delicious lunch.

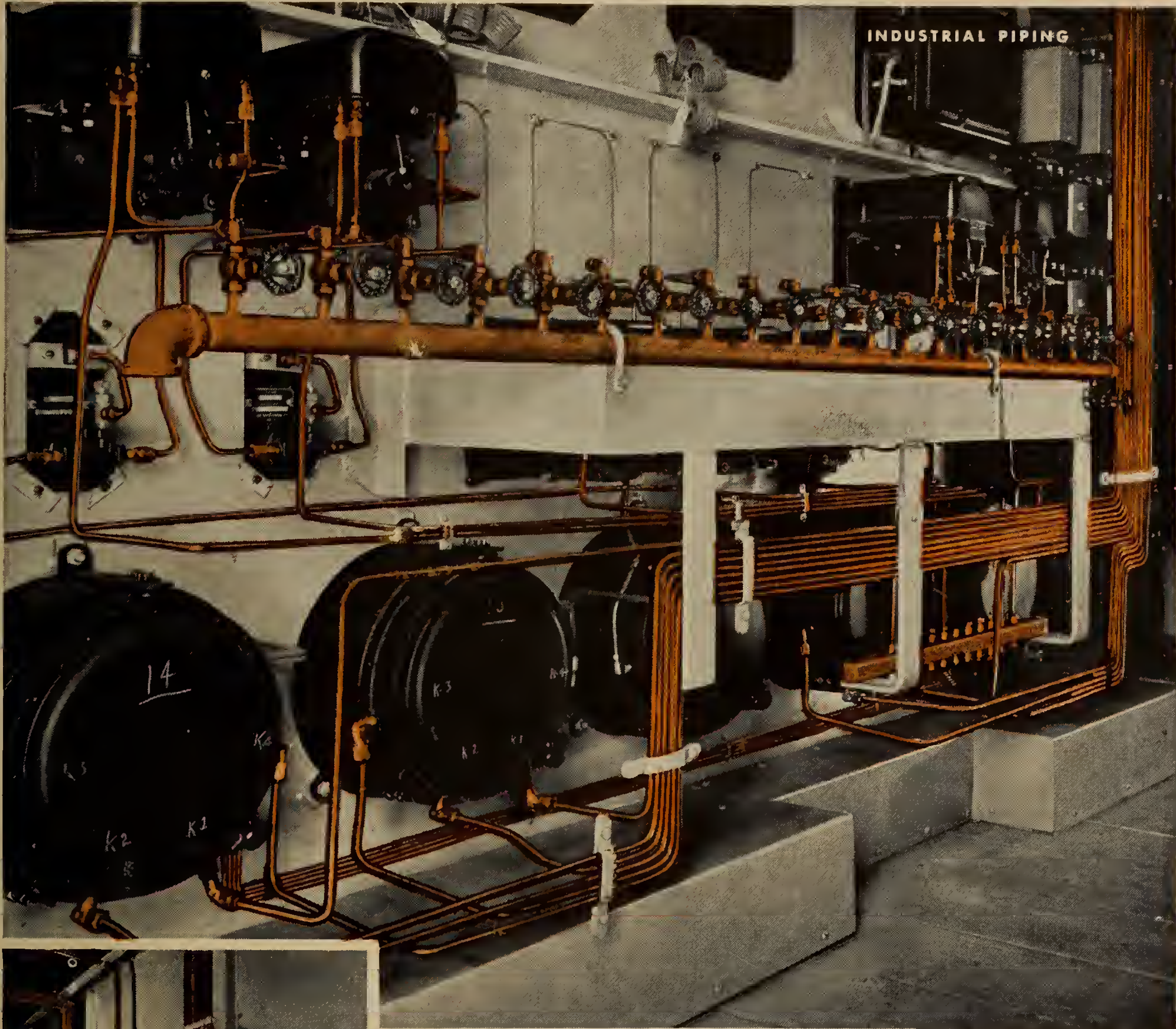
## Lethbridge

R. D. Hall, Jr.E.I.C.,
*Secretary-Treasurer*

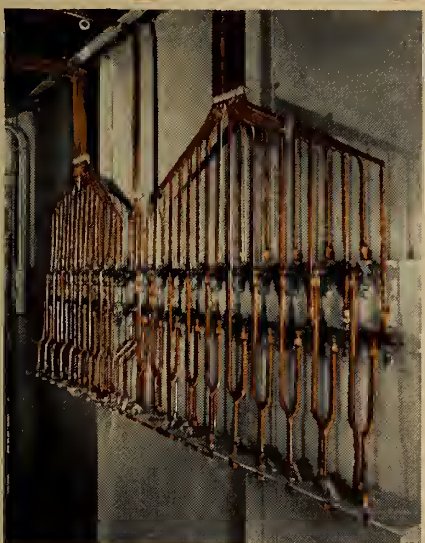
Paul Harding, S.E.I.C.,
*Branch News Editor*

#### W. Bird Speaks on Coal Industry

Thirty-eight members and guests attended the November dinner meeting of the Lethbridge Branch. Following dinner Bob Lawrence and George Brown led in community singing. Dave Howell favoured the meeting with two vocal selections "Where E'er You Walk" and "Old Man River". He was accompanied by Mrs. Brown at the piano. Dinner music was presented by Browns Orchestra.



THESE AIR SIGNAL LINES in Toronto's Richard L. Hearn Power Station use copper tube in long lengths, change direction and avoid obstructions without fittings.



MOIST COMPRESSOR AIR can never form rust or scale to impede control in this installation made by Bailey Meter Co., Ltd.

# Wet air can't rust this copper control piping

CONTROL would be impaired if moisture could create rust or scale in these pneumatic control lines for coal-pulverizing equipment installed by Bailey Meter Company, Limited, in Toronto's Richard L. Hearn Power Station. A number of these copper tubes convey differential pressures to the pulverizer feeder controllers, while others transmit an air signal to the pulverizers to selectively limit the rate of coal feed. Rust particles which might interfere with the satisfactory operation of the control system cannot form, and the smooth bore keeps flow resistance at a minimum.

Here, as in all copper tube systems, the long lengths, the light weight and the elimination of many fittings by bending all make important savings in installation costs. Where flare or solder-type fittings are used, there are no threads to cut, and connections stay tight.

Publication C-24 offers many additional facts on how ANACONDA Copper Tubes can help improve product quality, reduce operating and maintenance costs and avoid costly shutdowns. Write to: *Anaconda American Brass Limited, Main Office and Plant, New Toronto, Ont.—Montreal Office: 939 Dominion Square Building.*

**ANACONDA®**

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The speaker for the evening, W. Bird, General Manager of West Canadian Collieries Ltd., was introduced by P. E. Kirkpatrick.

In his address entitled "Run of Mine", Mr. Bird stated that coal plays a very important part in the Canadian economy. Although the coal industry is now passing through a difficult, yet not critical stage, the industry will not only survive, but will continue to be our main source of energy for many years, Mr. Bird said. To insure success, a staff of good engineers is required, people with originality and creative spirit as well as technical skill.

West Canadian Collieries have been producing about one million tons of bituminous coal per annum, and whereas this used to be sold almost entirely as "Run of Mine", it is now graded into six different sizes.

In the field of coal cleaning, drying and briquetting, the Canadian industry is well advanced. Many mines in the United States are now using cleaning machinery developed in the Crow's Nest Pass.

"Run of Mine" is screened into the various sizes, and the one and one-half-inch-plus size is cleaned in a sink and float machine which uses loes as its medium. One-quarter to one-and-one-half inch sizes are cleaned by air tables, and the refuse is crushed and then passed through another sink and float machine which uses its own dust as medium.

The one-quarter-inch-minus size presents a real problem in cleaning. Vacuum jigs invented by J. A. Brusset, vice-president of West Canadian Collieries, are used quite successfully. The mine also uses the only Lamex patented wet cleaning plant in Canada. Five "Parry" dryers are used to dry the fine coal.

Improved cleaning using magnetite now makes it possible to recover between twenty-five and thirty tons of coal per hour from previously discarded refuse.

Because of the limited market for fine coal in Canada, and the necessity of finding a means of marketing this commodity, West Canadian Collieries are now producing about 1,200 tons of briquettes per day, said Mr. Bird.

Coal has been essential to the progress of our civilization. In 1950 world production of all classes of coal amounted to 1,741,000,000 tons.

In the United States the percentage of power from all sources in 1950 was as follows: crude petroleum, 37.3; natural gas, 18.7; water power, 4.2; coal, 39.8. Comparable figures for Canada are as follows: petroleum fuels (fuel oil, gasoline, and kerosene), 27; natural gas, 5; hydro electric power, 27; coal, 41.

Coal was used for copper smelting in China two or three thousand years ago. In Europe coal was first used about the tenth century, and in North America, Nova Scotia coal was first used around 1637.

In addition to the commonly known uses, such as heating and power, metallurgy and the manufacture of gas and coke, coal is used in the production of dyes, medicines, disinfectants and the conversion into liquid fuel.

Engineering developments have so advanced that now only two-thirds of a pound of coal are required to produce one kilowatt hour of electricity, whereas a few years ago four to five pounds were required.

**The Junior Section of the Montreal Branch formed a ladies' committee under the direction of G. L. MacLean, Program Chairman, and presented a fashion show with proceeds going to the Canadian Cancer Society. They obtained the services of Juliette Hat Shop for fashions and held the event at Victoria Hall, Westmount. Over six hundred attended the event. The ladies' committee was composed of the following: Mrs. E. R. Frigon, convener; Mrs. G. L. MacLean secretary-treasurer; Mrs. J. P. Dagenais, Mrs. L. J. Hammershmid, Mrs. J. Soucy, Mrs. W. T. Clarke, Miss Giselle Desrosiers.**

In 1950 some 23,400 people were employed in the Canadian coal industry, and these persons were paid some sixty-one million dollars. This industry pays out a greater percentage of the receipts from the sale of its product in the form of wages than any other industry on the continent.

The major coal producing areas in Canada are in the West while the major markets are in the East. Canadian railways in 1950 hauled 19,139,000 tons of coal compared to a total tonnage of 13,832,000 tons of wheat. Coal imports in 1950 amounted to 26,500,000 tons of coal while Canadian production amounted to only 18,750,000 tons. Thus it is apparent that one of the major problems affecting the bituminous coal industry is the relative location of the supply and the market.

In conclusion, Mr. Bird stated that increased industrialization in Western Canada would greatly assist all Western Canadian coal mines, and that in time of war sufficiently developed reserves of coal are essential if the war is to be won.

A. G. Donaldson expressed the thanks of the Branch to Mr. Bird for his very interesting and educational address.

## Montreal

R. J. Harvey, M.E.I.C.,
*Secretary-Treasurer*

S. T. Rudkin, M.E.I.C.,
*Publicity Vice-Chairman*

#### *Owen Lake Guest Speaker on November 10*

Under the sponsorship of the Civil Section, Owen Lake, general manager of Construction Borings Ltd., delivered a paper on "Piling in Engineering Practice" to some hundred branch members on November 10. Mr. Lake obtained his early training in Norwich, England, with Dawnays Bridge, construction engineers; with the British Air Ministry; and later, as general design engineer of the British Steel Piling Company.

The speaker stated that piling has been used since primitive times. Pile-driving formulae of the dynamic type, he said, do not always give satisfaction. The bearing capacity of a single pile does not necessarily bear any relation to that of a group of piles, and adequate and appropriate soil investigation is necessary, requiring expert interpretation of soil properties. The type of pile used, and method of installing, have a great effect on bearing capacity. A question period followed the paper. Mr. Lake was introduced by meeting chairman D. H. Sharp, and thanked by W. Sefton. J. S. Lochhead was responsible for meeting arrangements.

#### *W. P. Moffat Discusses Diesel-Electric Locomotive*

"The Economics of the Diesel-Electric Locomotive in Railroad Operations" was the subject of a talk given on November 12 by W. P. Moffat, head of the Transportation Engineering Section, Operating Division, C.N.R., and sponsored by the Transportation Section of the E.I.C. Some 55 members were present at the meeting for which J. D. Sylvester was in charge of arrangements.

In determining the extent to which steam locomotives, with no resale value except scrap, should be replaced with diesels costing from $100,000 to $250,000 each, exclusive of the cost of the additional serving facilities required, Mr. Moffat said the following factors must be taken into account:

1. The diesel of equal hp. has greater tractive effort at low speed and on grades.
2. Diesel available for road duty 85 per cent of time vs. 65 per cent or less for steam.
3. Diesel fuel costs about 40 per cent of coal-burning steam locomotive and 60 per cent of oil-burning steam locomotive.

4. Future maintenance of diesel estimated about 25 per cent lower than steam.
5. Operating maintenance of diesel about 30 per cent of that of steam.
6. Wage saving in operating staff due to longer train lengths and unit construction.
7. Diesel savings are highest in manifest freight and switching service; smaller in way freight and passenger service.

Mr. Moffat was introduced by meeting chairman G. A. Morison, and thanked by Frank Haney.

#### Prof. D. L. Mordell Speaks on Gas Turbine

On November 16 the Electrical Section sponsored a joint meeting with the A.I.E.E., at which the speaker, Professor D. L. Mordell, chairman of the Department of Mechanical Engineering at McGill University, spoke on the "Development of the Gas Turbine and its Application as a Source of Electrical Power". Over one hundred persons were present. Professor Mordell has carried out considerable research on the gas turbine, recently on its possibilities as a coal-fired prime mover for driving electric generators. This talk was divided into three main headings:

1. Base Load Units—Several installations in the 25,000 kilowatt class have been built, but they are in a sense experimental, and not necessarily cheaper to operate than conventional steam units. He suggested the use of four jet engines, all impinging on a common turbine, as an interesting unit from a cost point of view.
2. Standby Units—This is the ideal use for the gas turbine, with its low cost and small size, and where, with operation for a relatively short period of time, thermal efficiency and fuel costs are not over important points.
3. Topping or Boosting Units — The addition of the gas turbine to an existing steam plant actually increases the efficiency of the entire plant, as the waste gas from the turbine heats the feed water for the steam plant.

A lengthy question and answer period followed. E. D. Gray-Donald was meeting chairman, and introduced the speaker, who was thanked by R. H. King, also in charge of meeting arrangements.

#### Sir Robert Watson-Watt Addresses Joint Meeting

"Dial K for Knowledge" was the title of a discussion on the philosophy of instrumentation in industry, given by Sir Robert Watson-Watt, C.B., F.R.C., on November 17, before a joint meeting of the E.I.C. and the Instrument Society of America. Lt. Col. J .Martin, M.B.E., was meeting chairman, and D. Woods, program chairman of the I.S.A., was responsible for meeting arrangements. Well over one hundred members of the two societies were present.

As introduced by Mr. John More, president of the I.S.A., Sir Robert, known as the "Father of Radar", is governing director of Sir Robert Watson-Watt and Partners Limited; President of Adalia Incorporated, and President of the Continental Oil Company. Sir Robert emphasized in his talk, which was tape-recorded by the I.S.A., the necessity for the instrument engineer to know management's mind and to talk its language, in order to sell instrumentation effectively. The utilization of suitable instruments could serve to improve the product, cut costs, boost production, protect worker and plant, increase efficiency, and interest of the worker, develop new products, and thus create new industries.

The gift of original and creative thought, he said, is still the finest tool in the instrument engineer's mental kit, along with the necessary knowledge, and the judgment and wisdom that comes from experience. To get the right information in the right form, at the right time, the instrument engineer must be human in his approach, but cold-blooded in his conclusion.

A question and answer period followed Sir Robert's talk, after which he was thanked by G. N. Martin, Montreal Branch Chairman.

#### Montreal's Economic Role Discussed by G. S. Mooney

On November 19, under the sponsorship of the Special Section, George S. Mooney, industrial commissioner and co-director of Montreal's Economic Development Bureau, gave a talk on "Montreal's Economic Role in the Life of the Nation".

Tracing the development of Canada from its original discovery by Norsemen around 1000 A.D., to the present day, Mr. Mooney pointed out how Montreal, first as a military and fur-trading centre after its settlement by Maisonneuve in 1642, and then as a port

# POWER

and growing industrial centre, and finally as the major financial centre, maintained its position as the hub of the expanding nation.

The deepening of the channel was a key factor in maintaining a flourishing port and encouraging industrial development.

Some of the many interesting statistics involving Montreal, given by the speaker, showed that it was the headquarters of six banks, having 60 per cent of all banking assets; the locale of thirty-eight consulate general offices, and Canada's principal economic listening post. One-tenth of Canada's population lives on the Island of Montreal, and huge natural resources of minerals, hydro-electric energy, and timber are at her doorstep.

Orby R. Brumell was meeting chairman and in charge of arrangements, and Mr. Gauthier thanked Mr. Mooney for his fine talk.

#### C. F. B. Stevens Speaks on Pulp and Paper Research

"Co-operative Engineering Research in the Pulp and Paper Industry" was the theme of an address given on November 24 by C. F. B. Stevens, technical assistant to the president of the Pulp and Paper Research Institute of Canada.

The meeting was sponsored by the Chemical Section. It was chaired by Dr. L. R. Thiesmeyer, president of the Pulp & Paper Research Institute, and arranged by Dr. W. H. Gauvin.

In the course of his talk, Mr. Stevens stated that an Institute team has been working under the sponsorship of and in co-operation with 17 paper mills in seeking to design a pulpwood holding system to withstand the pressure of river currents and weight of pulpwood in river storage. Such booms would cost a great deal, but a relatively small percentage of the millions of dollars' worth of pulpwood they contain.

Another team, he said, is seeking a pretreatment process to shorten the cooking time of pulp, and thus increase the quality of the finished product, and at the same time reduce operating costs.

The problem of corrosion in alkaline pulping equipment is being investigated by still another team of researchers.

#### Dr. Don Leet Is Civil Section Guest

Judging from the question and answer period, it was a debatable point as to whether insurance adjusters outnumbered engineers in the audience of over 125 which listened to Dr. Don Leet expound his theories on "Vibrations from Blasting" at a meeting sponsored by the Civil Section on November 26.

As chairman, Division of Geological Sciences, Harvard University; seismologist in charge, Harvard Seismograph Station; president of the Vibration Engineering Company, and consultant in the measurement of earth motion at the test of the first atomic bomb in 1945, Dr. Leet is no stranger to the effects of man-made explosions of any conceivable magnitude.

Based on the results of thousands of seismograph records of vibrations caused by blasting, certain criteria for safe limits have been set up, he said. With the relatively new system of short period delay blasting, wherein the explosives in a series of holes are detonated at pre-determined intervals separated by thousandths of a second, as many as 20 holes can be fired with no more vibration than formerly resulted from two. However, there is an optimum condition for any given location. The frequency of vibration has a distinct bearing on its effect on buildings, with a rapid vibration being much more liable to cause damage than a slow vibration of even greater amplitude. The slamming of doors is more prone to cause plaster cracks than the vibration caused by a large blast in the vicinity, provided the safe limit regulations have been observed, Dr. Leet stated.

The lively question period was testimony to a thoroughly enjoyed talk. H. John Racey, as meeting chairman and arranger, introduced Dr. Leet, who was thanked by Mr. Tait.

## Newfoundland

M. A. Foley, M.E.I.C.,
*Secretary-Treasurer*
R. P. Hunt, Jr.E.I.C.,
*Branch News Editor*

#### President's Visit

Ross L. Dobbin, the president of the Engineering Institute of Canada, accompanied by Donald Dunbar, the secretary-treasurer of the North Nova Scotia

**The Honorable J. R. Smallwood, Premier of Newfoundland, and President Dobbin.**

**The president at Newfoundland. S. J. Carew, Dean of Engineering, Memorial College; Chairman C. A. Knight; G. R. Jack, Vice-President of the Association of Professional Engineers of Newfoundland; President R. L. Dobbin, and Dr. R. Gushue, President of Memorial College.**

Branch of the Engineering Institute, arrived in St. John's by train on Sunday morning, November 8, following a visit to the newly-formed Corner Brook Branch of the Institute.

The president and Mr. Dunbar, with C. A. Knight, chairman of the Newfoundland Branch, and S. J. Carew, immediate past chairman, visited the Dominion Steel and Coal Corporation iron ore mines on Bell Island on Sunday. There they were met by Herbert P. Dickey, general manager, and other company officials. The party enjoyed an inspection tour of the operation and were entertained at a luncheon by the company. On return to the city the president held a press conference with representatives of the St. John's newspapers and radio stations.

Accompanied by the Branch chairman and vice chairman, Mr. Dobbin made official calls on the Premier of Newfoundland and His Honour Mayor Mews on Monday morning. The Branch executive joined the party in an inspection tour of Job Brothers Limited Fresh Fish Plant, after which they had lunch as guests of C. A. Pippy, president of the company. Luncheon featured a special fish menu in keeping with Newfoundland's sea-harvesting heritage.

A reception for the president was held on Monday evening at the Newfoundland Hotel. It was well attended by special guests, members and their wives.

Later the same evening Mr. Dobbin attended the regular monthly meeting of the Branch, at which he was the special guest speaker. He told the members of the growth and the increasing prestige with which the Institute was held in all parts of the Western World, especially in England, where he was so well received by various engineering bodies. He described the most colourful Coronation ceremonies which he attended at the invitation of the Queen as the official delegate of the Engineering Institute of Canada. Mr. Dobbin also spoke of the many engineering feats that were accomplished to make the Coronation the efficient function that it was. The Engineers' Wives' Club served refreshments after the meeting.

The president addressed the engineering students at Memorial University on Tuesday morning, November 10, and spoke on the wonderful opportunities offered to the young engineer in Canada. He wished them every success in their studies and hoped they would be active participants in E.I.C. endeavours as students and assured them that they would be most welcome as members of the Institute.

Immediately after the meeting with the students, the president and Mr. Dunbar were guests at a luncheon given by the Association of Professional Engineers of Newfoundland. Mr. Dobbin was welcomed by E. Dickinson, president of the Newfoundland Association, who offered the friendly and close co-operation of that body. Following the luncheon, a joint meeting of the executives of the local Branches of the Institute and the Association was held. Matters of common interest were discussed, the continuing of friendly relations and co-operation between the two bodies were stressed.

#### C. H. Conroy Is Speaker

At a regular monthly meeting of the Newfoundland Branch, held at Memorial University on October 19, 1953, Branch Chairman C. A. Knight, presided. C. H. Conroy, chief engineer, Buildings Division of the Provincial Department of Public Works, presented a paper entitled "Control of Moisture in Frame Walls".

The speaker outlined the basic principles involved in the control of moisture in frame walls and, with the aid of sketches and diagrams, explained how these principles should be applied in this type of construction. Mr. Conroy stressed the proper use of vapour barriers and analyzed and discussed several instances of local construction failure due to lack of fundamental knowledge in their use.

A lengthy discussion period followed, during which the members asked questions, commented and gave their opinions on the subject.

Gerald Knight extended a vote of thanks to Mr. Conroy on behalf of the Branch for his most interesting paper.

Following the meeting refreshments were served by the Engineers' Wives' Club.

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Montreal Branch

## Annual Dinner Dance

February 19, 1954 • Windsor Hotel

3 Orchestras • Original attendance prizes
Continuous music

7 p.m. Dinner, Dance, Gratuities: $5.00 per person • 9 p.m. Dance: $4.00 per couple
Formal wear optional

Chairman, Entertainment Committee:
Leo Scharry

In charge of table reservations
R. W. Evans, Ha. 3121

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## Niagara Peninsula

G. W. T. Richardson, jr.e.i.c.,
*Secretary-Treasurer*

J. H. Saldat, jr.e.i.c.,
*Branch News Editor*

**R. S. Ritchie Speaks on Oil Developments**

R. S. Ritchie was guest speaker at a dinner meeting of the Niagara Branch held on the evening of October 22 at the Queensway Hotel, St. Catharines, which was attended by some 35 members. The speaker, who is assistant manager, Ontario Division of Imperial Oil Limited, spoke on "Recent Oil Developments in Canada".

Mr. Ritchie indicated how the impact of the oil development in the last six and a half years has boosted Canadian economy. Before 1946 we produced 10 per cent of our oil consumption as compared to today's reserves which are nearly 100 times those of 1946. Canada's per capita oil consumption is 70 per cent of that of the United States, with our present production equal to some 45 per cent of our consumption. Canadians have invested one and a half billion dollars in oil since 1947, and have laid some 3,000 miles of oil pipelines.

Pointing out some of the economic implications, Mr. Ritchie said that in 1946 our largest import cost was in petroleum, but that this cost is now decreasing despite a much greater consumption. The impetus of the oil boom of other resource development programs has strengthened the Canadian dollar. Foreign capital accounts for only about 50 per cent of the capital invested in oil expansion in the past six years.

The fact that Canada is such a large oil consumer contributes to our standard of living. Canada has been investing 20 per cent of its production into the development of its resources.

An active program for developing resources makes for the economic integration of Canada.

The American continent consumes 60 per cent of all the oil consumed in the world. The United States has become a deficit country in oil since 1948, and Canada's deficit is decreasing daily. Oil is vital for survival in world conflicts and will play an important role in Canadian efforts in the event of war.

The future for the oil industry and petroleum exploration is bright. A known reserve of 2 billion barrels exists, with a possible 20 billion barrels yet to be discovered. It is believed that the oil sands of the Northwest Territories may contain more petroleum than the existing world's reserves.

The speaker was introduced by W. Scott, and Mr. Climo thanked Mr. Ritchie on behalf of the Niagara Falls Branch.

Mr. A. Bennett was chairman of the meeting.

**Presidential Visit**

Members of the Niagara Penninsula Branch turned out on November 17 to meet President R. L. Dobbin, and his party, visiting the Sir Adam Beck Niagara Generating Station No. 2. During the afternoon Mr. Dobbin and party were the guests of W. M. Hogg of the Ontario Hydro-Electric Power Commission as they toured the local development.

At a dinner at the Red Casque Inn, the president addressed some 40 members of the Niagara Branch. J. A. Ogilvie introduced the president, who informed the group that the E.I.C. has grown to the extent of 16,000 registered members, with some 47 branches. Mr. Dobbin expressed hopes for having a total of 50 branches. The pronounced growth of the E.I.C. is heartening to the president and it is his plan to spend all his time and effort towards the work and expansion of the Institute.

The British Empire's recognition of the E.I.C. was indicated by the Lord Chamberlain's command invitation to the president to attend the Coronation service in the Abbey. The president was also a royal guest at the Queen's Garden Party held on May 28, which some 7,000 Commonwealth guests attended. A detailed and pictorial account was given of the Abbey services and the Coronation day.

Mr. Dobbin related how the electrical system for televising and broadcasting of the Coronation was installed and operated with unbelievable precision and efficiency.

The president had visited many firms and manufacturing industries in Britain. He expressed confidence that his tour of England did much to introduce knowledge of the Engineering Institute in England.

Mr. Bush thanked Mr. Dobbin for his interesting talk. Chairman A. J. Bennett presided at the meeting.

## Ottawa

G. A. Sutherland, m.e.i.c.,
*Secretary-Treasurer*

C. E. Howard, m.e.i.c.,
*Branch News Editor*

**Elsie MacGill Guest Speaker**

On Tuesday, December 8, the 1953 activities terminated with a joint meeting arranged by the Engineers' Wives' Association of Ottawa. The meeting was held in the cafeteria of the National Research Council Building on Sussex Street.

Miss Elsie MacGill, m.e.i.c., the only female aeronautical engineering consultant in North America, was guest speaker, her topic being "Implications of Civil Flying at High Speeds".

Miss MacGill discussed the growth in civil transport aircraft performance from the days of the early bi-planes up to the highly streamlined monoplanes. She pointed out that the present piston-engined airliner had about double the speed of the early bi-plane transports and represented the ultimate in development in aircraft with piston engines. The jet transport aircraft, however, is completely new and relatively undeveloped.

The changing equipment on airlines and the increased speed of jet transports have and will continue to revolutionize all our established concepts of airline operations, servicing and maintenance, she said.

Mrs. W. R. McClelland, president of the Engineers' Wives Association was in the chair. Miss MacGill was introduced by Dr. J. J. Green and thanked by Group Captain H. R. Foottit.

**Discussion of N.W.T. and the Yukon**

On November 12, Major General Hugh A. Young, Deputy Minister of Public Works, spoke to a large attendance on "Resources Development in the Northwest Territories and the Yukon".

"Development of vast mineral and oil wealth in the Yukon and N.W.T. is making Canada conscious of a 'northern movement' to new frontiers," he said. "We have the greatest possible grouping of resources in our north country and development of them will depend largely upon the opening up of power supplies, roads, railroads and transportation facilities to the production areas".

A power operating company has been formed and is working on development of four to five million horse power in the Yukon, he said. This development of power is leading to tremendous happenings. The Yukon and the Northwest Territories are rich in uranium, gold, silver, lead, zinc and nickel, and exploration at Pine Point offers "potential for the greatest base metal development on the North American Continent."At Ferguson Lake, the International Nickel Company has already spent large sums of money and extensive investigation into the nickel deposits at Rankin Inlet Bay have been carried out.

Dealing with oil producing possibilities, the speaker said 28 million acres are under permit in the Northwest Territories for oil exploration.

Major General Young was introduced by Dr. John J. Green, chairman, and thanked by Major General Guy Turner.

**W. Sefton Discusses Concrete Shell Roofs**

At the luncheon meeting held in the Chateau Laurier on November 26, the design and construction of "Concrete Shell Roofs" was the topic discussed by W. Sefton, senior engineer with C. D. Howe Company, Montreal. Dr. J. J. Green, chairman of the Branch, presided.

Concrete shell roofs, Mr. Sefton explained, are arched concrete structures of exceptionally small thicknesses which span very large distances. For example the roof of the Quebec Stadium is only 4 inches thick and spans 240 ft. On the other hand, some structures have been built of concrete only half an inch thick, spanning 24 ft. and carrying large loads.

All such structures find their strength in the same way as does an egg shell. It is well known that one cannot break a raw egg with the pressure of the human hand, when such pressure is applied at both ends without touching the sides. Both shells, egg and concrete, absorb considerable external loads as membrane stresses are parallel to their surface.

The speaker showed many examples of shells constructed in Europe and in North America, and discussed the different types, their history, and principles of design, construction methods, costs and modern developments, including his own fully precast poststressed shell, as well as the future of shells in Canada.

Ralph Johnson thanked Mr. Sefton on behalf of the Branch.

Under the chairmanship of Dr. J. J. Green, a sub-committee has been formed to survey the possibility of locating a memorial to Colonel John Bye, somewhere in the centre of the City of Ottawa. When plans crystallize a report will be submitted to the members.

## Nipissing and Upper Ottawa

R. A. Booy, jr.e.i.c.,
*Secretary-Treasurer*

**December Meeting**

The December meeting of the Nipissing and Upper Ottawa Branch was held at the Marine Room, Trout Mills on Wednesday evening December 2. Robert Dye of Temiskaming, chairman of the Branch, was in charge of the meeting which was attended by 40 members and guests from North Bay and district points.

# Let's think About Lubrication

## AND PREVENT 80% OF BREAKDOWNS TOO!


FIGURE 1

Yes, you **can** save the costly time that's spent on manual lubrication, and yet, still be sure that your equipment is thoroughly and regularly lubricated! How? By installing Tecalemit Automatic Lubrication. It's as simple as that!

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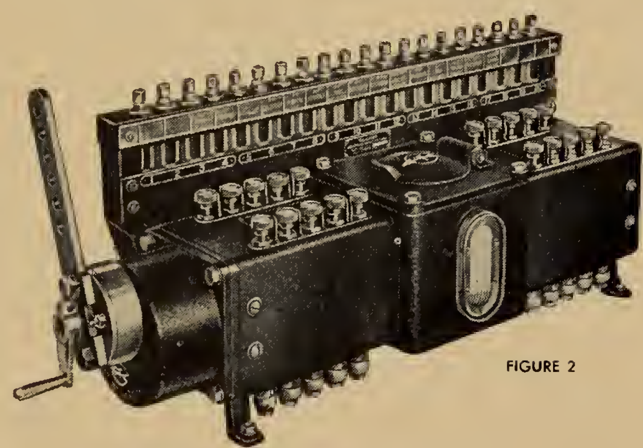

FIGURE 2

Complete Tecalemit range for industrial and marine machnery.

**Figure 1** — Model 17850 Radial Pump far grease or heavy oil. 1-19 units, each adjustoble. Ideal far Crushers, Plate Shears, Ore Mills, etc.

**Figure 2** — 20 unit "Brentford" Lubricator with Rising Drop Indicatars, 1-4 step-up Gearbox, Ratchet Arm ond Priming Handle.

- **One, three and eight pints.**
- **One to twenty pumping units.**
- **Rotary or reciprocating drive.**
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**431 KING ST. WEST TORONTO, ONT.**

Following dinner, H. R. D. Graham, manager of the northeastern region of the Hydro-Electric Power Commission of Ontario, presented an illustrated lecture on the construction of the new Sir Adam Beck Generating Station No. 2 now being built at Niagara Falls.

The outstanding engineering features of this development are two huge tunnels conveying water five and one half miles from an intake structure above the falls down under the city of Niagara Falls and then connecting together in a two and one quarter mile open-cut canal leading to the power house. When completed the plant will generate 1,200,000 horse power, with the first unit scheduled to deliver power in March, 1954. Since much of the province is now interconnected with tie lines, Mr. Graham stated, northern as well as southern Ontario would benefit.

Mr. Graham also stressed the remedial works being undertaken above the falls to distribute the water more evenly over the width of the cataract to preserve its natural beauty. The power house, too, was being designed to blend as far as possible into the natural appearance of the Niagara gorge.

## Quebec

Roger Desjardins, M.E.I.C., *Secretary-Treasurer*

Guy Babineau, Jr.E.I.C., *Branch News Editor*

**President's Visit**

In reporting the activities of the past year, the Branch recalls with pleasure the visit of President J. B. Stirling on May 8. After the executive meeting in the afternoon, President Sterling and General Secretary Austin Wright met informally a large section of the membership at a dinner at Le Cercle Universitaire.

After outlining the highlights of his tour of the various branches across Canada, Dr. Stirling urged the engineers toward increasing activity in the public service so that the public's respect for the profession could reach a still higher level. Since engineers cannot be legislated into higher salaries, the president expressed the opinion that constant personal effort and willingness to achieve results are still the best means of improving their situation.

After reviewing the activities of the Institute, the general secretary answered some questions from the floor during the informal discussion which followed.

G. E. Sarault, vice-chairman of the Quebec Branch, presided at the dinner meeting in the absence of Chairman A. E. Paré.

**Armand Mayer Addresses May Meeting**

The speaker at a meeting of the Quebec Branch on May 18 was the French consulting engineer Armand Mayer, M.A.S.C.E., president of the Centre d'Etudes et de Recherches des Liants Hydrauliques, Paris, France, and vice-president of the French Committee on Soil Mechanics. The subject of his discussion was "Some Aspects of Soil Mechanics as Applied to Dam Construction".

The meeting was under the chairmanship of P. A. Duchastel.

Reviewing the main stages of the design and construction of a modern hydraulic power dam, Mr. Mayer showed by means of graphs and actual field measurement data obtained on various projects he was responsible for, how the various aspects of soil mechanics applied to each of the above stages and particularly to dam foundations, water-proofing and embankment static equilibrium. Describing briefly some of the measurement methods used in the study of rock mechanics, he said that further investigation and research in this new aspect of soil mechanics might possibly result in the water intake tunnels' steel lining being eliminated or replaced by concrete lining in some specific cases.

Mr. Mayer's paper was followed by films on the recent French Rhône River major water power developments, Donzere-Mondragon and Gemissiat.

Introduced by the Branch Chairman A. E. Paré, Mr. Mayer was thanked by G. Piette. The meeting was under the chairmanship of P. A. Duchastel.

**Annual Golf Tournament**

The Quebec Branch annual golf tournament was held on Monday, September 14 at the Royal Quebec Golf Club in Boischatel.

With a gross score of 85, C. E. Rochette won the George T. Davis Cup. The Talbot Cup went to P. Vincent *ex-aequo* with C. Beaudoin; both these players had a 70 net. With a gross of 76, A. Tessier had the best score among the guest players.

The engineers' and guests' wives took part in a nine-hole contest which was won by Mrs. P. Vincent and Mrs. Y. Hyndman, with a score of 56 and 55, respectively. The ladies' putting contest first prizes went to Mrs. O. Longpré in the "expert" class and to Mrs. G. E. Sarault, C. Beaudoin and A. Desrivières all *ex-aequo* in the "beginner" class.

Despite rather unfavourable weather conditions, the annual golf tournament attracted a large portion of the membership. The prize distribution took place immediately after the buffet. This was presided over by P. A. Duchastel who was also responsible for the organization of this year's golf tournament.

The remainder of the evening was spent most pleasantly in dancing.

## Vancouver Island

P. F. Fairfull, M.E.I.C., *Secretary-Treasurer*

**Douglas Fir Plywood Manufacture Described**

A joint meeting of the Vancouver Island Branches of B.C. Engineering Society and Engineering Institute of Canada was held on Friday, November 27.

The speaker was S. G. Gardiner, Jr.E.I.C., mechanical engineer of B.C. Forest Products Ltd., Victoria, who spoke on the subject, "The Manufacture of Douglas Fir Plywood". Mr. Gardiner explained in detail the various processes entailed in the production of Douglas Fir plywood panels. Commencing with the virgin logs in the pond, he traced each step, the barking of the logs; the veneer cutting lathe which takes timber up to 7 ft. 6 in. in diameter and reducing it to 8 in. in diameter; the drying, grading, glueing and pressing.

It was interesting to learn that the dryers at this plant are believed to be the largest in the Pacific Northwest, and that 1,500 lb. of special phenol-formaldehyde waterproof glue are used every hour. The plywood panels are hot pressed at 285 deg. under a pressure of 200 lb. per sq. in, the pressing process varying from five to 15 minutes, depending upon the panel thickness. Test samples are taken at regular intervals and subjected to a severe freezing and boiler water test, the cycle being carried out three times.

On Wednesday December 2, a field trip was made to the Plywood Division of the B.C. Forest Products in Victoria where the members saw in practice the various machines and processes described in the address previously given by S. G. Gardiner.

## Winnipeg

C. S. Landon, M.E.I.C., *Secretary-Treasurer*

### Electrical Section

G. Flavell, Jr.E.I.C., *News Editor*

**G. W. Clayton Is Speaker**

On November 5 a large number of the section members attended a meeting at which G. W. Clayton, application engineer of the Canadian General Electric Company, Peterborough, Ontario, presented a paper on "Voltage Regulation of Subtransmission and Distribution Lines".

Mr. Claxton explained in detail the causes and cures of voltage regulator troubles. With the aid of graphs, he emphasized the many disadvantages of poor regulation, pointing out that it not only affects the efficiency of electrical apparatus, but also, incurs increased losses on the power supplier.

The speaker described briefly the various types of regulating equipment now being used, such as the load ratio control transformer, step-voltage regulator and induction voltage regulator. The choice of apparatus depends upon the frequency of operation and the degree of regulation required.

By means of slides the members were shown the extent to which poor regulation affects the performance and life of lamps and motors.

A discussion period followed this interesting talk, and Mr. Clayton was thanked on behalf of the attending members by R. T. Harland, executive member of the Section.

**Eighth Annual Dinner and Dance**

Over 250 guests attended the eighth annual dinner and dance of the Electrical Section, which was held in the Marlborough Hotel on November 20.

Guest speaker of the evening was Dr. Lennox G. Bell, head of the Medical College of the University of Manitoba. Dr. Bell presented a humorous philosophy of the evolution of life from the amoeba to the human being and back to the amoeba again. He was introduced by Professor N. A. Williams, vice-chairman of the Electrical Section, and thanked by R. T. Harland, executive member of the Section.

E. Scott, past chairman of the Section, proposed a toast to the ladies, and the response to the toast was ably made by Mrs. J. S. Merritt.

C. D. Osterland, chairman of the Section, thanked the convenor of the dance, L. Marrin, for the work he and his staff had done to insure a successful evening.

### Civil Section

K. R. Ebbern, Jr.E.I.C., *News Editor*

**Supercrete Plant Tour**

On Saturday afternoon, September 19, approximately 50 members and guests

**At the annual dinner and dance of the Electrical Section, Winnipeg. Left to right, C. D. Osterland, chairman of the Section; Mrs. Osterland, Dr. Lennox G. Bell, the speaker, Dean of the Medical College, University of Manitoba; Mrs. A. E. MacDonald, and Dean of Engineering A. E. MacDonald of the University of Manitoba.**

were shown through the Dawson Road Plant of Supercrete Limited which at that time was casting the pre-cast roof joists and slabs and the pre-stressed roof girders for the two Royal Canadian Ordnance Corps warehouses at Tuxedo, Man. These warehouses are the first pre-stressed structures of their kind to be built in Western Canada. The visiting engineers were fortunate in seeing the girders in various stages of completion starting from the make-up of the forms.

J. Boux and W. Taylor of Supercrete Limited, together with their staff, described the pre-stressing operation as it progressed and later entertained the visitors at coffee.

#### R.C.A.F. Stevenson Field Visit

On Saturday, October 10, the section visited the R.C.A.F. Cantilever Hangar under construction at Stevenson Field in Winnipeg. The visit was supervised and arranged jointly by the R.C.A.F., Central Mortgage & Housing Corp., and the Bird Construction Company, general contractors on the job.

Messrs. Hay and McKenna of Central Mortgage & Housing Corporation briefed the group in one of the completed 160-foot span steel arch hangars. After this the section was shown the unique cantilever hangar with its massive three storey concrete centre section and its 147-foot structural steel cantilevers. The structural steel on this hangar is being fabricated and erected by the Dominion Bridge Company at Winnipeg. This job was at an interesting stage for the visitors to see the cantilevers in various stages of erection. Some of the features shown to the group were the expansion devices used in the centre section, and tension ties used to prevent complete collapse of the structure should one cantilevered side be demolished by enemy action. Following this inspection tour the officers' mess was opened to members and their guests for refreshments.

#### Chas. J. Poppe Guest Speaker

On Thursday evening, November 12, the Civil Section held a meeting at which Charles J. Poppe, project engineer for Construction Aggregates Corporation of Chicago, was the guest speaker. Mr. Poppe has been active in the contract which his company has for the hydraulic stripping of mud overburden at the Steep Rock Lake Iron Mines.

He said that after the lake had been drained, there remained the problem of the removal of approximately 100 feet of mud including insulated boulders. The Construction Aggregates Corporation eventually employed two hydraulic dredges and actually pumped mud and water through steel pipes to a nearby lake reservoir. This operation was well illustrated by a coloured motion picture which showed the tremendous difficulties to be overcome particularly in winter operations.

Mr. Poppe was thanked by W. L. Wardrup.

## Yukon

John L. Phelps, m.e.i.c.,
*Secretary-Treasurer*

#### First Report from the New Yukon Branch

The first annual meeting of the Yukon Branch was held at Whitehorse on November 13 at the Whitehorse Inn for members and prospective members of the new organization.

Twenty-eight persons were present at the dinner and ballots for officers for the coming season, which had been previously mailed out to members, were reported by the scrutineers, Brig. H. W. Love and E. O. Greening. The following officers were elected: president, Lt.-Col. M. C. Sutherland-Brown, secretary, John L. Phelps; directors, C. E. White, Lt. K. Baker, and F/L G. H. Hicks.

Lt.-Col. Sutherland-Brown gave a short talk on the aims of the Institute. A general discussion followed, during which it was decided that meetings should be held at approximately one month intervals, at the discretion of the executive.

After the meeting, the film "Man with a Thousand Hands", was shown.

**First annual meeting of Yukon Branch, November 13, 1953. Seated, left to right—N. S. Tate, B. Sigurdson, C. E. White, J. L. Phelps, Brig. H. W. Love, Lt.-Col. M. C. Sutherland-Brown, E. O. Greening, Capt. R. W. Libby, F/L G. H. Hicks. Standing, left to right—Capt. D. J. Kempster, M. E. Almstrom, Lt. W. E. Royds, W. D. Gordon, Lt. R. G. Armstrom, P. Yurkiw, Capt. S. M. Bancroft, Alec. Berry, Maj. J. Burgoin, K. N. Domas, Lt. G. V. Clarke, E. McCarney, G. R. E. Leverman, E. O. Chrisholm, W. M. Emery, D. E. Finlayson, A. B. Yates, Ross Scrimger, N. Gritzuk.**


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## BOOK REVIEW

**Proceedings of the international congress on pre-stressed concrete, 1951.** London, Concrete publications, 1951. 705 pp., $15.00.

Three languages, English, French and Dutch, are all used throughout this volume, depending on the nationality of the specialist presenting the paper. In many cases, but not all, there is a digest in one or both of the other languages, and the discussion is reported.

Commonly known as A.I.G. (Association Internationale de Gand) the proceedings are divided into two parts, i.e., 1, Applications, and 2, Theories and tests. Papers presented are by the acknowledged leaders in the field from ten different countries, and illustrations both photographic and diagrammatic, are liberally dispersed throughout the volume.

Subjects treated include factory problems with pre-stressed joists, posts and pylons in pre-stressed concrete, floors, reservoirs, beams for vibration tables, bridges, pre-stressing of natural stone, and various types of bridge reconstruction.

Another interesting treatment is the results of use of formulae typical of one country being used in another, for instance, the Belgian process in Germany, and the Magnel-Blaton system in the United States.

Theories and tests include the Vacuum process, test of composite beam with a pre-stressed slab; trace of concordant cables in a hyperstatic pre-stressed construction; ultimate strength of simply supported pre-stressed concrete beams and their design; frames in pre-stressed concrete; beam fatigue; maximum bridge span lengths, and self anchored suspension bridges.

This volume is really a mine of up-to-date information in one of the most popular fields of engineering today. —E.K.

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## BOOK NOTES

**Prepared by the Library**
**The Engineering Institute of Canada**

*Book notes marked by an asterisk have been provided through the courtesy of the Engineering Societies Library in New York.

**Alternating current electrical engineering,** 8th ed. Philip Kemp, Toronto, McMillan, 1953. 680 pp, figs., $6.15.

First published in nineteen hundred and eighteen, and now in its eighth edition, this volume has long been established with electrical engineers. As in the past, machinery principles are stressed rather than descriptions of particular types of machinery and apparatus.

As late head of the School of Engineering at the Polytechnic in London, the author includes the requirements of study for courses preparing for both the "ordinary" and the "higher" National Certificates, as well as presenting the general principles of alternating currents.

Three chapters on design are intended to portray the principles and processes by which actual designs are involved, such knowledge being invaluable towards an understanding of the functions of various parts.

Thermionics have been totally excluded except for mercury-arc rectifiers.

British Standards symbols, notations and definitions are used, except for the use of the term "Alternator", instead of the recommended term "A.C. Generator".

The figure illustrations throughout the volume are numerous, and excellent. Numerical examples are included with the chapters, with solutions in the appendix, and the book is well indexed.

**Les atmosphères contrôlées dans le traitement thermique des métaux.** Ivor Jenkins. Paris, Dunod, 1953. 522 pp., illus., 4,800 fr.

Originally published in nineteen hundred and forty-six in London, by Chapman & Hall, under the title CONTROLLED ATMOSPHERE FOR THE HEAT TREATMENT OF METALS, this book has now been translated into French by J. Bernot, and will


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The use of controlled atmosphere in the thermal treatment of metals is largely a development of the last twenty years.

Prior to this, an immediate change of temperature following the thermal treatment itself, often made additional measures necessary to counteract oxidation, the decarburation of carbonized metals, or the loss of zinc in brasses.

Besides presenting the principles and results of controlled atmosphere, the author also deals with the practical aspect of putting these principles to use.

Most of the chapters include detailed bibliographies, and the book carries an index of names of authors, as well as a very complete subject index.

**Beam formulas.** A. Kleinlogel, tr., enl. and adapted by H. G. Lorsch. New York, Ungar, 1953. 143 pp., illus., $5.50.

Translated from the author's Belastungsglieder, this volume forms the third and complementary part of Multi-Column Frames and Rigid Frame Formulas of the same author, but can, at the same time, be used independently for the computation of statically determinate and indeterminate structures.

Over seventy loading conditions are covered, which is sufficient for most normal engineering requirements.

No other reference is necessary for computing, and this translation has in addition, been enlarged and specially adapted for engineers on this side of the Atlantic.

All loading conditions are just as presented by Kleinlogel. The data for beams with end restraints has been added as the original dealt only with simply supported beams.

The whole section "Use of Formulas and Tables" has been rewritten, as has also a large part of appendix one.

From requests we have had in the past, we know this book will fill a definite need for a number of our readers.

**Blaine's the slide rule as an aid in calculating, with numerous worked examples,** 7th revised ed. A. T. J. Kersey, ed. London, Spon; Toronto, British Book Service, 1952. 120 pp., illus., $2.50.

Now generally regarded as the textbook on the slide rule, this volume describes the different instruments available, in the simplest possible language.

The principal changes in this edition are concerned with additions on the use of the log-slide rule relating to calculation on the compression and expansion of gasses, particularly in the use of gas turbines.

Detailed descriptions of the long scale rules, or calculators, omitted from the last edition, have been reintroduced to this one; and, for reasons of history, or record, some old time information, such as railway fare computations in nineteen hundred, have been retained.

**Boiler house practice.** J. N. Williams. London, Allen and Urwin, Toronto, British Book Service, 1953. 600 pp., illus., 60/–.

"Combustion is generally understood as the phenomenon resulting from oxidation with the evolution of light and heat. There are other chemical reactions which furnish light, heat and flame which are included under the term, even though oxygen be absent . . . In steam boiler practice, a "combustible" is a substance capable of combining with oxygen to liberate heat, yet it is usual to employ the term to cover the portion of the fuel remaining after the subtraction of moisture and ash."

With this introduction, basic information is defined, and theory and practice of combustion and heat transmission are discussed.

Shell and water tube boilers are then detailed, followed by various types of mechanical stokers, and their suitable furnaces and grates.

The several types of fuel, their storage and their handling are considered, along with boiler control and the treatment of water.

Refractorics and temperature control, chimney emissions, and the cleaning of flue gas and boilers are all discussed.

Thirty pages of measurements and tests conclude the main body of the text, and the whole thing is summed up in a Finale, followed by seven pages of tables, and a comprehensive index.

**Calcul et exécutions des ouvrages en beton armé.** V. Forestier. Paris, Dunod, 1953. Tome 1, 263 pp., illus., 1,060 fr.

This is the first volume of the above title, dealing with general methods of calculating and working.

The three source documents on which the writing is based, are as follows:

1. The circular of July nineteenth, nineteen hundred and thirty-four, published by the authority of the Ministry of Public Works,
2. Rules for the use of prestressed concrete for works under the jurisdiction of the Ministry of Reconstruction and Town Planning, and private works (of December nineteen hundred and forty-five and March nineteen hundred and forty-eight),
3. Rules defining the effects of snow and wind on constructions, in the same category as number two.

The first of these deals primarily with Civil Engineering, including works of art, retaining walls, and road, river and marine transportation, all under the Department of Public Works.

Those under the Ministry of Reconstruction and Town Planning include industrial and commercial buildings, private structures, domestic buildings, etc. There are a few footnote references and a detailed table of contents.

**The characterization of organic compounds,** rev. ed. S. M. McElvain. Toronto, Macmillan, 1953. 303 pp., $4.50.

The author states in his preface that training in the identification, or characterization, of organic compounds is now practically essential for students in chemistry. His reasons for this are that without such training students cannot easily organize and consolidate the vast amount of information acquired in studying elementary organic chemistry. He also believes that this training can easily be applied in any future research which students may pursue.

The outlines of procedure for the characterization of organic compounds are given in the first chapter, and the four steps listed are developed in the subsequent chapters of the book. First, the purification of organic compounds, the determination of the more useful physical properties and the relation of boiling point to structure are discussed; following this are discussions of the relationship between structure and solubility and the use of solubility behaviour in the process of characterization. The class reactions of various groups of compounds are next dealt with, together with experiments illustrating their use. The last chapter deals with some of the more useful derivatives available for different classes of compound, the experimental procedures by which they can be prepared, and tables listing the properties of about fifteen hundred of the more common members of the different classes, and their distinguishing derivatives. These compounds are listed alphabetically in the index, with page references to this chapter.

The fact that this is a second edition would seem to prove its value to students of chemistry. The book has been brought up to date; the final chapter has been revised and enlarged, and references to other derivatives not listed in the tables have been appended.

**Les circuits de contrôle électronique dans l'industrie.** W. D. Cockrell. Paris, Dunod, 1953. 334 pp., illus., $9.00.

Originally published by McGraw-Hill in nineteen hundred and forty-four, and again in nineteen hundred and fifty, under the title Industrial Electronic Control, this volume will now be welcomed by our French speaking members in a translation by G. Henry-Bezy.

There have been many books on the theory and construction of electronic tubes, and their use in high frequency communication circuits.

This volume, therefore, deals only with applications of a general character, with the same circuit used over and over to illustrate the different types of applications. This basic circuit is for this reason used throughout, to illustrate an infinite variety of complete circuits.

By the same token, the publication is limited to electronic circuits, magnetic, optical and mechanical being completely ignored.

The whole presentation is for industrial use, presented in as practical a manner as possible, to be of real value both to the consultant and engineer in charge of installations of equipment in unfamiliar industrial surroundings and machinery.

It has an alphabetical index, and carries bibliographies and/or questions with a number of chapters.

**Corrosion testing procedure.** F. A. Champion. London, Chapman & Hall, Toronto, British Book Service, 1952. 369 pp., figs., $7.25.

"Corrosion consists essentially of reactions between a metal and its environment . . . Thus corrosion behaviour is a conjoint property of the metal and the environment to which it is exposed. There is, therefore, no universal test . . ."

These tests may be carried out for qualitative or quantitative results, or for both.

To achieve the maximum in satisfactory results, the book has been divided into five stages, and each one treated individually.

1. The choice and preparation of metal corrosive.
2. Exposure of the metal to the environment in laboratory, field or service tests.
3. Cleaning of the specimens preparatory to examination.
4. Examination of the specimens or the corrosive, for the effects of corrosion.
5. The expression and interpretation of results with particular reference to the form of the corrosion/time curve.

A little more detail in the index might be desirable, but the illustrations, both figures and photographs, are good, and excellent bibliographies accompany each chapter.

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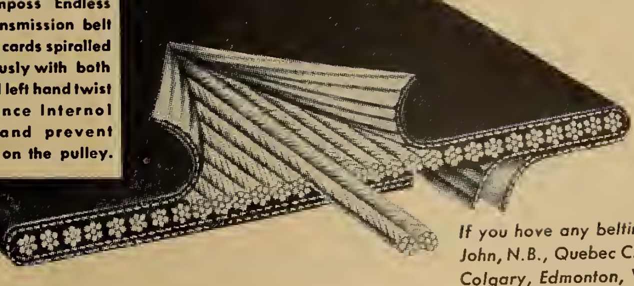

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**Diesel engineering handbook,** 8th ed. A. B. Newell, editor. New York, Diesel Publications, 1953. 827 pp., illus., $8.50.

As in the previous editions, detailed information is given on the Diesel cycle, fuels, engine components, and auxiliary equipment, including some specialized topics such as dual-fuel engines. In this new edition there is a brief chapter on marine Diesels and a new section has also been added describing representative American makes and types, with tabulated up-to-date specifications of all makes and models.

**Dislocations and plastic flow in crystals.** A. H. Cottrell. Toronto, Oxford, 1953. 223 pp., $3.75.

"When a large force is applied to a crystal two things may happen; the atoms in the crystal may slide past one another; and they may pull apart. The purpose of this book is to describe the theory of the first of these processes."

An advance in the still far from complete theory of dislocation of crystals has been made possible only by the basic orderliness of the crystal. But, by the same token, this theory is dependent on the peculiarities of abnormal places when the structure goes wrong.

In this study, the author has kept mathematics to a minimum, stressing rather the qualitative physical ideas, for the benefit of the experimental physicist interested in crystals; and the metallurgist and engineer working to improve the mechanical properties of engineering materials.

The work is clearly arranged in a logical sequence. Opening with the interpretation of slip, dislocation and their elastic properties follow. The second half deals with theories of yield strength, and work hardening, annealing, and creep.

The book has both author and subject index, and footnote bibliographical references.

**Electric motors and control gear.** E. Molloy, ed. London, Newnes. Toronto, British Book Service, 1952. 180 pp., illus., $4.00.

Number four in Newnes practical electrical engineering series, this volume consists of contributions from seven engineers, all specialists in their field. The information includes detailed information on design, principles of operation, and practical application of electric motors and their allied control gear.

This should prove a practical and useful little manual.

**Electrical equipment of buildings.** E. Molloy, ed. London, Newnes. Toronto, British Book Service, 1952. 260 pp., illus., $4.00.

The second in the series, Newnes practical electrical engineering series, this volume treats of the requirements of buildings from a business and industrial angle, of lamps, socket outlets and power points, and the selection and installation of electrical services, such as elevators, bells and indicators, house telephones, cooking and heating appliances, electric clocks, etc.

The actual presentation of material has been done by a group of fourteen engineers, specialists in the field, and it is all of a very practical and useful nature.

**Electrical instruments, meters, and electronic control.** E. Molloy, ed. London, Newnes. Toronto, British Book Service, 1952. 196 pp., illus., $4.00.

Accuracy of present day electrical instruments is responsible, in no small measure, for the recent extraordinary progress in electrical engineering.

Electricity meters are discussed in the first half of the book, including the electricity supply meter, and the theory, operation and use of portable indicating instruments and laboratory electrical instruments.

Automatic control through electronics, and the construction and operation of the magnetic amplifier are then discussed. The book is indexed and illustrated, and is another of Newnes practical electrical engineering series.

**Eléments de construction à l'usage de l'ingénieur, tome 10. Moteurs à combustion interne, 2nd ed.** G. Lemasson and A. L. Tourancheau. Paris, Dunod, 1953. 156 pp., diagrs., 420 fr.

As the invention of the steam engine was the start of the phenomenal development in modern machinery, so also has the internal combustion engine contributed in comparable importance to the more recent revolution in this field.

Internal combustion of variable cycles, diesel, and finally gas turbine have continued this struggle for development in the engine field, and it is this development that is considered in the first part of this volume.

The second, and more important part deals with the construction of motors, two chapters being devoted to mixtures, one for Diesels, and one for explosive motors.

The study of gas turbines is condensed in the third part into twenty-five pages.

The book is elementary in that it gives detailed explanations and illustrative diagrams of the various types of motors being considered, and will be most valuable to advanced technical school students and young engineers.

It has a bibliography, but the entries are only in briefest form, and are undated.

***Elements of heat treatment.** G. M. Enos and E. Fontaine. New York, Wiley, 1953. 286 pp., $5.50.

This volume describes the basic theory involved in the heat treatment of metals in simple, straightforward language. Following introductory chapters on the properties of metals and alloys, the major heat-treatment processes — annealing, normalizing, hardening and tempering — are discussed in detail. Other operations such as forging, rolling, pressing, machining, welding, and casting are briefly described. Graphs and tables of pertinent data are included.

***Engineering mechanics.** L. E. Grinter. Toronto, Macmillan, 1953. 408 pp., diagrs., $5.75.

This elementary textbook covers the normal subject matter of statics, dynamics, and kinetics, with a final chapter on virtual work. The author's aim has been to present the material in a logical and unified form which will aid the student in formulating an analytical approach to problems as well as give him the necessary factual information.

***Experimental nuclear physics,** vol ume 2. E. Segre, ed. New York, Wiley-1953. 600 pp., $13.20.

This is the second volume of a three-volume work on the experimental techniques and theoretical interpretation of the data in nuclear physics. It includes a treatise on nuclear reactions and an extensive discussion of the properties, sources, detection, and interactions of the neutron. Each treatise with its accompanying bibliography provides the reader with the main results obtained in nuclear physics up to the end of 1952.

***Fields and waves in modern radio,** 2nd ed. Simon Ramo and J. R. Whinnery. New York, Wiley, 1953. 576 pp., illus., $9.63.

The electromagnetic theory essential to an understanding of the subject is fully treated at an intermediate level. This second edition contains much new material, including an entirely new chapter on microwave networks, new developments on slow-wave guiding structures and other miscellaneous guiding systems, and various recent developments concerning horns, slot antennae and receiving antennae.

***50-100 binomial tables.** H. G. Romig. New York, Wiley, 1953. 172 pp., $4.40.

This volume gives the tables for positive binomial $(q+p)^n$ where $q=1-p$, and covers the range of n values from 50 to 100 in steps of 5 and the range of p values from .01 to .99 in steps of .01. Directions for the use of the tables, including a brief discussion of interpolation, indicate their many possible uses, especially in the field of quality control.

**Heat transfer and fluid mechanics institute, 1953.** Preprints of papers. Stanford, University Press, 1953. 240 pp., illus., $5.50 (U.S.).

The sixteen papers in this collection were prepared for presentation at the nineteen hundred and fifty-three Heat Transfer and Fluid Mechanics Institute, which was the sixth in a series started in nineteen hundred and forty-eight to make available to engineers a program of high caliber representing fundamental contribution to the engineering sciences. The papers are discussions of the latest scientific contributions of research and development centres in the United States and cover various aspects of heat transfer, and related topics. Some idea of the contents of the papers can be best given by quoting some of the titles:

> Experimental investigation of heat transfer at hypersonic mach number.
> Temperature measurements in the wake of bodies in supersonic flow.
> Heat transfer in curved flow channels.
> Evaporation from liquid wall films into a turbulent gas stream.
> Open channel flow of water-air mixture.

All the papers are accompanied by tables, graphs and diagrams, and some have bibliographies appended.

The compilation should prove of interest to all those concerned with these subjects, as they are here given an opportunity to read, in one volume, all the papers presented at the Institute, before they appear in the publications of the societies which sponsored it.

**Industrial specifications.** E. H. MacNiece. New York, Wiley, 1953. 158 pp., illus., $5.50.

Dedicated to the American Society for Quality Control, the American Society for Testing Materials, and the American Standards Association, this work is an effort to assist companies wishing to solve their specification problems, and improve their effectiveness by the application of statistical quality control techniques.

Carefully chosen samples explain and amplify the author's principles and generalizations. He stresses the need for better specifications, of the simplification of standards and standardization, and good co-operation between purchaser and supplier. Specifications of various recognized organizations are then discussed, and the whole summed up in a final chapter entitled "Maintenance and application of specifications".

The book is well indexed and illustrated, and well documented with facsimiles of illustrative standards.

**An introduction to power system analysis.** F. S. Rothe. New York, Wiley, 1953. 187 pp., figs., $5.00.

With the use of electric power increasing in the United States at the rate of one hundred per cent each eleven years, power systems have not only increased in size to meet this demand, but they have also increased in complexity. The result of this is an increased difficulty in the analysis required for their economic design.

The analysis included in this volume considers the characteristics of the generator, the transformer, the transmission line, and the load. The transient behaviour of the components during disturbances is thoroughly investigated, and the problem connected with the fundamental operating frequencies are covered.

The book is briefly indexed, and worked problems are included with the chapters.

***An introduction to relaxation methods.** F. S. Shaw. New York, Dover Publications, 1953. 396 pp., $5.50 (U.S.).

A detailed guide for solving problems arising in fluid mechanics, the design of electrical networks and machinery, forces in structural frameworks, stress distribution, electron-optics, and many other fields. The broad application of the book has been made possible by emphasis on the different types of equations solvable by these methods rather than on specific subject problems. The treatment is logical and fully detailed.

(This new Dover edition is an unabridged reissue of the original English translation first published in 1914). (Ed. note).

**Newfoundland fisheries development committee report.** St. John's, The Committee, 1953. 136 pp., fold. maps, $1.00. (Published by authority of The Honourable James Sinclair, Minister of Fisheries, and the Honourable W. J. Keough, Minister of Fisheries and Co-operatives.

Founded in January nineteen hundred fifty-one through co-operative effort on the part of the governments of Canada and Newfoundland, the aims of the Fisheries committee were to find the best method of examining the fisheries problems of Newfoundland.

Their three methods of approach were:

1. To examine into fisheries resources available to the Province of Newfoundland, with a view to the fullest utilization of known resources, and the discovery and development of others.
2. To examine into the economics of existing methods of fishing, and of other methods which may be applicable.
3. To examine into the economics of existing methods of processing and other methods which may be applicable.

The arrangement and presentation of the material is excellent. The book is divided into five sections, namely: The problem and its setting; The fishery resources of Newfoundland; Fish production and distribution; and, A program of development.

Under these headings, types of fish, of craft, of processing, and of development are clearly differentiated and arranged, and are all in turn enumerated in the table of contents.

Appendices include statistics, geographically arranged and otherwise of volume and values of catches, with all related information, and a bibliography.

Three folded maps complete this valuable little volume, showing "approximate location of fishermen, on June 1, 1951"; "Distribution by districts of average annual landings, nineteen hundred forty-five to nineteen hundred fifty"; and "Value of annual fish production by districts, nineteen hundred forty-five to nineteen hundred fifty".

**Power cables; their design and installation.** C. C. Barnes. London, Chapman and Hall, Toronto, British Book Service, 1953. 272 pp., illus., $7.00.

The aim of the series of monographs on Electrical Engineering, of which this book is a volume, is to provide up-to-date authoritative works on subjects which are either not touched upon, or inadequately dealt with in standard text books, and which often can only be found in periodicals. This particular volume is devoted to a review of the practical and theoretical considerations necessary for the successful design, manufacture and installation of paper-insulated power cables.

The chapters on the design of power cables are extensive, and include notes on design and testing requirements, protection, dimensions and weights, and current rating. The author reviews American and Continental super-voltage cable systems, and discusses the use and development of oil filled and gas pressure cable systems. He also provides some observations on the use of aluminum as a substitute for lead in the metallic sheathing of cables, which has developed in recent years owing to the high cost of lead.

Considerable space is given to the installation of underground cables, for, as the author points out, transmission and distribution cables in England are more and more frequently placed underground.

A short bibliography, and many illustrations are included. It is expected that the book will be useful to designers, engineers, students, and cable-users who are interested in the specialized field of paper-insulated power cables.

**Pulp and paper manual of Canada, 1953.** Gardenvale, Que., National Business Publications, 1953. 452 pp., illus., $7.50.

This 1953 edition of the Pulp and paper manual includes all the features found in previous years, some in an expanded form. The sections on equipment and engineering include papers with such titles as: The load control of wood grinders; A study of recovery boiler cleaning; Valve sizing accuracy; The use of small tractor in pulpwood logging; Watering pulpwood, etc. There is also a section describing recent advances in equipment and processes.

The flow sheets of pulp and paper mills have been checked and brought up to date, and several additional ones included. The information in the tables and charts prove very useful for quick reference, whilst equally useful, although completely different in content, is the list of machinery, supply and service companies. These companies are listed in alphabetical order, and for each are given locations of head, branch and sales offices, and personnel, both officials and salesmen.

Trade names of many items of machinery and equipment are listed with their manufacturers; and there is also a listing of Canadian representatives of foreign manufacturers.

This manual should prove useful to all those interested in the pulp and paper industry in Canada, and will be a valuable reference book for those in either engineering or purchasing divisions.

**Sewerage and drainage of the great Vancouver area, British Columbia.** Vancouver, Joint Sewerage and Drainage Board, 1953. 278 pp., illus., $10.00.

With the rapid expansion of cities all over the continent, this detailed report on the findings of the Joint Sewerage and Drainage Board of Vancouver will be of inestimable value to many sanitary and civil engineers.

It includes all sewerage projects considered feasible, in the greater Vancouver area, each being considered with regard to general suitability and total annual cost.

Minimum service necessary for drainage of storm water for the protection of potential flood areas are studied, and costs approximated.

Eight locations for final disposal of sewage are detailed, and in all but two, sewage can be discharged to the receiving waters without treatment.

Plans, discussions, and estimates are considered for the general system and for the two proposed processing and disposal plants.

Construction costs and estimates are figured up to the year two thousand with a history in graph and table form, of existing facilities, with their date, time and cost of construction. Also included are present costs of servicing, corrosion problems, etc. and the staff employed to maintain them.

Maps, plans, tables and graph sheets accompany the text all the way through, constituting an invaluable volume for the thousands of engineers now engaged in this type of work.

**Strength and testing of materials.** Technical information and document unit, D.S.I.R. London, Her Majesty's Stationery Office, 1952. Part 1, Theoretical papers on strength and deformation, 260 pp., illus. Part 2, Testing methods and test results, 244 pp., illus., £2 15s. 0d. each volume. (Selected government research reports, volume 6).

Selected from research work carried out under the direction of the Ministries of Supply and Aircraft Production, now combined as the Ministry of Supply, this publication was undertaken primarily for the benefit of British industry by the Technical Information and Documents Unit of the Department of Scientific and Industrial Research.

Volume one includes papers on indentation and hardness tests, wedge indentation and penetration, plastic and elastic deformation, autofrettage of a closed end tube, compression, notch brittleness and ductile fracture, extrusion, wire-drawing, the axially symmetric problem in plasticity, and the yielding and plastic flow of anisotropic metals.

Part two covers testing methods and results, and includes papers on all the regular testing methods.

Among the less common research reports are the effect of skewness of the frequency distribution on the relationship between required test factors and strength variation; the detection of peel on white-heart malleable iron track links by a non-destructive test; the transformation of components of stress and strain in two-dimensional elasticity; and the distribution of stress in a decelerating elastic sphere.

Most of the papers include a bibliography.

This will be an invaluable pair of volumes for our many hundreds of members interested in any phase of materials testing.

**Three-phase motors: theory and operation.** T. F. Wall. London, Newnes. Toronto, British Book Service, 1952. 232 pp., figs., $6.00.

"The three-phase induction motor is far and away the most widely used type of electric motor and its operation is based on the fact that, if a symmetrical three-phase current is supplied to a symmetrical three-phase winding, a uniformly rotating magnetic field of constant magnitude will be produced in the air gap."

The first man to produce such a machine was Nikola Tesla, who was searching for an electric motor operable with neither commutator, nor brushes. In eighteen hundred and eighty-seven, he completed the first such motor. His patents for it were acquired by George Westinghouse, who erected the first three-phase generator station in eighteen hundred and ninety-one, at Niagara Falls.

Symmetrical component analysis for solving performance problems of these motors is considered, as is also the "Electric Shaft"; the "Kusa" method of speed control; and the Kloss Formula.

The whole of chapter five is devoted to the control of power factor, and the functions of reactive current, which is becoming so vital a consideration with world-wide developments in electric supply installations.

The circle diagram, squirrel cage type, Selsyn and Electric shaft systems, and "Shunt"-type induction motors are all detailed for treatment.

Mathematical tables and a good index complete this rather unique volume.

**Trees to news: a chronicle of the Ontario Paper Company's origin and development.** Carl Wiegman. Toronto, McClelland & Stewart, 1953. 364 pp., illus.

Although primarily a history of the Ontario Paper Company, this book also tells in non-technical language how pulpwood is cut and floated to the mills, how newsprint is made, and discusses some of the technical advances in the industry, and the by-products recently developed, which ensure that greater use will be made of the resources of the forests. The author relates the career of Colonel Robert R. McCormick who, before becoming editor of the Chicago Tribune, was a successful paper manufacturer in Canada. The book also tells of the opening up of the Quebec North Shore of the Gulf of St. Lawrence, the development of widespread logging operations in Ontario, and the growth of the Company's manufacturing interests on the Niagara Peninsula.

**Ultra high frequency propagation.** H. R. Reed, and C. M. Russell. New York, Wiley, 1953. 562 pp., diagrs., $10.45.

Under the authorization of the United States Bureau of Aeronautics, Department of the Navy, propagation studies were made at the United States Naval Air Test Center, Patuxent River, Maryland.

This volume is the result of the findings at this time, its primary purpose being to present current information on UHF radio wave propagation, and include a review of all other related system parameters.

The second purpose is to create "systems-minded" personnel, i.e., the engineer in his application of engineering principles to the propagation problem, and the pilot in his appreciation of the multiple effects when attempting to communicate with a ground station, or another plane in flight.

How to determine operational ranges when using UHF communications systems is also explained, and a good deal of the work deals with dynamic system performance characteristics.

Discussions include, in addition to the three hundred to three thousand megacycles per second frequency band, the upper regions of the UHF band, and the lower regions of the higher SHF band.

Problems are included with the chapters, and the book is well indexed.

## BOOKS RECEIVED

**Behaviour of metals at low temperature.** R. M. Brick, J. R. Low, Jr., and C. H. Lorig. Cleveland, American Society for Metals, 1953. 112 pp., figs., $3.00 (U.S.)

**Canadian master tax guide,** 9th ed., 1954. Toronto, CCH Canadian, 1953. 317 pp., $3.00.

**Catalogue of ferrous alloy specifications (Commercial and service).** Canada, Department of National Defence, 1949. 932 pp.

**Cooling towers, with special reference to mechanical-draught systems.** J. Jackson. Toronto, Butterworth, 1951. 104 pp., illus., $3.50.

**Employment and wages in the United States.** W. S. Woytinsky (and others) New York, Twentieth Century Fund, 1953. 777 pp., $9.00.

**Foams: theory and industrial applications.** J. J. Bikerman. New York, Reinhold, 1953. 347 pp., illus., $10.00 (U.S.)

**Gas turbines.** H. A. Sorensen. New York, Ronald Press, 1953. 460 pp., figs., $6.50 (U.S.)

**Handbook of personnel management,** rev. ed. G. D. Halsey. New York, Harper, 1953. 468 pp., $6.00 (U.S.)

**Introduction to mechanical design.** T. B. Jefferson and W. J. Brooking. New York, Ronald Press, 1953. 612 pp., illus., $6.50 (U.S.)

**Kinematics of machines.** R. T. Hinkle. New York, Prentice-Hall, 1953. 231 pp., illus., $4.75 (U.S.)

**Metallic creep, and creep resistant alloys.** A. H. Sully. Toronto, Butterworth, 1949. 278 pp., figs., $5.00.

**Outline of executive development.** Lee Stockford, comp. Pasadena, California Institute of Technology, 1953. 46 pp., pa. $2.00 (U.S.) (Bulletin no. 23).

**Pipe and tube bending.** P. B. Schubert. New York, Industrial Press, 1953. 183 pp., illus., $5.00 (U.S.)

**Principles of automatic control.** F. E. Nixon. New York, Prentice-Hall, 1953. 409 pp., $9.35 (U.S.)

**Protective atmospheres.** A. G. Hotchkiss and H. M. Webber. New York, Wiley, 1953. 341 pp., illus., $7.00.

**Technology of engineering materials.** B. R. Hilton. London, Lange, Maxwell & Springer, Toronto, Butterworth, 1953. 389 pp., illus., 36/-.

**Theory and practice of structural design applied to reinforced concrete.** B. Eriksen. London, Concrete Publications, 1953. 401 pp., figs., $5.50.

**Traffic management in industry.** L. A. Bryan. New York, Dryden, 1953. 452 pp., $5.50 (U.S.)

## TECHNICAL BULLETINS AND PAMPHLETS RECEIVED

**American society for testing materials:** Review of ASTM research, May 1953. Year Book, 1953.

**British electrical and allied industries research association. Technical reports:**

No. 6/T262—Gas-blast circuit-breakers. Effect of arcing on the mass-flow of air through the nozzle and on nozzle pressure. (Second progress report) by A. A. Hudson. No. L/T271—Discharges in dielectrics at high voltages and in the presence of harmonics, by J. H. Mason. No. V/S1—Recommended definitions of terms used in power system studies.

**CCH Canadian Limited. Canadian income tax act consolidated:** 20th edition, 1953.

**Canada. National research council. Canadian government specifications board. Specifications:**
1-GP-12a—Schedule of standard paint colors (Amendment No. 3). 23-GP-4—Metallizing operators' qualification procedure. 23-GP-8—Recommended methods for inspection of metallizing. 43-GP-8—Barrier materials, grease resistant; flexible non-corrosive, non-transferable coating. 43-GP-131—Barrier materials, water vapor resistant; flexible. 43-GP-10547—Linners, case; water resistant. 50-GP-1—Identification of steels.

**Canada. Department of resources and development:**
Surface water supply of Canada: Arctic and western Hudson Bay drainage: 1947/48 and 1948/49. (Water resources paper No. 105).

**Canada's atomic energy project, Chalk River, Ontario.** March 1953.

**Canadian standards association. Approvals laboratories:**
List of approved equipment, 4th ed., Supplement B, May 1953.

**Conservation des richesses naturelles renouvelables.** Laval, Presses Universitaires, 1953.

**Electricals Limited:**
Ampo-Lite diffused lighting fittings catalogue.

**McGill University:**
Report of McGill demonstration training course for construction industry integration. Montreal, August 1953.



**Montreal Board of Trade, Young Men's Section.** Blue book.

**Resources for tomorrow: the engineer's stewardship.** R. F. Legget. 6th Wallberg lecture, 1953, University of Toronto.

**United Nations scientific conference on the conservation and utilization of resources, 1949, Reprint:** Volume 4, Water resources.

**Yearbook of the heating and ventilating industry.** Volume 7, 1953. London, Technitrade Journal Ltd., 1953. 302 pp.

## STANDARDS REVIEWED

**Canadian standards, Canadian standards association, National research building, Ottawa, Canada.**

**C.S.A. A60-1953 — Vitrified clay pipe,** 2nd ed. 75 cents.

This new edition of the original 1941 Specification has been necessitated by the developments which have taken place since that date. This Specification covers the requirements for physical dimensions, methods of testing, and permissible variations, of vitrified clay pipe and fittings intended for the conveyance of sewage, commercial and industrial wastes, chemical liquids and vapours, and storm water, or as thermal ducts and vents. It also contains suggested ideas for the installation of vitrified clay pipe. Reference to this Specification is made in the National Building Code.

**C.S.A. Comparison of the fifth and sixth editions, Canadian Electrical Code, Part 1.** 25 cents.

This 22-page booklet compiled by L. A. Shaver, the Vice-Chairman of the Committee on the code, is sub-titled A summary of major rule changes and a cross reference to corresponding rules. It contains a brief summary of the changes, and a cross reference index to the rules of both editions. It will be a valuable aid to those who are familiar with the fifth edition in locating the corresponding rules of the sixth edition which have been renumbered and re-arranged.

**C.S.A. G110 Series—Specifications for stainless steel.** Complete set, $4.25.

This is the first edition of the specifications for wrought stainless steel in the forms made in Canada. Wherever possible, these Canadian specifications are based on those of the ASTM for stainless steel, although the latest American Iron and Steel Institute tolerances are employed. Where applicable, the ASTM specification number is shown. The specifications are of a fairly general nature, so as to serve industry in the broadest way possible. The titles of the seven individual specifications which at present form this series are as follows:

Corrosion-resisting and heat-resisting steel billets and bars for reforging:

Hot rolled-cold-worked, and cold-finished corrosion-resisting and heat-resisting steel bars:

Corrosion-resisting and heat-resisting chromium steel plate, sheet and strip.

Corrosion-resisting and heat-resisting chromium-nickel steel plate, sheet and strip:

High-strength corrosion-resisting chromium-nickel steel sheet and strip.

Corrosion-resisting and heat-resisting wire:

Corrosion-resisting chromium and chromium-nickel steel plate, sheet and strip for fusion-welded unfired pressure vessels:

The scope of each specification is stated, and many include diagrams and tables.

**C.S.A. Z7.2.4.11-1953 — Specification for attachment threads for lens accessories.** 25 cents.

**C.S.A. Z7.3.4.2-1953—Specification for standard format sizes, focal lengths, and operating temperatures for air cameras.** 25 cents.

**American society for testing materials. 1916 Race Street, Philadelphia 3, Pa. Special technical publications:**

**No. 128 — Symposium on strength and ductility of metals at elevated temperatures.** pa. $3.25.

The papers and discussions in this Symposium, sponsored by the Joint ASTM-ASME Committee on Effect of Temperature on the Properties of Metals, were presented at the 1952 Annual Meeting of the American Society for Testing Materials held in New York City.

The material presented in this Symposium concerns the effects of notches on metals at elevated temperatures, under either static or dynamic loading, and discusses results of current research on the subject. It also deals with another aspect of the behaviour of metals at elevated temperatures, namely, the metallurgical changes which occur during heating at elevated temperatures, and the effects of these on strength and ductility.

**No. 130 — Symposium on continuous analysis of industrial water and industrial waste water.**

This Symposium was arranged by the Advisory Subcommittee of ASTM Committee D-19 on Industrial Water, because of the great interest in the continuous analysis of water, and the rapid development in electronic procedures and their use in control operations, many of which have been partially applied to analytical methods. The topics covered by the five papers in the Symposium include pH, conductivity, oxidation reduction potential, alkalinity, acidity, chlorine demand and residual, colour, turbidity, hardness, oil, silica, and dissolved gases.

**No. 142 — Symposium on exchange phenomena in soils.** pa. $1.75.

Because of the recognized significance of physico-chemical properties of soils in engineering, ASTM Committee D-18 on Soils for Engineering Purposes authorized this present Symposium to deal with this field. Emphasis is placed upon the influence of molecular and ionic exchange upon properties and responses of soils, thus leading to methods by which soils are altered to achieve adequate engineering performance even under adverse circumstances. It is also demonstrated that exchange phenomena are dynamic.

This Symposium should encourage interest in the fundamental characteristics of fine-grained soils. Work in this direction can lead to improved soil mechanics testing and analysis as well as to design and construction practices which will improve unstable materials and ameliorate difficult conditions on the job.

**British Standards, British standards institution, 24-28 Victoria Street, Westminster, London, S.W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.**

**B.S. 2030: 1953 — Dimensions of X-ray films for crystallography.** 2/–.

The special needs of crystallographers cannot be satisfactorily met by the sizes of X-ray film specified in B.S. 1443 — Sizes of X-ray film and intensifying screens — and this standard B.S. 2030 has, therefore, been prepared to deal with the sizes of X-ray film used in the various instruments peculiar to the Crystallographer, e.g. diffraction powder cameras as specified in B.S. 1693.

It is hoped that this British Standard will give guidance relating to the future design of crystallographic equipment and apparatus.

# Business & Industrial Briefs

## A Digest of Information received by The Editor

## Appointments and Transfers

**Horton Steel Works, Limited.**—Horton Steel Works, Limited opened a new sales office at 313—8th Avenue, West, Calgary, Alberta, Canada, on September 1st. George Crase, Jr. is manager of the office.

**Sandwell and Company Limited.** — Senior technical staff appointments have been made by Sandwell and Company Limited, consulting engineering firm of Vancouver, B.C., and Seattle, Wash., to its Murapara project in New Zealand, near Auckland.

E. S. Barton, of Vancouver, is resident engineer for Sandwell and Company Limited on the $40,000,000 design and construction project for Tasman Pulp and Paper Company Limited.

C. Victor Rapson, of Auckland, is civil engineer; Robert D. Wilson, formerly of Boyer, Tasmania, is electrical engineer; Thomas J. McKie, of Wanganui, New Zealand, is field engineer; James G. Brown, of Auckland, New Zealand, is cost control auditor.

**W. P. Favorite Company of Canada, Limited.**—The W. P. Favorite Company of Canada, Ltd., 418 Main Street East, Hamilton, Ontario, has been appointed sales representatives in Canada for the equipment in the Dempster-Dumpster System of materials handling and Dempster-Balester scrap metal baling presses. Announcement was made by Mr. Goodloe Walden, sales manager of Dempster Brothers, Inc., Knoxville, Tenn.

In the Favorite organization, Mr. T. P. Partridge will be in charge of Dempster-Dumpster equipment sales and Mr. L. V. Potvin will be in charge of Dempster-Balester sales, the same capacity each held while with the Hamilton Bridge Company, Ltd. Hamilton Bridge will continue the manufacture of Dempster Brothers' equipment in Canada.

L. A. Cox

**Lionel A. Cox.** — The appointment of Dr. Lionel A. Cox as Director of Research of Johnson & Johnson, Limited, Montreal, is announced.

A graduate of the University of British Columbia, Doctor Cox received his doctorate at McGill University.

His extensive background includes a number of important positions in chemical research both here and in the United States.

**J. McL. Schell.**—The appointment of J. McL. Schell as manager of engineering sales for Northern Electric's communications equipment division has been announced.

**Professor George Winter.**—Prof. George Winter of Cornell has been appointed to the American Concrete Institute's Standard Building Code Committee, whose decisions govern nearly all reinforced concrete construction in the United States.

Professor Winter is head of the Department of Structural Engineering in the School of Civil Engineering at Cornell.

**Cleaver-Brooks Company.** — James M. Sturman has been designated Sales Manager of the Escher Wyss Division. Mr. Sturman has 10 years' service with the company, the last three of which have been spent in San Francisco as West Coast Sales Manager of distillation units.

**Canadian General Electric Company.**—The general managers of the five self-contained operation divisions of Canadian General Electric Company have been elected vice-presidents. H. M. Turner, president, made the announcement in Toronto following a meeting of the company's Board of Directors.

The vice-presidents and general managers are: A. M. Doyle, Apparatus Division; J. S. Keenan, Industrial Products Division; E. H. Lindsay, Lamp Division; R. M. Robinson, Appliance Division; J. H. Smith, M.E.I.C., Wholesale Division.

**The Baker-Raulang Company.** — John A. Matousek, formerly vice-president of Manufacturing for the Baker-Raulang Company, has been named vice-president and general manager. Ernest R. Scovil, formerly secretary of the company, has been named secretary and treasurer.

**A. F. McLachlin.**—The appointment of A. F. McLachlin to the Directorate of the Board of Canada Iron Foundries Limited, is announced by Mr. T. F. Rahilly, Chairman of the Board and President of Canada Iron Foundries Limited, Montreal. Mr. McLachlin is President and Director of Railway & Power Engineering Corporation Limited.

W. M. Davidson

William M. Smart

Ewart Greig

G. D. Garrett, Jr.

A. A. Cumming

G. O. Loach

**Union Carbide Canada Limited.** — Announcement has been made of the election of Mr. Ewart Greig as President, and Mr. William M. Smart as Vice-President, Secretary and Treasurer at Union Carbide Canada Limited.

Announcement was also made by Mr. Ewart Greig of the appointments of Mr. A. A. Cumming as President, National Carbon Company, Mr. D. S. Lloyd, M.E.I.C., as President, Dominion Oxygen Company (see Personals), Mr. G. O. Loach as President, Electro Metallurgical Company, Mr. George D. Garrett, Jr. as President, Carbide Chemicals Sales Company and W. M. Davidson as President, Bakelite Company, divisions of Union Carbide Canada Limited.

●

**Douglas Willmot.**—Provincial Engineering Ltd. announce the appointment of Mr. Douglas Willmot to the post of Ontario Sales Manager, Mechanical Construction Division, operating from their Hamilton office.

●

**Provincial Engineering Ltd.** — Provincial Engineering Ltd., Montreal and Niagara Falls, announce the opening of their Lake St. John District Office at Chicoutimi, Quebec, with Mr. Eric Gautby as superintendent in charge of operations.

●

**Lance H. Cooper.**—Lance H. Cooper, of London, Eng., Chairman of The Mond Nickel Company, Limited, has been elected a Vice-President of its parent company, The International Nickel Company of Canada, Limited, Dr. John F. Thompson, Chairman of the Board of Directors of Inco, announced. He assumed his new office on January 1, 1954.

●

**Canadian Marconi Company.** — Mr. Stuart M. Finlayson, President of Canadian Marconi Company, announced that Mr. H. G. Nelson had been named to the Board of Canadian Marconi Company.

●

**W. S. Cowell.**—Mr. D. Vance, President of Wheel & Rim Company of Canada Limited, announces the appointment of W. S. Cowell as Vice-President and General Manager. He has been associated with the automotive industry for many years and is past chairman of the Montreal Section of Society of Automotive Engineers, past president of Canadian Automotive Wholesalers and Manufacturers Association, Director of Automotive and Aircraft Manufacturers Association and a Councillor of Society of Automotive Engineers.

●

**Editor's Note.**—The "Interesting Advertising Appointment" in our November issue was not, as reported, a first in the annals of Canadian advertising.

T. S. Glover, M.E.I.C., informed us that he was appointed a director of Ferres Advertising Service in 1952 and that he has been engaged exclusively in industrial advertising for 25 years.

●

# New Equipment and Developments

**Management Transfer.** — The decision to power the F86 Sabre with the Orenda engine in place of General Electric's J-47 has resulted in a transfer of management of the Crown-owned repair and overhaul plant at Downsview airport, Toronto. The Department of Defence is negotiating with the DeHavilland Aircraft of Canada Ltd. on the basis of that company assuming the management of the Downsview plant on Jan. 1, 1954.

DeHavilland is being chosen because of it's capabilities and because it is currently managing a government-owned engine facility which is contiguous to the Downsview plant.

**Hydraulic Press.**—A 50 000-ton capacity hydraulic press, believed to be the largest of its type in the world, is now under construction for the U.S. defence program and will be used for the manufacture of aircraft parts.

Dominion Bridge Co., Lachine plant, have just completed two large weldments, consisting of loading girders for a sliding table which forms part of this huge press. The girders will act as supports for the ways of the lower bolster which slides out of the press to facilitate the setting of die holders and dies. The girders also serve to support the hydraulic equipment which powers the movement of the sliding table. An indication of the size of each weldment may be obtained from the following dimensions: Length 66 ft. 4 ins., height 6 ft. 9 ins., webs and flanges 3 ins., in thickness with some portions of the weldments 7 to 8 ins. thick. Each girder weighs 60 tons. This weight is necessary to counteract deflection in operation.

The bottom flange of each girder has a double bend which is produced by first bending the plate and then burning the profile to suit. The rail slab, 6½ ins., thick, was machined all over to produce a flat surface for contact with the web and also to secure the desired dimensions on the outer face.

Pre-heating was carried out by a system of block welding. Local pre-heating to 400 F., then welding for the full weld section in block increments.

**Electric Power Industry.** — The electric power industry marked an important "birthday" recently—the 60th anniversary of the signing of contracts that led to the world's first large power installation and the harnessing of Niagara Falls.

On Oct. 27, 1893, Westinghouse and the Niagara Falls Power Co. signed contracts for the building and installation of three alternating current waterwheel generators.

The installation of the three units was completed two years later and they are still operating today—58 years later.

**Fellowship.**—The School of Civil Engineering of Cornell University has announced the establishment of a two year fellowship for graduate study in the use of bituminous materials and aggregates for bituminous paving mixtures.

This fellowship has been made possible by the New York State Bituminous Concrete Producers Association.

Applicants for the spring term 1954 are now being considered. Information about the fellowship may be obtained from Professor Taylor D. Lewis, Lincoln Hall, Cornell University,' Ithica N.Y.

# Publications

**For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.**

**Please mention *The Engineering Journal* when writing.**

**Plant Modernization.**—"Basic Planning—Plant Modernization and Expansion" is the title of a new study published by Walter Kidde Constructors, Inc., to help guide company management and engineers in dealing with the complex problems of modernizing and expanding plant facilities.

The 16 page publication outlines a detailed step by step procedure for analyzing existing plant facilities to establish the type, quantity and value of products which should be manufactured; type, number and cost of tools, equipment and machinery required; and size, location and cost of floor space needed for projected modernized or expanded plant and production facilities.

Copies are available on request to Walter Kidde Constructors Inc., 140 Cedar St., New York 6, N.Y.

**Measurement of Surface Temperatures.**—Literature is available describing the use of RdF Stikon resistance thermometer elements and Minneapolis Honeywell Electronik recorders for the measurement of surface temperatures in the range of —100 to +400F.

For information write for Instrumentation Data Sheet 10.1-3 to Minneapolis-Honeywell Regulator Co., Ltd.; Leaside, Toronto 17 Ont.

**Surface Finishing.**—The complete story on the newly developed Metablast process for controlled surface finishing is available in a four-page, two-colour bulletin issued by the American Metaseal Manufacturing Corporation, West New York, N.J.

Photographs show how a pre-determined, consistent finish can be applied to metal parts through the use of a special abrasive suspension applied to parts by means of air pressure.

Special sections explain the variety of problems the process can solve. Write to the company for this bulletin.

# THE ENGINEERING JOURNAL

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*Indexed in The Engineering Index*

# WHY Westinghouse DRY TYPE "E"

## DISTRIBUTION TRANSFORMERS

## E. B. EDDY INSTALLATION TELLS WHY . . .

In the corrosive and moisture-laden atmosphere of the paper mill blow pits, the E. B. Eddy Company has installed two 15 KVA Westinghouse Dry Type "E" transformers for lighting service.

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# Recent Studies of Foundation Behaviour

*by*

Dr. G. G. Meyerhof, M.E.I.C.

*Foundation of Canada Engineering Corporation, Limited, Montreal, Que.*

Perhaps the most striking phenomenon in foundation design during the past decade or two is the growing tendency to bring the theories of soil mechanics out of the laboratory and onto the job. The rough and ready methods of the prewar years are no longer adequate or economical.

This paper, presented before the Montreal Branch, on January 28, 1954, gives a clear idea of the lines along which foundation experts are thinking and describes in simple language how theory may be applied to practice.

Until recently allowable bearing pressures were commonly used for the design of shallow foundations and the bearing capacity of piles was estimated from the results of pile driving formulae. It was considered also, that an equal bearing pressure or pile load all over a site caused a negligible and uniform settlement over the whole loaded area. Structures were thus almost invariably designed and erected on the assumption of perfectly rigid foundations. The study of foundation behaviour and of the performance of structures, amplified by laboratory research, has led to a more rational approach. It is now recognized that a site exploration and soil tests are required to ascertain the nature and probable behaviour of the ground during and after the construction of the works, so that an economical and safe foundation design can be prepared.

Since foundations form the link between the superstructure and the soil, they have to fulfil two main and interrelated functions. First, the stability of the foundation must be assured with an adequate margin of safety and second, the movement of the foundation must be within limits that can be tolerated by the superstructure.

### Stability of Foundation

In order to ensure the stability of a structure, the foundation loads must be within the ultimate bearing capacity of the soil. This bearing capacity depends on the soil properties, mainly the shearing strength and ground water conditions, and the foundation characteristics, mainly the size and depth. An estimate of the bearing capacity at which shearing failure of the soil occurs can be obtained from plastic theory (1, 2), which is supported by extensive research on model foundations and field loading tests. According to this analysis the unit base resistance is

$$q = cN_c + \gamma \frac{B}{2} N\gamma \quad \ldots\ldots\ldots (1)$$

in which $c$ = cohesion of soil, $\gamma$ = effective density of soil i.e., the submerged density below ground water table, $B$ = width of the foundation, and $N_c$ and $N\gamma$ are bearing capacity factors, depending mainly on the angle of internal friction $\phi$ of the soil, the depth and shape of the foundation and the inclination of the load.

For clays (purely cohesive materials, $\phi = 0$), Equation (1) may be simplified to

$$q = cN + \gamma D \quad \ldots\ldots\ldots\ldots (1a)$$

where $N_c = N\,(1 + D/4B)$, very nearly, with a maximum of $N_c = 1.5N$, and

$N = 5$ for strip foundations,

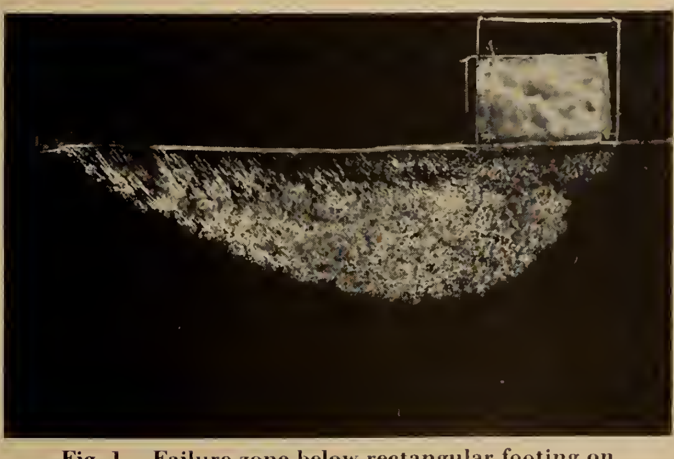

**Fig. 1. Failure zone below rectangular footing on surface of dense sand.**

**Table 1 — Relation of Consistency and Shearing Strength of Clays**

| Consistency . . . . . | Soft | Firm | Stiff | Very stiff | |
|---|---|---|---|---|---|
| Shearing strength, (c) tons/sq. ft. | 0.13 | 0.25 | 0.5 | 0'1 | 2.0 |

$N$ = 6 for circular or square foundations
and $D$ = depth of foundation.

The consistency and shearing strength of clays are commonly related as indicated in Table 1.

For sands and gravels (cohesionless materials, $c = O$) Equation (1) may be simplified to

$$q = \gamma \frac{B}{2} N\gamma \ldots\ldots\ldots\ldots\ldots\ldots (1b)$$

in which $N\gamma = N\ (1 + D/B)$, very nearly and $N$ is given in Table 2, together with a suggested relationship between the state of packing and angle of internal friction of sands and gravels (see Appendix).

For silts and other materials having both cohesion and internal friction, the ultimate bearing capacity is determined from Equation (1); reference should be made to the papers (1, 2) mentioned for further details.

In practice, foundations are frequently subjected to a horizontal thrust and a bending moment in addition to a vertical load. This condition has recently been investigated both theoretically and experimentally for shallow foundations(3). These investigations show that the bearing capacity decreases rapidly with eccentricity of the load. The customary practice of taking the maximum toe pressure as governing the bearing capacity was found to be generally safe for small eccentricities, but not for large ones. A more rational method is obtained by assuming that the contact pressure distribution under an eccentric load is identical with that of a centrally loaded foundation of reduced area. Similarly, the investigations show that the bearing capacity decreases considerably with inclination of the load, for which no allowance was previously made. As a result of this study, a method has been suggested of combining the effects of eccentricity and inclination to determine the bearing capacity under eccentric inclined loads.

For deep foundations, such as piers and piles, the skin friction (adhesion of the shaft) is added to the base or toe resistance to obtain the total bearing capacity of the foundation. The skin friction can be estimated from the mechanical properties of the soil, from ground water conditions and from the physical characteristics and method of installing the foundation. In clays the adhesion varies between wide limits and, except in the case of piers, governs the bearing capacity. Field loading tests (4) on bored *in situ* piles installed in unlined auger boreholes in stiff clay show that water from the concrete softens the clay and reduces the adhesion to 0.15-0.35 tons/sq. ft. On the other hand, tests on driven piles, even in very sensitive clays, indicate (2) that a month or so after driving the adhesion may be taken as equal to the undisturbed shearing strength of the soil within a limit of about 1 ton/sq. ft.

The total bearing capacity of a pier or pile is

$$Q = 9cA + c_a F \ldots\ldots\ldots (2)$$

in which $c$ = average cohesion of clay near pile toe
$c_a$ = average unit adhesion along pile shaft
$A$ = area of toe
and $F$ = embedded surface area of shaft.

In sands and gravels the skin friction is frequently small compared with the point resistance and can be ignored, so that the total bearing capacity of a pier or pile is then

$$Q = \gamma ADN/2 \ldots\ldots\ldots (3)$$

where $\gamma$ = effective density of soil near pile toe
$A$ = area of toe
$D$ = depth of toe below sand surface
and $N$ = bearing capacity factor, depending on the angle of internal friction of soil near the toe (see last line of Table 2 just preceding).

Where piers or piles pass through clay and rest in underlying cohesionless material, the adhesion of the clay to the shaft can be added to the toe resistance corresponding to the embedment of the toe in the cohesionless soil.

Where the pier or pile spacing is less than about four times the base or toe width, the bearing capacity of a group is usually given by the base resistance of piers or piles and enclosed soil plus the skin friction of the perimeter of the group; for stratified soil the method of estimating the bearing capacity is similar to that outlined above.

**Table 2 — Suggested Relationship Between the State of Packing and Angle of Internal Friction of Sands and Gravels**

| Type of material | State of packing | | | |
|---|---|---|---|---|
| Uniform sands | Loose | | Compact | Dense |
| Well-graded sands and gravels | Very Loose | | Loose | Compact |
| Angle of internal friction ($\phi$) | 30° | 35° | 40° | 45° |
| Factor N for strip foundations and shallow circular or square foundations ($D/B \leq 1$) | 23 | 48 | 114 | 300 |
| Factor N for deep circular or square foundations ($D/B \geq 10$) | 25 | 60 | 240 | 960 |

### Settlement of Foundation

If the foundation is located below the depth at which the soil is subject to volume changes because of climatic or artificial influences, movements due to structural loads govern the allowable bearing pressures or loads. To ensure a reasonable margin of safety against shearing failure of the soil, it has been suggested (5) that allowable foundation loads should not exceed one-third of the ultimate bearing capacity under normal loading conditions, nor one-half of the ultimate under the most unfavourable conditions. These allowances give factors of safety of the same order as those normally used in structural design.

The total settlement of foundations depends on the soil properties, mainly on the thickness and compressibility of the strata within a depth of one or two times the width of the building, and the foundation characteristics, mainly the size and loading. Settlement can be divided into immediate settlement due to deformation of the soil without volume change, and consolidation settlement due to closer packing of the grains. Immediate settlement occurs essentially on application of the load and consists of an elastic (recoverable) portion, which can be estimated from elastic theory (1), and a plastic (irrecoverable) portion, which can be estimated from plastic theory (6). The magnitude and rate of consolidation settlement can be estimated from consolidation theory (1); the maximum time to be considered depends on the economic life of the structure. Field observations (5) on structures have shown that these methods of estimating settlement are adequate for most practical purposes in the case of clays and silts; for sands an empirical extrapolation of field loading tests is required at present to estimate the probable movement of structures. With a factor of safety of three on the ultimate bearing capacity of the soil, the settlement usually varies from one to ten per cent of the width of the foundation.

While total settlement is mainly important in relation to access to, and services of a structure, the differential settlement must be limited to avoid harmful distortion of the superstructure. Relative movement depends on the layout and rigidity of the structure and on the variation of the compressibility of the soil under various parts of the foundation. For uniform soil and loading conditions, the differential settlement is about one-half of the total movement, but for non-uniform soil conditions it may be as much as the total settlement.

The movements which can be tolerated in a structure must be fixed in each particular case on the basis of structural analysis. For this purpose a method has recently been proposed (7, 8) in which the foundation and settlement characteristics of the soil at a site can be inter-related with the loading, layout and rigidity of the structure on the site. This method treats the superstructure, its foundations and the underlying soil as one complete statically-indeterminate system. The analysis is based on elastic theory for both structure and soil, which would appear to be reasonable for working stresses of one-third or less of the ultimate. On this basis, the total and differential settlements, bending moments and shearing forces in foundations and structures of different types and relative stiffness in relation to the soil can be estimated. Since in practice the flexural rigidity of the whole foundation is frequently small compared with that of the superstructure, approximate methods have been suggested for estimating the stiffness of open and enclosed multistorey building frames and of load bearing walls.

The results of this analysis, which can also readily be applied to the design of footings and raft foundations (8), show that the total settlement is not much affected by the relative stiffness of the structure as compared to that of the soil. The differential settlement, however, decreases rapidly as the relative stiffness increases, while correspondingly greater bending moments and shearing forces are induced in the structure. Analysis of a few typical building frames indicates that considerable settlement stresses could be induced in all structural members and would be largest in beams at external joints and in all but centre columns, especially in the lower storeys. It is also shown that in

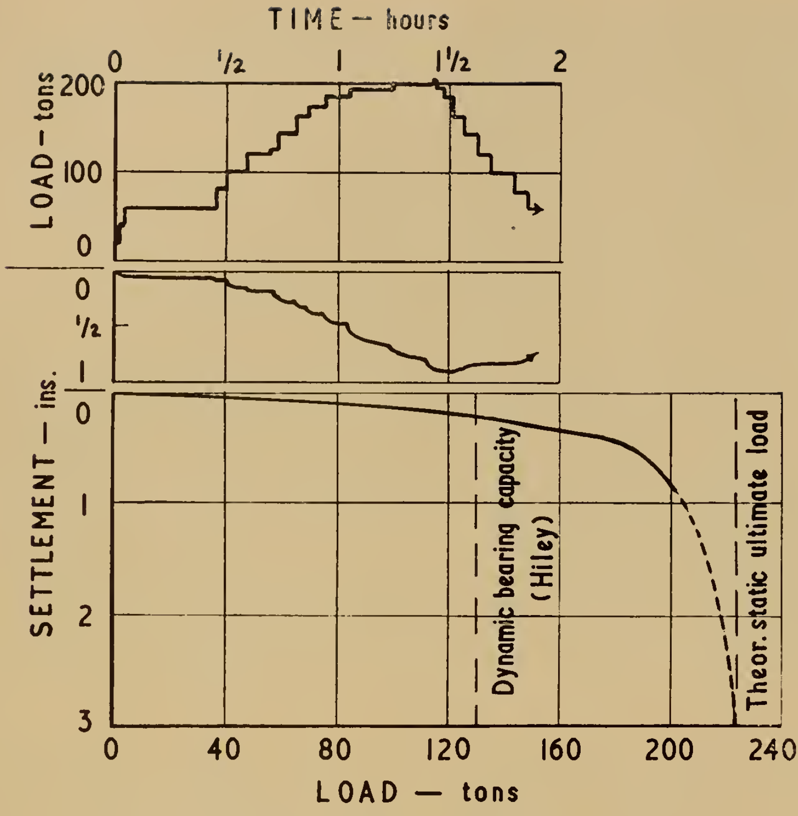


Fig. 2. Results of pile loading test on dense sand and comparison with estimates.

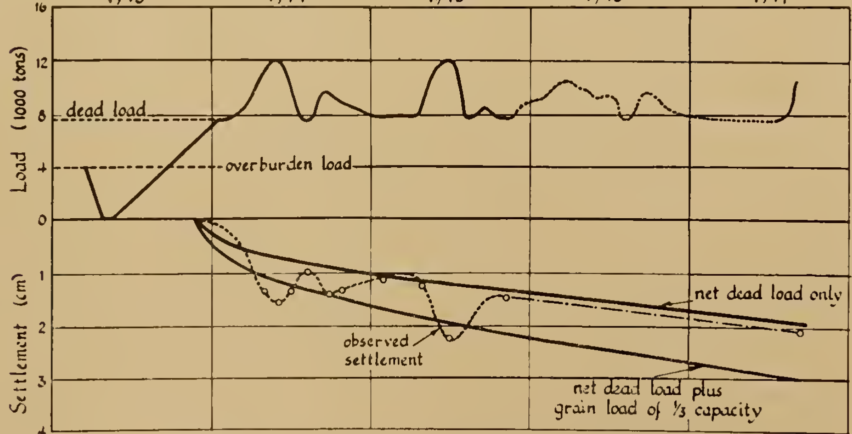


Fig. 3. Comparison of observed and estimated settlement of grain elevator on clay with variable foundation load.

Fig. 4. Distortion of long factory building on fill.

order to prevent overstressing, as distinct from collapse, the permissible bearing pressures or loads for a given layout of the foundation have to be reduced as the structure becomes stiffer. Panels and other wall enclosures stiffen exterior building frames appreciably, and the proportion of the load carried by curtain walls and by the framework depends on their relative flexural rigidity. Recent observations on the behaviour of building frames and load-bearing brick walls have enabled tentative safe limits to be suggested (8) for the deformation and stresses of such structures in practice; the results are summarized in Table 3.

In order to obtain information about the behaviour of framed buildings undergoing settlement, the total and differential foundation movements and the stresses in the two bottom storeys of a new government office building in London, England, have been recorded(8). This fairly stiff, enclosed, steel framed structure of 12 storeys rests on a raft foundation on stiff clay, with a maximum net bearing pressure of 0.8 ton/sq. ft. The total settlement observed to date varies from about ¾ to 2 in. At a section where the maximum differential settlement between adjacent columns since substantial completion is of the order of 3/16 in. on a span of 25 feet, the originally observed maximum stress in the steelwork of the order of 6,000 lb. per sq. in. has been increased to about 7,500 lb. per sq. in. by the differential settlement. On account of the enclosure of the frame and its composite behaviour, an action verified by the results of loading tests on the building, both the original and the settlement stresses are smaller than those estimated for rigidly-connected bare sections. Nevertheless, the present settlement stresses are about one-quarter of the stresses due to normal structural loads.

Table 3 — Tentative Safe Limits for the Deformation and Stresses of Building Frames and Load-Bearing Brick Walls

| Type of structure | Maximum allowable differential settlement | Maximum allowable tensile stress |
|---|---|---|
| Open reinforced concrete and encased steel frames | 1/300 of span between adjacent columns | 2/3 tensile strength of concrete |
| Ditto with enclosing walls | 1/1000 of span between adjacent columns | Ditto for the frame; ½ tensile strength of walls |
| Load-bearing brick walls | 1/2000 of length of wall | 30 lb. per sq. in. |

#### Horizontal Movement and Tilting of Foundation

Where a foundation is subjected to a horizontal thrust and a bending moment in addition to a vertical load, horizontal movement and tilting must be expected as well as settlement. The horizontal and tilting movements, which can be estimated in a way similar to those due to settlement, are especially important in single-storey arched and framed structures. In multistorey building frames the effect is greatest in the bottom storey and decreases with distance from the base. The bending moments and shearing forces induced by the movement are determined by a structural analysis, in conjunction with the deformation characteristics of the soil. Such an analysis has been made (8) for building frames on footings with "hinged" and "fixed" feet to determine the horizontal thrust and bending moment at footing level after movement. The results show that the original thrust and moment decrease rapidly as the relative stiffness of the lowest columns compared to that of the soil increases and as the footing width increases. The reduction in bending moment is particularly marked, because it depends on both the lateral movement and the tilt of the footing. Unless the footings are small, the moment may be practically zero, or even be reversed, due to lateral movement changing the eccentricity on the base; this may affect the mode of failure and limit the collapse load of superstructures.

To study the interaction between simple framed structures and the soil, especially in relation to horizontal movements and tilting of the foundation, some loading tests have been made on model steel portal frames resting on clay and sand (8). It was found that under a given load the horizontal and tilting movements of the footings of a frame, which was stiff in relation to the soil, were less than those of a similar flexible frame and led to a much smaller horizontal thrust and bending moment at the footings. The results also indicated the beneficial effect of a tie between the feet and showed that the bending moment at the footings may be practically zero unless the footings are well restrained. While the stiff frames failed because of insufficient bearing capacity of the soil, the slender frames failed generally by structural collapse, in accordance with predictions based on plastic theory. The collapse load varied from a maximum for portals with tied and deep footings, to a minimum for frames without ties on the surface, when the soil resistance to lateral and rotational foundation movement was insufficient to permit plastic hinges to develop at the joints and thus reduced the collapse load by up to about 40 per cent. Field observations should be made on full-sized structures to ascertain the lateral and rotational movement of the foundations, as well as the settlement, in order to study their effect on the behaviour of different types of superstructures.

### Conclusions

Rational foundation design requires an estimate of the stability of the soil, of the movement of the foundation and of its effect on the behaviour of the superstructure. The ultimate bearing capacity of shallow and deep foundations can be determined from soil and foundation characteristics under most conditions.

Settlement of foundations can also be estimated in most cases from the results of a site investigation. Differential settlement depends on the layout and rigidity of the whole structure, as well as on the soil and foundation characteristics. Methods have recently been developed to estimate the stiffness of structures and to relate it to the deformation characteristics of the soil. Such an analysis shows that differential settlement decreases rapidly as the relative stiffness of structure to soil increases, while correspondingly greater bending moments and shearing forces are induced in the structure.

Recent observations on the behaviour of brick walls and enclosures for building frames have been analysed to suggest tentative safe limits for deformation and stresses. Observations on a multistorey steel frame building undergoing settlement have shown that appreciable stresses can be induced in frameworks by differential settlement of the foundations. Horizontal movement and tilting of foundations has a considerable influence on the behaviour of walls and single-storey structures. Some support for an analysis of this problem has been obtained from the results of loading tests on model portal frames on clay and sand, which also indicated the beneficial effect of a tie between the feet.

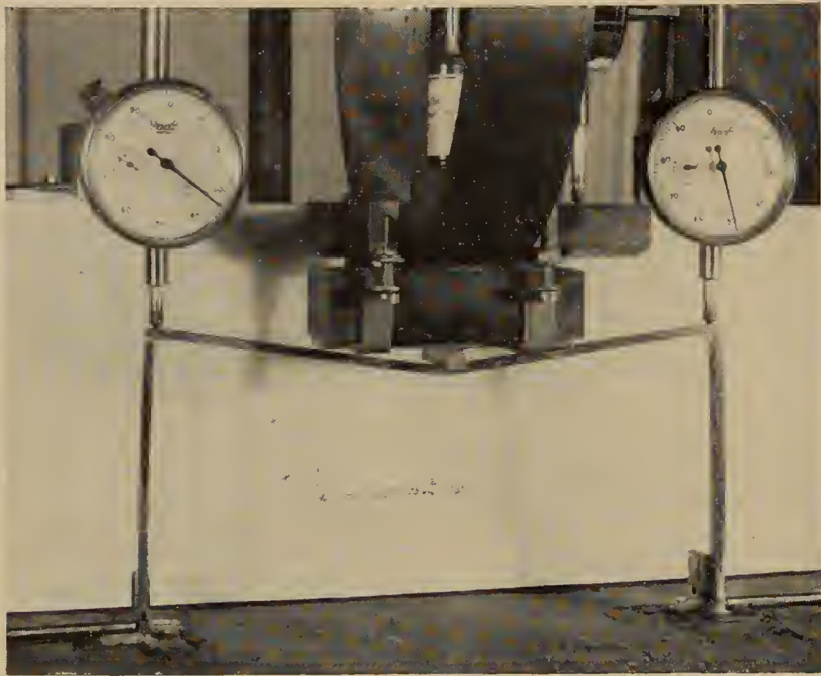

Fig. 5. Failure of slender portal frame under vertical load on clay; structural collapse.

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(8) Meyerhof, G. G., "Some Recent Foundation Research and its Application to Design." Struct. Engr., 1953, vol. 31, p. 151.




### Appendix

#### State of Packing and Angle of Internal Friction of Sands and Gravels

On account of the difficulty and expense in procuring and testing undisturbed samples of sands and gravels, it is frequently preferable to use mainly the results of field penetration tests to ascertain the relative density of the soil from which the angle of internal friction and bearing capacity are estimated (see under "Stability of Foundation"). For this purpose either dynamic or static penetration tests are made.

In dynamic (standard) penetration tests a 2 in. diameter sampling spoon or solid drive point is driven into the ground by a drop hammer under about 350 ft.-lb. energy, and the number of blows per foot of penetration is measured(5). In static (deep sounding) penetration tests a 60° cone is pushed into the ground by a jack at a controlled rate, and the bearing pressure during penetration is measured. While the penetration resistance determined by both methods depends not only on the density but also on the depth of the soil below the surface, an approximate correlation between the relative density, penetration resistance and angle of internal friction of sands and gravels is given in the following table.

Table 4. Approximate Relationship Between Relative Density, Penetration Resistance and Angle of Internal Friction of Sands and Gravels.

| State of Packing | Relative Density | Penetration Resistance | | Angle of Internal Friction ($\phi$) | |
|---|---|---|---|---|---|
| | | Dynamic Blows/Foot | Static T/Ft.$^2$ | Uniform Sands | Well-graded Sands and Gravels |
| Very Loose | <0.2 | <4 | <20 | <30° | <35° |
| Loose | 0.2 – 0.4 | 4 – 10 | 20 – 50 | 30° – 35° | 35° – 40° |
| Compact | 0.4 – 0.6 | 10 – 30 | 50 – 150 | 35° – 40° | 40° – 45° |
| Dense | 0.6 – 0.8 | 30 – 50 | 150 – 300 | 40° – 45° | 45° – 48° |
| Very Dense | 0.8 – 1.0 | <50 | >300 | >45° | >48° |

# Vapor Phase Corrosion Inhibitors

*by*

I. D. G. Berwick *and* B. H. Levelton

*British Columbia Research Council, Vancouver, B.C.*

**The prevention of corrosion is a universal problem. The types of inhibitors described in this paper, and the methods of their application, should be of value to engineers in many branches of industry.**

One of the commonest methods of controlling metallic corrosion consists of adding chemical agents to the system to modify the corrosive solution. For instance, one way of stopping acid corrosion is to neutralize the acid by the addition of sodium hydroxide,—a method frequently employed in the treatment of boiler water. Other corrosion promoters, such as hydrogen sulphide or certain bacteria, may also be removed or rendered inactive by chemical additions.

However, the most important class of chemical agents used for arresting corrosion, function not by reducing or removing corrosive agents, but by changing the electrochemical processes occurring at the metallic surface. These substances are known as corrosion inhibitors, and include chromates, nitrites, phosphates, silicates and numerous organic substances.

Since the chemistry of corrosion problems is complex, and since many variables are involved, there is no universal corrosion inhibitor. Indeed, the action of inhibitors is highly specific, and an inhibitor which completely suppresses corrosion in one system may be of no benefit in a system which is only slightly different.

In most cases the inhibitor can be conveniently added to the corrosive solution in contact with the metal to be protected. However, there are some systems where such a procedure is impossible. For instance, moisture condensing from the atmosphere on a metallic surface cannot be practically inhibited by this method.

In order to combat corrosion by condensed moisture, special compounds known as vapor phase inhibitors, have been developed. These vapor phase inhibitors have the advantage of being volatile, which enables them to exert their protective influence throughout a gaseous space without requiring them to be in contact with the metal surface to be protected.

The development of vapor phase inhibitors arose out of a war-time problem concerning the corrosion of metal stores packed in cardboard containers. It was found that heavy rusting of steel surfaces often occurred during transit due to the penetration of moisture. The problem was particularly aggravated in tropical climates, where high relative humidities and extreme temperature variations were encountered.

The first patent application covering the new type of inhibitor was filed in Britain in 1945 by the Shell Development Company (1). Subsequent research both in Britain and in the U.S.A. has disclosed a number of compounds which possess the valuable property of "protecting across space". So far, however, few have reached the stage of commercial production and sale. Extensive tests on some of these volatile inhibitors, both in the laboratory and under service conditions, have proved that corrosion of packaged metal articles by moisture that enters or is present within a package, can often be completely prevented.

### Principal Vapor Phase Inhibitors

A successful vapor phase inhibitor must possess certain properties other than its ability to reduce corrosion. It must be stable and water-soluble, and must be sufficiently volatile to maintain an adequate inhibiting concentration in the atmosphere around the metal to be protected. In addition, the vapor must be readily transported by convection and diffusion.

There are three principal categories of substances which fulfil all these requirements, namely, the amine and other nitrites, the esters of carboxylic acids, and the amine carbonates. As well as these main groups, there are a number of additional compounds such as the heterocyclic nitro-compounds or nitro-heterophenes, (2) which exhibit favorable inhibiting properties.

#### *1. Amine Nitrites*

Nitrites have long been recognised as efficient inhibitors of the corrosion of steel immersed in oxygen-containing water. Thus, it was natural that the search for compounds possessing adequate stability and volatility should begin with the nitrites. Many inorganic and organic nitrites have been found to be suitable, including ammonium and stannic nitrites, copper ammonium nitrite, nitrite salts of hydrocarbon substituted ureas, hydrazines, etc., as well as a whole range of alkyl, aryl, heterocyclic and alicyclic nitrites.

In particular, dicyclohexylammonium nitrite and diisopropylamine nitrite have been singled out for manufacture on a commercial scale. Both dicyclohexylammonium and diisopropylamine nitrites have a natural pH of about 7.0 and, if used in solution, operate best at a pH of 7.0 to 8.0. More alkaline conditions make them more stable, while acid conditions convert the compounds to nitrose amines which are not effective inhibitors.

The vapor pressure of dicyclohexylammonium nitrite is about one tenth that of mercury at room temperature, and 1 gram would saturate 20,000 cu. ft. (3). It is extremely stable. Diisopropylamine nitrite has a higher vapor pressure but is less stable. Several investigations on amine nitrites, particularly dicyclohexylammonium nitrite, have been carried out (3. 4, 5).

A recent process that has been developed in the nitrite field for the packaging industry depends on the formation of an inhibitor, by chemical interaction between its components in the presence of a carrier, which is normally paper (6). The components, an organic amine salt and a metal nitrite, interact and the vapor phase inhibitor which is formed becomes fixed to the fibrous carrier.

*2. Organic Esters*

Early research (7) suggested that certain esters of benzoic acid had appreciable inhibiting properties in the vapor phase. More recent work (8) has shown that various esters, including n- and iso-propyl benzoates, n-butyl benzoate and methyl cinnamate, afford good protection to steel exposed to moisture-laden air. Several other compounds, such as ethyl dihydrocinnamate, cyclohexylamine cinnamate and dicyclohexylamine cinnamate, also showed promise as vapor phase inhibitors, but have not been examined in detail.

*3. Amine Carbonates*

Complete inhibition of steel and cast iron is effected in moist air by some amine carbonates, even when the air is heavily contaminated with sulphur dioxide. Cyclohexylammonium carbonate has been found to give excellent protection, even to iron and steel surfaces which have commenced to rust (8, 9).

### Methods of Application

The chief use of vapor phase inhibitors is in the preservation of packaged equipment and of the interior of engines and similar machinery. In all cases it is essential that the inhibitor be located within effective range of the surface to be protected from corrosion.

The choice of method of application depends on the general dimensions and configuration of the article, but there are three principal methods. First, a solid powder of the inhibitor may be used; it may be put into small muslin bags or sprinkled loose in the bottom of the packing container. The powder method has been found to be particularly effective for complex pieces of machinery (10).

Secondly, the inhibitor may be dissolved in acetone, alcohol, benzene, etc., and sprayed on to the article so that the inhibitor remains after evaporation of the solvent. Good protection for periods of many months has been achieved by this method using dicyclohexylammonium nitrite dissolved in ethanol(10).

Thirdly, the packaging material may be impregnated with vapor phase inhibitor, i.e. as outlined earlier. This has become the most popular method of application of dicyclohexylammonium nitrite. Figures 1 and 2 show methods of packing wire and machine parts in paper impregnated with vapor phase inhibitors.

### Action of Vapor Phase Inhibitors

Stroud and Vernon (8) consider that the protection given to a metallic surface by these volatile substances is due to the absorption of the vapor in a thin film of precipitated moisture. Wachter et al (3) agree with this point of view and state that, in the case of dicyclohexylammonium nitrite, the inhibitor is vaporized and transported to the metal surface where it condenses or dissolves in condensing moisture. It is considered that the inhibition is due to the nitrite ion, and that the volatility is merely a means of transport for the inhibitor.

An alternative explanation has been advanced by Baker (11), who considers that the vapor adsorbs so that the organic group is close to the metal surface and the nitrite faces away, forming a hydrophobic film. As pointed out by Wachter (3), this view is unlikely to be correct since the amine nitrites are water-soluble. However, whatever the exact mechanism of protection may be, it is indisputable that these inhibitors operate through space over appreciable distances.

### Pseudo-Vapor Phase Inhibitors

It may be of interest to mention another type of inhibitor which is becoming popular for the impregnation of wrapping materials (12). Sodium benzoate and other soluble benzoates, although not true vapor phase inhibitors, can be used for the production of corrosion-inhibiting wraps by the impregnation of materials such as paper, straw-

**Fig. 1. Wire is cleanly and quickly packed with paper impregnated with the volatile inhibitors.**

board, regenerated cellulose films and waxed papers. Provided that the chloride content of the wrap is sufficiently low (below 0.1 per cent), complete protection is effected for steel under adverse conditions of storage or transportation, by spraying or dipping the wrap in a 6 per cent sodium benzoate solution.

Sodium benzoate has no significant "vapor phase" properties but, surprisingly, one hundred per cent contact between the wrapper and the article to be protected is not essential. Naturally, at high relative humidities the inhibitor comes into operation, keeping the metal unattacked at places where the moistened wrap clings to the surface. However, other parts of the metal surface, not in contact with inhibited wrap, also remain bright. This is attributed by Stroud and Vernon (12) to the property of benzoate compounds to "creep" under moist conditions.

Wraps impregnated with sodium benzoate do not increase the corrosion of non-ferrous metals; in some cases the corrosion is substantially reduced, e.g. soldered joints. For the protection of cast iron surfaces it is necessary to introduce a nitrite to the wrapping, such as sodium nitrite, in addition to the benzoate.

Sodium benzoate, although not as efficient as inorganic inhibitors such as chromates, has a specific advantage. If used in insufficient concentration, the benzoate gives rise to general or "safe" attack on steel, whereas chromates under similar conditions may permit seriously localized corrosion. In addition sodium benzoate is non-toxic, does not cause skin irritation and possesses fungicidal properties.

Sodium benzoate inhibitor has also been used to impregnate rubber latex strippable coatings (13). In this application it has been found suitable for protecting steel, cast iron, tinplate and non-ferrous metals (excepting cadmium and magnesium) in adverse environments. Small amounts of sodium nitrite along with the benzoate increase the degree of protection.

Protective films which are hard and non-strippable may be obtained by the addition of sodium benzoate to emulsions of other organic high polymers such as polyvinyl acetate, polyvinyl chloride and copolymers.

### Selection of a Vapor Phase Inhibitor

Although protection is afforded to ferrous materials by most of the inhibitors mentioned above, the corrosion of some of the common non-ferrous metals is sometimes stimulated (7). For example, amine carbonates inhibit the corrosion of aluminum, zinc, chromium plate on steel, solder and soldered joints, but substantially increase the corrosion rate of copper, copper-rich alloys and magnesium.

Nitrites of nitrogenous organic bases are highly inhibitive towards steel and afford varying degrees of protection to cast iron and certain non-ferrous metals, but are severely corrosive towards solder. The behaviour of amine nitrite inhibitors is also reported to be affected by the relative humidity. At extremely low humidities they are corrosive towards magnesium and zinc and at higher humidities they also affect lead and cadmium (14). Consequently, it is most important to exercise care in the choice of vapor phase inhibitors, particularly if non-ferrous metals are likely to be present.

### Industrial Applications

Considerable interest has been aroused by the advent of vapor phase inhibitors. They are rapidly coming into practical use for preserving metallic equipment, either for short term transit or permanently. For instance, cars are frequently exported from the United Kingdom in a dismantled condition (10). Nests of about 12 pressed steel parts are packed together, each part being separated from the next by a layer of paper impregnated with dicyclohexylammonium nitrite. The shipments arrive in excellent condition and the cars can be assembled speedily. The only surface covering these parts have is a thin film of oil which, of course, is quite inadequate to prevent corrosion by itself.

The internal surfaces of aircraft engines are also protected during shipment by blowing a small amount of powdered inhibitor into the cylinders. Other vapor phase inhibitors are used in conjunction with the strippable plastic coatings, which are now often employed for corrosion prevention during shipment. The inhibitor is introduced into the fibre webbing on to which the plastic "cocoon" is sprayed (15).

Other applications of the inhibitors are in the packaging of canned goods, ordinance, electrical equipment, precision instruments and machinery of all kinds. Research is also in progress into the possibilities of adding these inhibitors to fuels, in order to reduce corrosion by condensed moisture in inaccessible tubes, pumps or storage tanks.

### Advantages of Vapor Phase Inhibitors

Since there is no need for direct contact between the inhibitor and

**Fig. 2. Packing pump parts in wrappers impregnated with vapor phase inhibitors.**

**Fig. 3. The rifle packed in paper impregnated with vapor phase inhibitor (right), is clean and ready for immediate use, while the rifle packed in grease must be cleaned before it is ready for firing.**

the article to be protected, the metal remains clean and the article is ready for use as soon as it is removed from its packing. This point is illustrated by Figure 3 which shows one rifle packed in grease and one packed in inhibitor-impregnated paper. The latter pack eliminates a 3-hour cleaning job and the rifle is ready for firing the moment it is taken from the bag.

Vapor phase inhibitors are easy to apply, and are efficient provided that the selection is made carefully, and that the inhibitor is placed close to the metal surfaces, in a relatively static atmosphere. It must be stressed that the use of vapor phase inhibitors is no substitute for good packing.

Excess moisture ruins the effectiveness of most inhibitors, and, although the vaporization losses are small in a static atmosphere, air currents sweeping over the inhibitor crystals greatly increase the inhibitor loss. The inhibitors can function successfully over a long period, sometimes for several years, and have the property of suppressing corrosion on inaccessible metal surfaces, even in moist, corrosive atmospheres.

The development of vapor phase inhibitors offers a new and practical method of combatting the ever-present problem of corrosion. The scope of these inhibitors is vast and the present applications constitute only a fraction of the possible uses.

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# *Future annual meetings of the Engineering Institute*

QUEBEC, QUE., May 12, 13, 14, 1954, Chateau Frontenac

TORONTO, ONT., May 11, 12, 13, 1955, Royal York Hotel

MONTREAL, QUE., May 23, 24, 25, 1956

*For news of the 1954 meeting turn to page 163 of this issue*

# Hydro-Electric Design in Germany

by

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The writer was formerly a civil engineering designer with Elektrizitaets-Actien-Gesellschaft, Frankfurt-on-Main, Germany. This company is a utility holding, management and engineering concern with many subsidiary and associated power companies in central Europe. The writer worked on the design of various river-basin developments, high-head projects and pumped-storage schemes, had also to be well informed about the methods and trends of hydro-electric developments elsewhere.

It is the intention of this paper to make available to Canadian engineers a comprehensive survey of developments and trends in the design of hydro-electric projects in Central Europe.

To those of us who are not specialists in hydro-electric power, it may come as something of a surprise that there is so much variation in design and construction in various quarters of the world.

This paper offers a general survey of German practice by an engineer who was closely concerned with it for some years. Though not much detail is given, it should perhaps stimulate thinking among our own hydro-electric experts; at least, it should interest them, as well as many of the rest of us who do not fall in that category.

### The Role of Hydro-Electric Power in Germany

In 1952, West Germany had an installed power capacity of 13.5 million kw. and the total power output of that year amounted to 56.2 billion kwh. West Germany relies to a great extent on steam power, especially from lignite won by open pit mining. Lignite costs two and a half times less than hard coal and gives economic power, if mined near the site of the power plant. It is intended to increase the number and capacity of such plants soon. If steam plants are not located close to the mine and hence the transport of fuel is required, hard coal from the Ruhr valley comes into the picture. Generally speaking, approximately 50 per cent of the public power comes from hard coal about 25 per cent from lignite and only about 25 per cent is hydro-electric power.

The congested industrial regions impose high loads during working hours, and, even if electro-chemical industry increases the night load somewhat, the load curve still shows heavy peak demands for certain hours of the day (Figure 1).

High pressure steam plants are not best suited for interrupted operation; it reduces their life and increases the inconvenience of frequent starting. As the West German grid relies to a great extent on this type of plant to carry the base load, requirements for the hydro plants are different from those in a country where they supply the base load. Thus, hydro-electric plants in Central Europe have to supply most of the peak load, besides delivering the basic load from the natural flow of the rivers.

Extensive use is made of hydraulic models in the design of structures and of equipment.

The normal peak load suppliers among the hydro-electric plants are those with large storage capacities and with high or medium heads, but some run-of-river developments also contribute. Sometimes more than one power company shares the power resources of a river basin. The downstream partner appreciates the improvement of the river flow characteristics by the upstream partner, but would protest if water were stored and used for peak loads, and the flow of the river changed to his disadvantage.

Therefore the scheme shown in Figure 2 is now often used in the design of river-basin developments. During the night only about 200 to 300 cfs. pass through the plants and all excess water is stored in the reservoir upstream of the first plant. This water is shunted through the reservoirs during the day and is stored in the one just upstream of the last plant of the scheme. This last plant has a constant discharge and equalizes the river flow in accordance with the inflow into the reservoir at the first plant. So peak load is provided for within the scheme without affecting the downstream partners. This is the reason why the rating of recently built plants is higher than it would have been formerly.

An interesting characteristic of this scheme is the choice of intermediate heads. The head of the downstream plant always submerges the tail race of the upstream plant one or two feet. A better use of the potential power of the river is achieved by this arrangement.

### Low-Head Projects

The Kaplan-type turbine is used mainly in low-head field in Germany. Its main advantages are its high specific speed, which effects a substantial saving in turbine and generator weight and cost, and its high, flat efficiency curve over nearly the entire range of discharge, irrespective of changes in heads. The discharge capacity of the Kaplan-type turbine may be increased for reduced head operation during flood flow. Kaplan-type turbines are used up to heads of 185 feet and are preferred to Francis-type turbines within this range.

In Central Europe, restrictions imposed by towns, railways and highways do not permit any material increase in water levels above flood stage, so the normal practice is to build a low weir across the river channel, surmounted by large gates that can be raised at time of flood. Generating stations are generally located at one end of the dam, out of the river if possible, but more frequently encroaching on the river; encroachment may complicate providing adequate spillway capacity. To eliminate channel restrictions the piers supporting the gates are sometimes used for the installation of power generating units.- This arrangement also improves the power output during times of flood flow. Jet action through the spillway openings depresses the tailwater below the dam and so has the effect of recovering in part the head that otherwise would be lost due to high tailwater. On the other hand, the spreading of generating units across the river requires longer transmission cables and impedes supervision. (Figure 3.)

This article describes three typical developments and will mention briefly some sidelines of design which apply only to individual projects. The normal fully enclosed power house design, which is still used at most projects everywhere, is not dealt with in this article.

A canal connection between the Rhine and Danube rivers is built in the valley of the Main. The Rhein-Main-Donau A.G. has been granted a license for the construction of a modern waterway and the use of the existing power sites for hydro-electric power generation. More than 60 power stations are planned and approximately one-third of the scheme is already in operation. The individual multi-purpose dams each consist of three sections:

The navigation locks, at a bend on the inside of the curve.

The spillway crest gates.

The power house. (Figure 5).

Roller gates are installed for spillway crest control (Figure 4). The rigid and robust roller allows long spillway sections, single side drive and good overflow conditions, unaffected by ice and debris. The roller is normally provided with an apron and a timber seal on the gate sill. At the ends timber-lined plate seals are forced by the water pressure against the concrete of the piers. The gate is opened and closed by raising and lowering it on in-

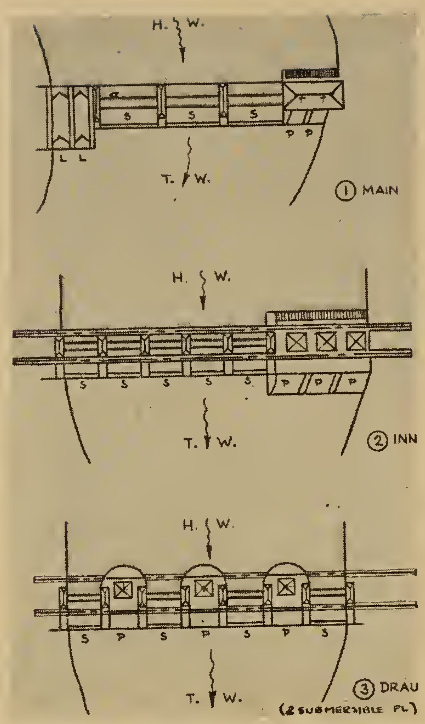


**Fig. 3. Typical Low Head Plants.**
(1) In navigable river. (2) In non-navigable rivers. (3) With generating power units installed in piers.

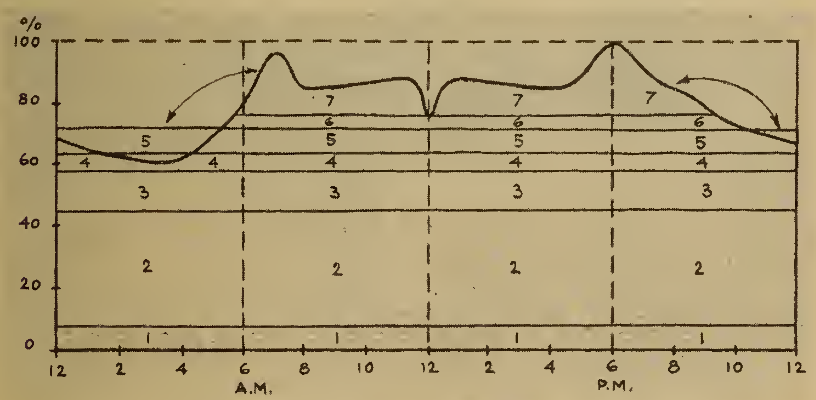


**Fig. 1. Typical load curve in Germany on a winter day.**
(1) Run-of-river plants. (2) Steam plants at open-pit lignite mines. (3) High-pressure steam plants at hard coal mines. (4) Low-pressure steam plants at hard coal mines. (5) High-pressure steam plants hard coal transported. (6) Low-pressure steam plants hard coal transported. (7) Peak-load and pumped storage plants. Shaded areas indicate off-peak power converted into on-peak power.

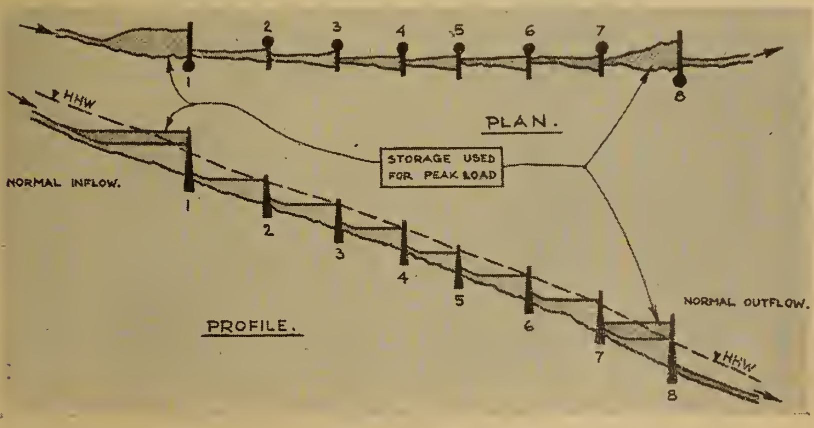


**Fig. 2. Peak Load Scheme in River Basin Developments.**

clined racks installed in recesses in the piers. The drive consists of a sprocket chain operated electrically or manually. A retaining chain winds counter to the raising chain on the free end of the roller and prevents any slip. Submersible rollers are installed where accurate water levels are important and to avoid waste of water when clearing away ice and floating trash. The seal of the apron is pressed against the sill by water pressure or springs. Fitting a movable flap to the roller has the same advantages as the submersible roller, but avoids the scaling difficulties at the sill and the curved sill forming. Rollers with attached hinged flaps are now the most common and have worked for years under extremely severe conditions. Electric heating can be installed where required.

The power stations of the Rhein-Main-Donau type are fully enclosed, but introduce new features resulting in substantial savings in construction cost and in pleasing architectural appearance (Figure 5). The scroll case is of the siphon type, i.e., the bottom of the wicket gates is above headwater level. The air is pumped out before starting the plant and the air valve is opened to stop the plant in emergencies, so head gates are omitted. The draft tube is raised; deep power house foundations are avoided by this arrangement. A cast-iron stay ring around the turbine supports part of the concrete and the machinery. The turbine and generator shaft is in one piece and has only two bearings. The thrust-bearing is located on the cover of the turbine. The adjustable runner blades are steel castings and plate-welded with cavitation-resistant material. The servo-motor is built into the hollow shaft above the upper guide bearing. A special light bridge carries the oil supply head for the turbine. Coolers are mounted on the back of the stator of the generator to keep the temperature of the power house low. The governor is operated by an electric motor which is fed by a small generator on the shaft. The exciters are separated from the main unit. Little crane clearance is required for these units and this allows a low power house superstructure.

A typical dam for non-navigable rivers has been developed by the Innwerke A.G. in southern Bavaria (Figure 5). It consists of spillway and power house sections only. An ingenious two-tier gate is used for spillway crest control (Figure 6). The upper hook-shaped leaf is

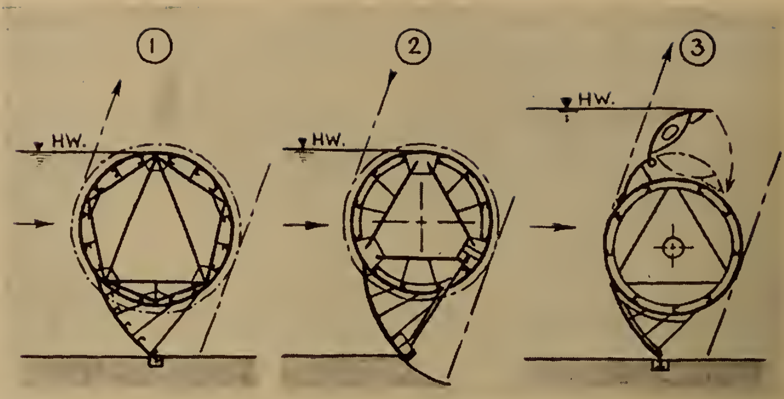


**Fig. 4. Typical Roller Gates.**
(1) Normal roller. (2) Submersible roller. (3) Roller with attached flap.

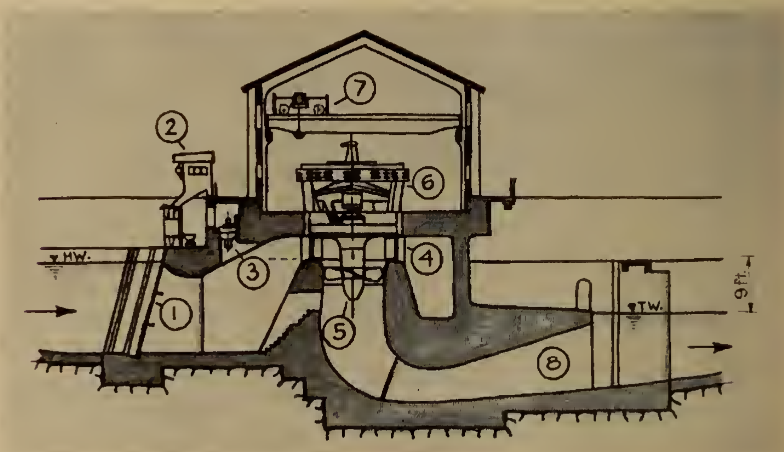


**Fig. 5. Typical Rhein-Main-Donau Plant.**
(1) Trash rack. (2) Raking machine. (3) Air valve. (4) Stay-ring. (5) Kaplan-type runner. (6) Umbrella-type generator. (7) Crane. (8) Draft tube.

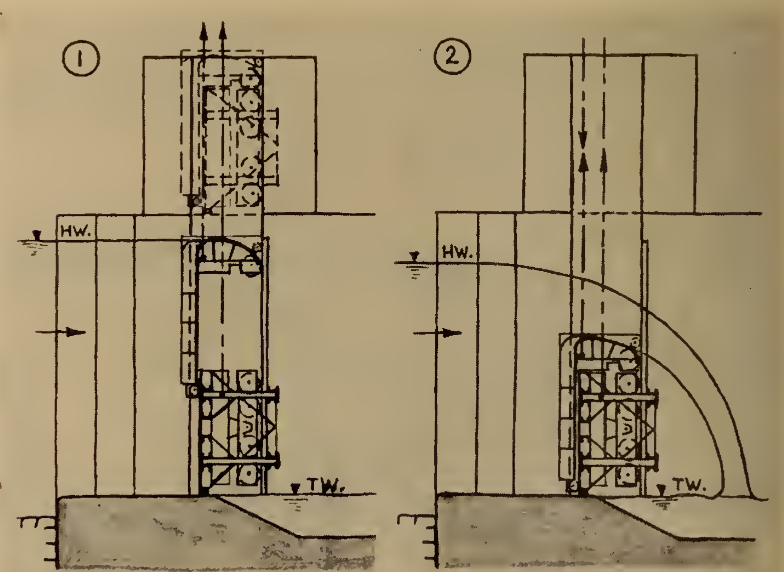


**Fig. 6. Typical Hook-shaped Two-tier Gate.**
(1) In closed position and raised (dotted lines). (2) Hook-shaped panel lowered.

the hoist houses provide the extended grooves for the raised gates.

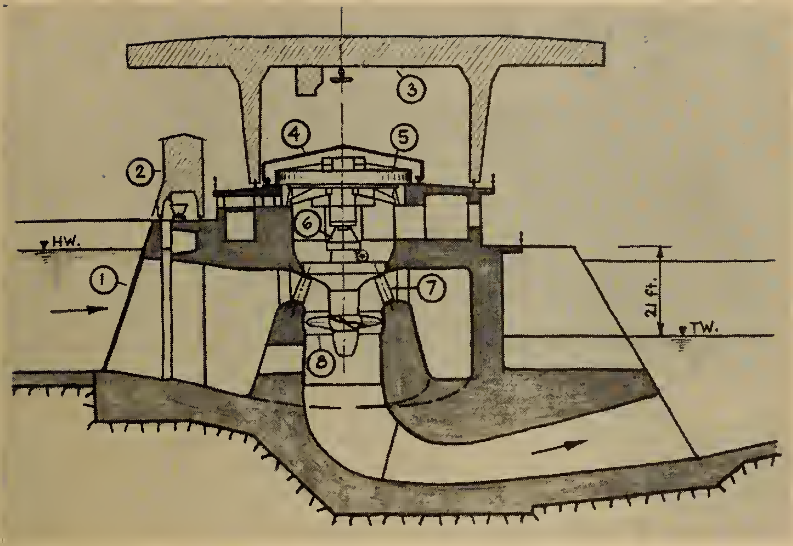


**Fig. 7. Typical Innwerke Plant.**

(1) Trash rack. (2) Raking machine. (3) Gantry. (4) Hatchway cover. (5) Umbrella-type generator. (6) Thrust bearing. (7) Conical guide-ring. (8) Concave throat-ring.

higher than in normal two-tier gates and allows for the discharge of minor flood water if entirely lowered. This upper leaf has only one upper cross-girder and is supported by rollers on the lower leaf. The shape causing the minimum load due to the overflow is given to the rear side. The main advantage of the hook-shaped gate is that at either end of the gate there is only one common track for the two leaves and therefore only one groove, of the same type as for a one-tier gate, is required. The gates move in the groove on roller trains fastened to the leaves and also positioned clear of flood water when the gates are raised. This constitutes a substantial advantage over freely moving roller trains, e.g., in Stoney gates. Where high pressures are likely to occur, the rollers are mounted in roller bearings. Rollers and slide plates act as guides in both longitudinal and transverse directions and along the grooves. The upper and lower leaves are normally raised and lowered by a common hoist. The hoist, both when lowering the upper gate below the normal head water level and raising it to this level, acts only upon the upper gate. If raised further, the lower gate will be carried with it. Link chains with triple pin support at the pinion offer particularly favourable conditions as to stress and wear. The piers between the spillway openings are kept low and

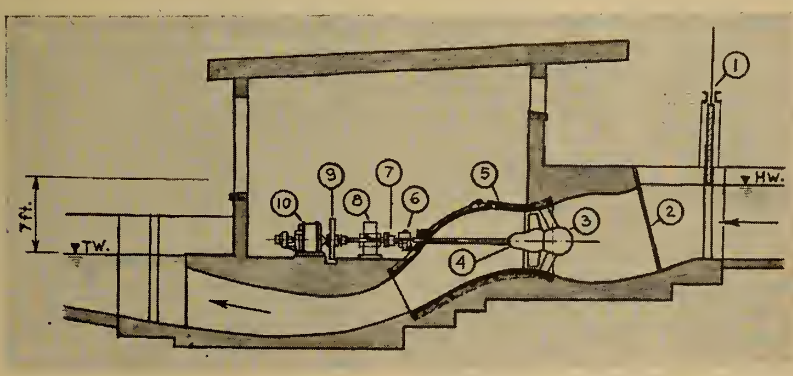


**Fig. 8. Typical Horizontal-Shaft Kaplan-type Turbine.**

(1) Sliding gate. (2) Trash rack. (3) Guide vanes with bearing. (4) Runner. (5) Cast-iron casing. (6) Bearing. (7) Servo-motor. (8) Speed increaser. (9) Fly-wheel. (10) Generator.

The power plant section is of the semi-open type (Figure 7). There are hatchways in the roof for the installation and removal of equipment and two gantry cranes travelling the full length of the power house and also of the spillway section, because they were used for the installation of the gates and later for the installation and removal of stop-logs in spillway openings and turbine conduits. The turbines have such advantageous features as a stay ring, the thrust-bearing on the generator head cover, a one-piece common shaft for turbine and generator, and cast steel runner blades with cavitation-resistant plate weldings. There are other features worth mentioning. The steel head cover consists of two sections which are field-welded together. The throat-ring is concave inside and installation of the propeller is made possible by vertical slots in its inner surface. Thus the space between blades and ring is kept equal at all positions of the runner blades, increasing efficiency. The shaft is held by two additional bearings in addition to the thrust bearing. The lower guide bearing is in the turbine head cover (grease lubrication) and the upper one is in the ventilation cone (pressure oil lubrication), containing also the oil supply for the servomotor. Exciter, governor and oil pumps are operated from the turbine shaft by bevel gears. The discharge ring (guide case) is conical and the wicket gates may be removed inwards and downwards into the throat-ring. They are operated by ring-shaped servomotors on the head cover.

The fixed-blade propeller turbine is not much used in Europe although it is cheaper than the Kaplan-type; its efficiency curve is less favourable for a variable load. However, a turbine with fixed wicket gates and adjustable blades has been developed for very low heads and units up to 1,000 kw. It may be installed with a horizontal shaft as shown in Figure 8.

These horizontal shaft units inspired the development of the Arno-Fischer turbine-generator unit for submersible operation. The arrangement for such plants is similar to that of pier unit stations, i.e., turbine conduits and discharge sluices alternate in the base of the dam. (Figure 5). The discharge of floods is further facilitated by bascule flaps on the dam crest, across the entire river channel if necessary. The cross section of these flaps is frequently fish-bellied and therefore they can withstand considerable torsional stresses, providing at the same time the most favourable hydro-dynamic conditions and thus preventing vibration. The flaps are supported over their full length on the dam top and secured to continuous water-tight articulation. The drive is operated from winch chambers within the dam. The discharge sluices in the dam are normally controlled by Taintor gates with the winch chambers inside the dam.

The capacity of the Arno-Fischer units is smaller than it would be if Kaplan units were installed. The turbine generator unit consists of two fixed enclosing pipe sections, which contain fixed wicket gates supporting the bearings, and the rotating runner band between these two pipe sections (Figure 9). The runner blades are supported on the central shaft and on the exterior rotating pipe section. They are moveable, similar to Kaplan blades. The electric generator rotor is built around the pipe outside the runner. A major problem in the design of this type of unit is that of minimizing leakage between the runner band and the fixed parts of the enclosing pipe, but this has been satisfactorily solved. The efficiency curves are comparable to those of Kaplan or Francis turbines, but somewhat lower in the maximum zone (88 to 92 per cent).

Power house equipment and cable ducts are located within the dam and individual operating chambers are connected by a gallery across the entire river. Ventilation towers are provided at the ends of the dams.

Comparative bids on power stations with spiral-casing Kaplan turbines and with conduit type turbines showed that the latter were cheaper. No comparison of real construction costs is available because the completion of the plants on the Lech and Iller rivers fell in the Second World War and in postwar periods.

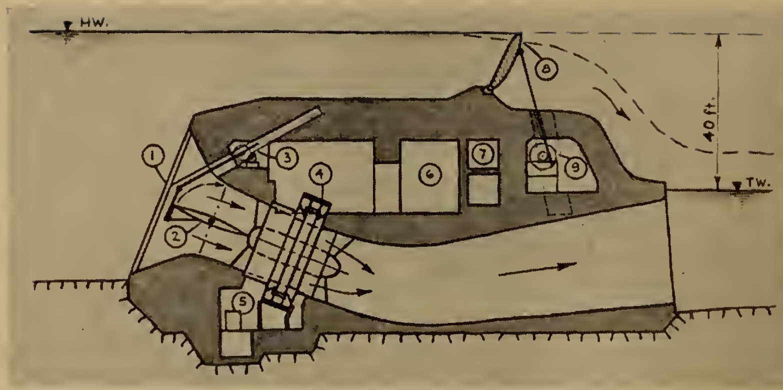


**Fig. 9. Typical Submersible Plant (Danube Project).**

(1) Trash rack. (2) Dow-valve. (3) Winch-chamber. (4) Turbine-generator unit. (5) Governor. (6) Switch-house. (7) Cable duct. (8) Flap gate. (9) Winch chamber.

#### Medium- and High-Head Projects

Although the turbine types for medium-head and high-head projects are different, the projects are similar with regard to their layouts and structural features. The Francis turbine is generally used in the 100-foot to 1,500-foot head range. Designers try to extend its range into the higher heads, so as to save in the weight and cost of turbine and generator achieved by the higher specific speed. So far as high heads are concerned, the Pelton wheel is used from 1,200 foot up to 6,000 foot. Both types are available with vertical or horizontal shafts.

Concrete gravity dams are normally favoured because of their safety factor. Arch dams and other thin wall constructions are used only at sites not endangering settled areas and if they bring really substantial savings in cost. Experience from air bombing and the introduction of heavy earth moving equipment will result in the construction of more earth and rock-fill dams. One of the biggest in Germany is presently under construction in the Lech river valley. Its crest will be rounded and the downstream slope landscaped to create a pleasant appearance.

Pipelines of high-head projects are steel pipes with flame or electrically-welded joints. Special steels are used for high stresses. The Unionmelt submerged-arc process allows welding of steel plates up to 3 inches thick. Therefore bandaging of the pipes will not be required in future. Small diameter pipes are buried to save anchors and supports. Pipes of 10 feet diameter or more, usual at medium-head projects, have rivetted joints and are exposed. Expansion joints are provided downstream of the anchorages. It is now normal practice to provide a penstock for each turbine unit. The penstocks run parallel and spread from the last anchor at high-head stations, or from the surge tank at medium-head stations, to the turbines in the power house. The power house substructure is used as an anchorage, too, and no expansion joint is used in the last penstock length.

Tunnels are normally circular and concrete lined. A special compressed concrete lining is applied in some cases where the water pressure is high and a normal concrete lining would not guarantee a tight tunnel. Where water pressures are exceedingly high, welded steel plate is inserted and the space

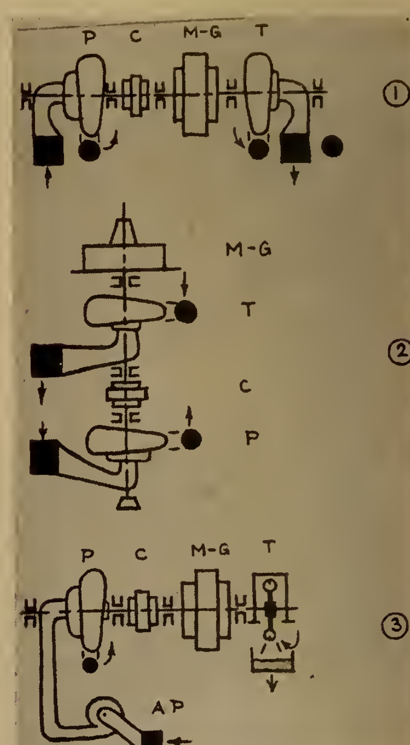


**Fig. 10. Typical Pumped-Storage Tandem Units.**

(1) Horizontal tandem with Francis turbine. (2) Vertical tandem with Francis turbine. (3) Horizontal tandem with Pelton wheel and auxiliary pump.

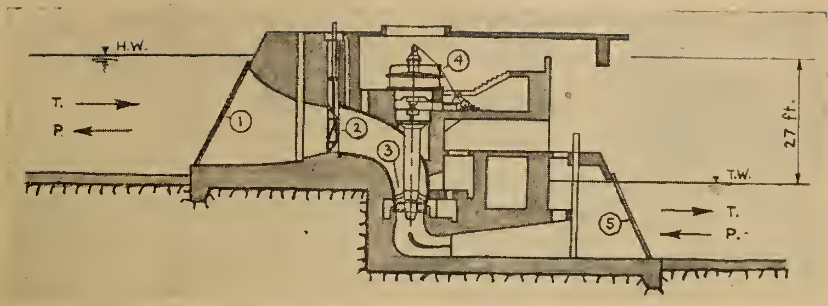


**Fig. 11. Kaplan-type Reversible Pump-Turbine.**

(1) Turbine trash-rack. (2) Hydraulically-operated emergency gate. (3) Reversible pump-turbine. (4) Motor-generator. (5) Pump trash-rack.

between steel and rock surface is pressure-grouted. The steel lining is calculated to take the bursting stress in case the bond between lining and surrounding rock fails.

Pipe lines or tunnels are controlled by two butterfly valves. One has an automatic safety control operating in case of penstock failure. This is a plate on a pendulum which swings out if the velocity of the water becomes too high. In some new projects, the difference in velocity at the conduit entrance and at its end, both measured by Venturi meters, will actuate the valve mechanism.

Some new projects in the Alps have underground power houses. Although their costs are somewhat higher than of those above grade, they have low maintenance cost and are safe from avalanches and bombing.

Francis turbines of high capacity with vertical shafts are normally preferred to horizontal units, because they allow a lowering of the setting of the runner with reference to the tailwater to avoid cavitation. Where the Francis turbine overlaps the head range of the Pelton wheel, air ventilation (sometimes compressed air) of the draft tube and a pressure regulator with auxiliary bypass must be provided to protect against cavitation and water hammer.

If Pelton wheels with horizontal shafts are used, two wheels usually drive the generator. The latter is placed in the centre on two bearings and the wheels are overhung at each end of the shaft. Double and multi-jet units increase the specific speed, reducing the weight and cost of the generator. Three- and four-jet units have vertical shafts and the wheel-housing supports the generator. Runner disk and bucket bowls are cast separately and bolted together for economy. Nozzles and needle valves are designed to give a truly circular jet. Jet-deflectors are provided to allow slow operation of the penstock valves to obviate water hammers. A small reverse jet is used as a brake.

### Pumped Storage Projects

The importance of pumped storage plants in the West German grid has been discussed in a previous paper.* Although reversible pump-turbines of the Francis type have been constructed by German manufacturers, it is present day practice to install tandem units for operational reasons. However, opinion may change with further progress in the development of the reversible pump-turbine. The tandem units consist of a Francis or Pelton turbine, a generator-motor, a clutch-coupling and a pump. Figure 10 shows diagrams of typical tandem units.

Hydraulically operated couplings of the friction-clutch type are not now used; the dog-clutch type is installed in new projects. These are safer and wear on the teeth of the coupling is small. A small impulse turbine raises the pump shaft to the speed of the turbine before the clutch is engaged. Full jet is used at the beginning of the starting operation and reduced as the revolutions of the two shafts approach synchronization.

Pumps for new pumped storage projects have fixed guide vanes. The pumps are always used at full load, so there is little advantage in adjustable guide vanes, which required frequent repairs.

Needle valves are commonly used now at the pumps instead of the cone (rotary) valves. Two-stage pumps are used for high heads; multistage pumps in high capacity projects are avoided for construction and economic reasons. Modern pump design has increased the limit of one stage to over 600 feet head. Pumps working against high heads require a setting deep below the water level of the suction pool. Auxiliary pumps are installed to reduce the suction lift of the main pump if the foundation should be otherwise too deep and expensive. An auxiliary pump is also required if the tandem unit includes a Pelton wheel, which must clear tail water level.

Finally, a reversible pump-turbine of the Kaplan type will be briefly mentioned. This unit was installed in the Baldeney plant on the Ruhr river (Figure 11). The average head is about 30 feet, the discharge as a turbine is 520 c.f.s. and as a pump, 280 c.f.s. The asynchron generator-motor changes the direction of rotation for the generating and for the pumping cycle, and the stator has two different pole arrangements (24 poles generating and 18 poles pumping). The rating for generating is 1,100 kw. at 0.38 power factor, 50 cycle, 1,200 v., 255 rpm., and for pumping 1,300 kw. at 0.86 power factor, 50 cycle, 1,600 v., 326 rpm. The guide-vanes are fixed and close to the runner to ensure a smooth decrease of water velocity in the upper conduit, when pumping. Preference is given to the generating cycle and the maximum efficiencies are 90 per cent as a turbine or 78 per cent as a pump.

### Conclusions

There is little room left for improving the turbine efficiencies. Therefore the tendency of new designs is to increase the size and capacity of the individual unit. Turbine types reach higher and higher head ranges to permit the economy of higher-speed, lower-cost machinery, cutting down space requirements and lowering power house costs. Further improvement may be expected in simplifications and in safety controls.

The cost of a hydro plant in Germany is approximately two and a-half times the cost of an equivalent steam plant. But operation and maintenance are cheaper, and the life of a hydro plant is three or four times greater than that of a steam plant. In Germany, therefore, hydro plants are an economical investment in the long run. The country's water resources will certainly be further developed, though hydro power will never play the role it has acquired in Canada. √

*"The Schluchseewerk Project", by Kurt A. Scholz, *Engineering Journal*, July, 1953, pages 856-862.

# Report of Council

## For the Year

## 1953

### Together with Committee and Branch Reports

After reviewing the events of 1953 and comparing them with 1952 and earlier years it appears that one year is very much like another. Within a year the changes are not noticeable, but over a longer period, say ten or fifteen years, great changes are in evidence. It is wise for an organization to make these studies from time to time in order to determine if its policies have suited the times, and if its officers in the light of all the surrounding conditions have given it the best guidance and direction.

The last fifteen years have been portentous ones, taking in the great holocaust of the second world war and out of it seeing develop the greatest period of expansion and prosperity ever known to this great Dominion. Any society living in such times must react to them, and either adjust itself to meet the quickly changing conditions or go down in the struggle.

The record of the Institute indicates that it has met the challenge. Not only have income and membership increased, but the activities have expanded almost beyond comprehension. Those giants of the profession who created the society in 1887, would never have thought that their membership of 423 in those days would have multiplied 37 times in 67 years. Over the same period the population of Canada has multiplied 3 times. This suggests that from the growth aspect, the Institute has kept pace with the nation.

#### Comparisons

In the last fifteen years the Institute membership has increased four times. The income has increased almost seven times, the number of branch organizations has doubled, the pages in *The Engineering Journal* have increased two and a half times, the staff at Headquarters has increased three times and the number of people working on committees has risen to almost 700.

What other figures are there to indicate growth? Fifteen years ago postage amounted to about $1,812.08 a year. In 1953 it reached the staggering sum of $10,445.66. In those days the printer's bill for the *Journal* was about $1,000.00 a month. Today it runs a little up or a little down from $12,000.00 a month. The number of inquiries in the library has reached the impressive figure of 15,000. The telephone calls are proportionately greater and the bills are proportionately greater. In the month of December, 1938, the telephone bill was $42.67. Last December it was $160.30.

This comparison could be carried into many other fields, but perhaps already the point has been gained. The Institute has expanded in every dimension to meet the growth of this great country and of this great profession. It would appear that the answer to the query set out at the beginning of this review is that the policies of the Institute have been suitable to the times and the officers have given good guidance and direction. With such support the promise of the future is even greater than the past.

#### New Branches

The year just concluded did not see as many new branches as 1952, but with branch sections included, the showing was comparable. A year ago eight branches were authorized. In 1953 there were 7 branches and 3 branch sections, at Amherst, Corner Brook, Huronia (Orillia), North Nova Scotia (New Glasgow), Northern New Brunswick (Bathurst), Brockville, the Yukon, Moose Jaw, Swift Current and Lloydminster.

#### Counselling and Guidance

Various branches have continued their activity in providing good advice and information to high school pupils who are contemplating their after high school careers. Not all branches are equally active in this field but the overall picture is good.

The Canadian Committee on Counselling in Engineering and Science held several meetings through the year, and made considerable progress in the Trans-Canada organizational set-up. The most important piece of finished business was the publishing of the guidance booklet "After High School What?" This is directed to the high school pupil "who is above average" and will be distributed widely to high schools and counsellors during 1954.

Last year's report speaking of this booklet said "It is expected that shortly the material of the booklet will be put into the hands of the printer." A whole year has passed and it is just now that the task is accomplished. The publication of any material that relates to the interests of several persons or organizations, if done jointly, is a slow process.

#### International Relations

The year showed many opportunities for maintaining and developing good international relations with friends in many parts of the world. For instance past president Colonel L. F. Grant attended a joint international conference on engineering education in London, England in January. Also at that time he held a reception in the premises of the Institution of Electrical Engineers, for members of the Institute living in the Old Country and for the officers of British engineering institutions.

Besides representing the Institute at the Coronation, President R. L. Dobbin attended the annual meeting in New York of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Engineers Council for Professional Development and the Fall meeting of the American Society of Mechanical Engineers at Rochester. He will be present in January for the annual meeting of the American Institute of Electrical Engineers.

#### International Meeting by Radio

Another international event of some importance was the two-way radio meeting with the Institution of Electrical Engineers in London, England. The subject discussed was the story of the electrical engineering back of the Coronation. The presidents of both organizations participated in the broadcast as did also the Dean of Westminster.

## UPADI

The Institute continues its interest in the Pan American engineering conference known as UPADI, and likely will be well represented at the conference which takes place in Brazil in 1954.

### Commonwealth Conference

The Conference of Representatives of Commonwealth Engineering Institutions continues to be an important interest of the Institute. Meetings are held at four year intervals and the next one will be in London in May, 1954. Because of this organization many members of the Institute enjoy guest privileges when in the countries of the other members, and many of their members are Institute guests here.

## ASME-EIC

Another international activity of real value to Canadian engineers is the outcome of the agreement with the American Society of Mechanical Engineers. By this agreement there has been created the ASME-EIC International Council—a joint body to develop cooperative projects between the two societies. Already several ideas have been put into effect for the benefit of all members and more are now in the process of development.

## ECPD

The Engineers Council for Professional Development has continued to be of benefit to all eight member organizations and to the profession generally. Colonel L. F. Grant was re-elected chairman at the annual meeting in October, 1953. Next year's annual meeting is to be in Cincinnati. The Institute has representation on all the main committees as follows:

Education, W. S. Wilson, Toronto.
Student Development, J. F. Harris, Toronto.
Training, George L. Schneider, Hamilton.
Recognition, E. V. Buchanan, London.
Ethics, C. R. Young, Toronto.
Information, L. Austin Wright Montreal.

## IAESTE

For the first time Canada participated in the work of the International Association for the Exchange of Students for Technical Experience. Early in the year 21 students came from Europe to spend this summer here in acquiring experience. From Great Britain there were 13, from the Netherlands 4, and from Germany 4.

No Canadians were sent abroad by way of an exchange but it is intended in 1954 to develop the movement both ways. Already several Canadian students have indicated their interest.

During 1953 the Association arranged exchange for almost 4,000 students with 18 countries participating. Here is an unusual opportunity for Canadians to show the young men of other countries the advantages of a real democracy. In 1954 it is expected that Canada's participation will be increased greatly.

### New By-laws

One of the most important developments of the year was the successful ballot on amendments to the by-laws. These all carried with substantial majorities. All the changes are in effect now, and already the benefits are easily discernible.

### Directory

A great portion of the year was devoted to preparing material for the new membership directory. This is a colossal task which required the temporary employment of extra staff. However the year end sees the work completed with the last stages wholly in the hands of the printer. Over 11,000 forms were returned by the members, which is an indication of the interest in an up-to-date directory.

### The Coronation

No review of the year would be complete without reference to the Coronation of Her Gracious Majesty Elizabeth II. The event was of special interest to the Institute because of the presence of the president in Westminster Abbey. This was a new acknowledgment of the rise of the profession of engineering in Canada to the level of the other learned professions. Coming from the British government itself the command invitation held unusual significance to all engineers in Canada.

Coupled with the honour of being represented in the Abbey was the further honour of having His Royal Highness the Duke of Edinburgh accept Honorary Membership in the Engineering Institute.

It was a great year of recognition for the Institute.

### Roll of the Institute

The membership of all cassifications now totals 15,131. New names added for the year amounted to 1,320, but deaths, resignations and removals amounted to 1,715. The reduction in figures for the overall membership is caused by several things but is principally due to the removal from the list of many Students and Juniors who are in arrears of fees. It was felt by the Finance Committee that there was no use carrying these cases any longer but that every endeavour would be made to secure applications for reinstatement.

During the year 1,233 candidates were elected. These were classified as follows: Members 369, Juniors 208, Students 714, Affiliates 2. The elections for the previous year totalled 1,407. Eighty-seven reinstatements were effected. Life Membership was conferred on forty-six members under by-law 26.

Transfers from one grade to another were as follows: Junior to Member 310, Student to Member 7, Student to Junior 860, a total of 1,177.

### Removals from the Roll

There have been removed from the roll during the year for non-payment of fees and by resignation: Members 256, Juniors 1,021, Students 365, Affiliates 4, a total of 1,646.

### Deceased Members

During the year the deaths of sixty-nine members of the Institute (including one Honorary Member) have been reported as follows:

#### Honorary Members

Stirling, Grote

#### Members

Baird, Earle Meharg
Bell, George Edward
Bleau, Jean-Marie
Bronson, Frederic E., The Honorable
Brunner, Godfrey H.
Burbidge, George Harrison
Cameron, Hugh D.
Campbell, James Gekkie
Chadwick, Douglas Moore
Crawley, Frederick Austin
Clifford, Harold Linscott
Corless, Charles Vandyke
Davis, John Caswell
Dwyer, Michael
Emrey, Desmond Joseph
Fergusson, Hugh Boscawen
Hamilton, Chester B.
Handley, John
Harza, Leroy Francis
Hebb, Donald Eugene
Irwin, William Eric Crommelin
Jaquays, Homer Morton
Kelly, Oliver G.
Killer, Frederick Anderson
Kingston, Laurence B.
Koreen, Olof Joel
Lewis, Stanley Thomas
Manley, Edward Hugh
Mansbridge, Alfred Swatton
Moffat, Thomas
Mount, Wilfred Rowland
McConnell, S. Bruce
McGorman, Samuel Ernest
MacKay, John Duncan
Mackenzie, John Fenwick Fraser
Maclaren, Alexander Munro
Nason, Edward McKinney
Newman, William Arthur
Paoli, Ambrose Aloysius
Riddell, Arthur G.
Robertson, Edgar Doctor
Roche, Ivor Francis Rees
Rowley, Harry William
Rutherford, Stewart Fleming
Smith, J. Norman
Smith, Paul Moody
Stenbol, Carl
Stephenson, Herbert Armstrong
Stuart, William Grey
Taylor, Robert Everson
Thwaites, Joseph Taylor
Wall, Edward Walter
Wilmot, Lemuel Allan
Williams, Charles Gunning
Winfield, W. A.
Wright, Charles Harvey
Young, Ross A.

#### Juniors

Booth, William Lawrence
Couchman, Edward James
Landau, Samuel Nathan
Maxwell, Walter Bernard
McCutcheon, Archibald Donald

#### Students

Brooks, Douglas Clark
Chow, David Yik Fu
Godin, Gilles
Jumis, Francis
Ross, William James
Schneider, Murray B.

### Total Membership

| | 1952 | 1953 |
|---|---|---|
| Honorary Members | 26 | 30 |
| Members | 6,459 | 6,855 |
| Juniors | 5,993 | 5,724 |
| Students | 2,981 | 2,457 |
| Affiliates | 67 | 65 |
| | 15,526 | 15,131 |

Respectfully submitted on behalf of the Council

R. L. Dobbin, M.E.I.C.,
*President*

L. Austin Wright, M.E.I.C.,
*General Secretary*

## Treasurer's Report

During the past year income from Membership fees amounted to $152,503.34, an increase of $8,731.58 over that for 1952. There was no voluntary assessment in 1953 but in its place contributions to the Harry F. Bennett Education Fund were received in the total amount of $4,842.86. Excluding voluntary contributions the total receipts from fees in 1953 showed an increase of 16½% over those for 1952.

The *Journal* produced a total revenue of $230,634.01, an increase of $41,117.66 over that for 1952 but at the same time total publication expenses for the *Journal* increased by $37,863.17 to reach a figure of $220,571.99. The profit for the year was $3,254.49 over that for 1952.

Further purchases of securities were made during the year amounting to $31,628.25. Already the benefit from this investment policy has been reflected in the increased income from investments amounting to $2,816.25 as compared with $1,490.24 in 1952.

A. Duperron, m.e.i.c.,
*Treasurer*

## Finance Committee

The total revenue for the year 1953 amounting to $386,297.14 once more constitutes the largest receipts for any year to date being $44,213.46 more than for the previous year. This large total does not include an amount of $4,842.86 which was obtained by voluntary contributions from many of the members. These contributions were requested last year in the name of the Harry F. Bennett Education Fund of the Institute which is doing good work in aiding deserving students to finance their education.

However, in spite of the high revenue for the year, due to increased costs in printing the *Journal* and operating our headquarters and field offices, the expenditures showed an excess of $2,613.62 over the receipts for the year. Increased advertising rates for the *Journal* were put into effect during the year for new accounts and the new rates will apply to all advertisers in 1954. This, together with the increase authorized for membership fees, will assist the Insti-

# Comparative Statement of Revenue and Expenditure

**For the Year ended December 31, 1953**

### REVENUE

| | 1953 | 1952 |
|---|---|---|
| **Membership Fees:** | | |
| Arrears | $ 8,437.08 | $ 7,640.60 |
| Current* | 137,452.56 | 129,537.92 |
| Advance | 639.00 | 759.25 |
| Entrance | 5,974.70 | 5,833.99 |
| Voluntary assessment | — | 6,694.02 |
| 1953 Receipts of $4,842.86 allocated to The Harry F. Bennett Educational Fund. | $152,503.34 | $150,465.78 |
| **Publications:** | | |
| Journal sales | 165.01 | 95.17 |
| Journal advertising | 230,469.00 | 189,421.18 |
| | $230,634.01 | $189,516.35 |
| **Income from Investments** | $ 2,816.25 | $ 1,490.24 |
| **Refund of Hall Expense** | 126.00 | 400.00 |
| **Sundry Revenue** | 217.54 | 211.31 |
| | $386,297.14 | $342,083.68 |

*Membership fees include *Journal* subscriptions.

### EXPENDITURE

| | 1953 | 1952 |
|---|---|---|
| **Building Expense:** | | |
| Property and water taxes | $ 1,586.16 | $ 1,567.21 |
| Fuel | 1,136.12 | 1,040.92 |
| Insurance | 619.61 | 610.56 |
| Light, gas and power | 693.36 | 799.66 |
| Caretaker's wages and services | 1,830.00 | 1,650.00 |
| Maintenance, alterations and repairs | 1,458.12 | 6,176.63 |
| | $ 7,323.37 | $ 11,844.98 |
| **Publications:** | | |
| Salaries | 24,529.51 | 19,077.20 |
| Printing and sundry expense | 137,836.16 | 115,283.15 |
| Advertising commission and management | 58,206.32 | 48,348.47 |
| | $220,571.99 | $182,708.82 |
| **Office Expense:** | | |
| Salaries | 63,096.75 | 53,400.91 |
| Telegrams, postage and excise | 4,718.63 | 4,108.16 |
| Telephones | 1,742.30 | 1,454.42 |
| Office supplies and stationery | 9,484.83 | 10,072.23 |
| Audit and legal fees | 1,010.00 | 1,270.67 |
| Messenger and express | 335.57 | 378.97 |
| Miscellaneous expense | 4,393.18 | 4,045.52 |
| Depreciation—furniture and fixtures | 1,247.85 | 1,279.75 |
| | $ 86,029.11 | $ 76,010.63 |
| **General Expense:** | | |
| Students' conference | 1,798.99 | 2,827.33 |
| Council and annual meetings | 4,975.52 | 5,034.52 |
| Travelling | 9,740.17 | 8,916.98 |
| Branch stationery | 381.41 | 228.08 |
| Institute prizes | 469.54 | 568.36 |
| Library salary and expense | 9,502.34 | 9,323.21 |
| Interest, discount and exchange | 704.45 | 625.06 |
| Committee expenses | 1,530.06 | 259.63 |
| Cost of membership in other societies | 2,315.80 | 2,812.04 |
| Sundry expense | 966.64 | 1,053.72 |
| Pension plan | 2,626.34 | 1,769.47 |
| | $ 35,011.26 | $ 33,418.40 |
| **Rebates to Branches** | $ 23,974.93 | $ 22,640.79 |
| **Total Expenditure** | $372,910.66 | $326,623.62 |
| **Transferred to Reserve Account** | 16,000.00 | 15,000.00 |
| **Surplus or (Deficit) Transferred to Surplus Account** | (2,613.52) | 460.06 |
| | $386,297.14 | $342,083.68 |

tute in its financing during 1954 and to cover the costs of publishing the new Membership Directory.

The amount of the Building Fund was augmented by $16,000.00 during the year in accordance with Council decision some three years ago. However, no money was available to increase the contingent reserve fund which will be considerably depleted in 1954 due to the final judgment rendered in connection with the suit brought against us by our previous advertising agency.

The present office space is taxed to the limit and with growth of the Institute membership and number of branches, consideration is being given to the most effective way to cope with the increased work involved. An assistant field secretary has been secured and is located in the Toronto office.

*The Engineering Journal* has again completed a successful year with receipts in excess of expenditures. However, a full-time editor is needed more than ever and although an extensive search has been made for one, a suitable person has not yet been found.

Regular monthly meetings of the Finance Committee were held during the year and agreements reached for appropriate recommendations to Council at each of its meetings.

The able assistance and co-operation of the General Secretary, the Assistant General Secretary, and their staff continued in full measure during the year and was greatly appreciated by all the members of your committee.

IRVING R. TAIT, M.E.I.C.,
*Chairman*

## Committee on Employment Conditions

This Committee wishes to report to Council that no specific problem was brought to its attention during the last year.

G. N. MARTIN, M.E.I.C.,
*Chairman*

## Legislation Committee

No matters concerning legislation came to the attention of the Committee during the year, and as a result it has nothing to report.

E. D. GRAY-DONALD, M.E.I.C.,
*Chairman*

## Publications Committee

*The Engineering Journal* in 1953 had the biggest year in its 35 years of pub-

# Comparative Statement of Assets and Liabilities

**As at December 31, 1953**

ASSETS

| | | 1953 | 1952 |
|---|---|---|---|
| CURRENT ASSETS: | | | |
| Cash on hand and in banks | | $ 1,315.34 | $ 13,781.19 |
| Accounts receivable—less reserve | | 21,523.70 | 19,840.04 |
| Arrears of fees—estimated | | 3,500.00 | 3,500.00 |
| | | $ 26,339.04 | $ 37,121.23 |
| INVESTMENTS AT COST: | | | |
| Property of The Engineering Institute of Canada | $87,814.26 | | |
| Property of special funds account—see contra | 19,857.54 | | |
| (Approximate market value $105,000.00) | | 107,671.80 | 76,043.55 |
| SUNDRY ADVANCES | | 2,850.00 | 3,350.00 |
| DEPOSIT WITH POSTMASTER | | 500.00 | 400.00 |
| PREPAID INSURANCE AND DIRECTORY EXPENSE | | 4,422.57 | 187.00 |
| LIBRARY—at cost, less depreciation | | 1,448.13 | 1,448.13 |
| FURNITURE AND FIXTURES—at cost, less depreciation | | 11,230.69 | 11,517.74 |
| LAND AND BUILDING—book valuation | | 36,000.00 | 36,000.00 |
| | | $190,462.23 | $166,067.65 |

LIABILITIES

| | | 1953 | 1952 |
|---|---|---|---|
| CURRENT LIABILITIES: | | | |
| Accounts payable | | $ 14,679.57 | $ 8,963.54 |
| Payable to The Harry F. Bennett Educational Fund | | 4,842.86 | — |
| | | $ 19,522.43 | $ 8,963.54 |
| SPECIAL FUNDS: | | | |
| As per statement attached | | 19,857.54 | 19,408.33 |
| RESERVES: | | | |
| Building fund | | 56,000.00 | 40,000.00 |
| Building maintenance | | 1,500.00 | 1,500.00 |
| Contingent reserve | | 20,000.00 | 20,000.00 |
| Pension fund reserve | | 10,366.50 | 10,366.50 |
| SURPLUS ACCOUNT: | | | |
| Balance as of December 31, 1952 | $65,829.28 | | |
| *Less:* deficit for year as per statement attached | 2,613.52 | | |
| | | 63,215.76 | 65,829.28 |
| | | $190,462.23 | $166,067.65 |

AUDITORS' CERTIFICATE

We have examined the statement of assets and liabilities of The Engineering Institute of Canada as of December 31, 1953, and the statement of revenue and expenditure for the year ended on that date and have obtained all the information and explanations we have required. Our examination included a general review of the accounting procedures and such tests of accounting records and other supporting evidence as we considered necessary in the circumstances.

In our opinion the above statement of assets and liabilities and accompanying statement of revenue and expenditure are properly drawn up so as to exhibit a true and correct view of the state of the affairs of the Institute at December 31, 1953, and the results of its operations for the year ended on that date, according to the best of our information and the explanations given to us and as shown by the books of the Institute.

PEAT, MARWICK, MITCHELL & CO.,
*Auditors*

MONTREAL, QUE., JANUARY 21, 1954.

lication. The number of copies printed totalled 195,480, an average of 16,290 per month. The circulation of 191,040, averaging 15,920 per month, was again the largest circulation of all Canadian technical publications.

The number of pages of reading material printed during the year totalled 1,029, an increase of 17% over 1952 and an average of 86 pages per issue. The *Journal* carried a greater volume of reading material as compared with advertisements than any other Canadian technical publication. Technical papers averaged 44 pages per month. The balance of the reading material, averaging 42 pages per month, was made up of items of topical interest.

In the technical section your Committee and members of the *Journal* staff made every effort to cover all phases of engineering development. The breakdown by engineering branches of the 82 papers published follows:

| | |
|---|---|
| Aeronautical | 3 |
| Chemical | 8 |
| Civil | 22 |
| Electrical | 10 |
| Mechanical | 14 |
| Mining | 5 |
| Miscellaneous | 20 |

The thanks and appreciation of the Committee are extended to all contributors.

Many of the papers published proved to be of such great interest that over 18,000 reprints of technical papers were ordered. This, together with the usual letters of commendation received during the year, indicates a continued satisfaction with the *Journal*.

Publication costs were up from the previous year to the extent that the average gross cost of production for 1953 was 83.4 cents per copy, or $10.02 per subscriber for the full year. The corresponding figure for 1952 was $8.53, representing an increase of just over 17 per cent.

With the steady increase in circulation the cost of advertising per page per copy reached a point where it was lower than for almost any other corresponding publication in Canada. Because of this and the steadily increasing cost of publication, the decision was taken during the year to approve a general increase in the *Journal* advertising rates of 50%. Even with this increase our rates per page per copy are still lower than many publications and the increase has been quite well received to date.

In accordance with a decision taken by Council a year ago, arrangements were made to publish a 1953 Membership Directory and Catalogue. The lists were closed as of October 15th and the final proofs were returned to the printer just before the end of December. It is expected that copies will be in the hands of most members before this report is printed.

It has been found that periodically the backlog of papers for publication in the *Journal* dwindles considerably. Your Committee has recommended therefore that every effort be made during 1954 to create and maintain a larger reserve of technical papers for publication.

Your committee held seven meetings during the year. All were well attended by its members as well as by the staff at headquarters.

Henri Gaudefroy, M.E.I.C.,
*Chairman*

## Papers Committee

Under the present by-Laws this committee has no specific duties.

However this year it was decided by Council that the Committee should have a part in the preparation of the papers program for annual meetings of the Institute.

The standing committee was enlarged to include the following members: Dean R. M. Hardy, Edmonton, Prof. L. P. Bonneau, Quebec, A. R. Harrington, Halifax, Dean H. Gaudefroy, K. G. Cameron, F. L. Lawton, H. S. Van Patter and C. E. Frost of Montreal.

The work of preparing the annual meeting papers is well under way.

Three meetings have been held.

After the annual meeting it will be possible more accurately to appraise the value of the new duties of the committee. A report will then be made to Council.

E. R. Smallhorn, M.E.I.C.,
*Chairman*

## Library and House Committee

Arrangements were made by your Library and House Committee for the carrying out of certain repairs and renovation of the Institute Headquarters building on Mansfield Street during the past summer.

These included the following:

Repairs to fire escape.

Painting of foundation wall of the original house.

Rearrangement and extension of ladies' washroom facilities.

Painting of cloak and washrooms, library and offices on main floor below lecture hall.

Rebuilding of fence in rear of property on north side.

A. S. Rutherford, M.E.I.C.,
*Chairman*

## Board of Examiners

In June of the past year, Dr. C. A. Robb, who acted as Chairman of the Board of Examiners for two years, resigned his post. The Board considers that the Institute is greatly indebted to Dr. Robb for his extensive contribution to its work, and wishes to take this opportunity of recording its appreciation.

During the year 1953, fourteen applications for membership were considered. Four of these were successful in passing the examinations of the Board and were recommended to Council for admission. For two of the applicants, arrangements for examination are presently being made. Six applications are under consideration and will be reported on when the findings of the Board have been completed.

J. L. de Stein, M.E.I.C.,
*Chairman*

## Membership Committee

This Committee reports to Council that it has, as yet, discovered no successful means of assisting the local branches to increase their membership from the eligible engineers in their district. The most successful means observed so far of bringing a greater proportion of the eligible engineers in an area into the Institute has been the breaking up of large branches into a number of local branches.

H. R. Sills, M.E.I.C.,
*Chairman*

## Admissions Committee

During 1953 the committee held eleven meetings and examined 1642 cases. These consisted of—

| | |
|---|---|
| Applications for Admission | 478 |
| Applications for Transfer | 220 |
| Applications through Professional Associations for— | |
| (a) Admission | 177 |
| (b) Transfer | 106 |
| Student Applications | 641 |
| Special Cases | 20 |
| | 1642 |

A. D. Ross, M.E.I.C.,
*Chairman*

## Nominating Committee

*Chairman:* C. M. Anson, Sydney, N.S.

| *Branch* | *Representative* |
|---|---|
| Amherst | ............ |
| Belleville | F. C. Adsett |
| Border Cities | C. G. R. Armstrong |
| Calgary | C. E. McNevin |
| Cape Breton | ............ |
| Cent. Br. Columbia | R. L. Bigg |
| Corner Brook | J. L. Barron |
| Cornwall | H. E. Meadd |
| Eastern Townships | G. M. Dick |
| Edmonton | B. Willson |
| Fredericton | Horace G. Hughson |
| Halifax | ............ |
| Hamilton | ............ |
| Huronia | B. C. Lamble |
| Kingston | J. W. Brooks |
| Kitchener | M. A. Montgomery |
| Kootenay | S. L. Baird |
| Lakehead | T. C. Anderson |
| Lethbridge | N. H. Bradley |
| London | D. D. C. McGeachy |
| Lower St. Lawrence | Roger Thomas |
| Moncton | M. F. K. Leighton |
| Montreal | E. B. Jubien |
| Newfoundland | D. L. Cooper |
| North Nova Scotia | ............ |
| Niagara Peninsula | C. G. Cline |
| Nipissing & Up. Ot. | ............ |
| North East. Ontario | G. M. Lyon |
| Northern N.B. | F. H. B. Chisholm |
| Ottawa | W. R. Meredith |
| Peterborough | B. Ottewell |
| Port Hope | ............ |
| P.E.I. | H. R. Miller |
| Quebec | C. H. Boisvert |
| Saguenay | P. Schopflacher |
| Saint John | H. S. McCleave |
| St. Maurice Valley | M. Eaton |
| Sarnia | ............ |
| Saskatchewan | Edward J. Durnin |
| Sault Ste. Marie | R. A. Campbell |
| Sudbury | R. H. Moore |
| Toronto | J. F. MacLaren |
| Vancouver | Hugh T. Libby |
| Vancouver Island | H. D. Dawson |
| Winnipeg | T. E. Storey |
| Yukon | ............ |

## Library Report

Looking back on 1953, the overall impression is one of giving out of information of all types, much of which cannot necessarily be recorded in statistics.

A number of firms have sent in employees requesting information on the organizing or recording of library and record material. Also, two representatives from the National Library in Ottawa, have spent considerable time discussing details and practices, as they are considering installing the type of classified catalogue we have at headquarters.

Inter-library loans were almost exactly doubled from the previous year. Items loaned to other libraries totalled 614, and we, in turn, borrowed 113 from them. 2,274 items were loaned out to members, and those used in the reading room totalled 4,874.

During the same period 182 members registered as new library borrowers. Of these, 66 requested repayment of their deposits, which left 718 active registered borrowers.

In addition to countless letters requesting two or three book titles on a given subject, 51 pages of bibliographies were prepared for members on 42 different subjects. It is interesting to note that these requests came from Canada, United States, British West Indies, and the United Kingdom.

Four hundred and seventy-three orders have been placed for books, magazines, standards or pamphlets, and the total number of requests by phone and by letter was 3,620, an average of 12 per working day.

Accessions for the year in review copies, totalled $2,510, representing 346 books, 150 standards and specifications, and 25 pamphlets.

Twenty-three exchanges and presentations in the periodical field totalled $108.00, which now brings the value of these acquisitions up to $842.00. This makes the total value of material received in this manner during 1953, $3,352.00.

Last February, due to illness and shortage of staff, winter library hours were cut to 9 a.m. to 5 p.m.

Last October, they were again extended to 9 a.m. to 6 p.m., and 9 a.m. to 8 p.m. on Thursdays, on the understanding that these hours would continue through the winter if the enthusiasm of the members warranted it.

During the five months of late hours, the attendance averaged 1 person per night between five and six o'clock, and 3 persons per night between six and eight o'clock. The inconvenience and expense of this extra library service was not considered justified by this sparse attendance.

At the end of December it was therefore decided to keep the library hours nine a.m. to five p.m. permanently, regardless of meetings or seasons.

(Miss) Emily Keeley,
*Chief Librarian*

## Employment Service

The activities of this department during the early months of 1953 maintained somewhat the same level as was reported during the latter period of last year. There were fewer Canadian personnel listed to fill existing vacancies and the demand for engineers exceeded the supply.

The majority of vacancies required a specialized type of experience and employers were willing to wait for the candidate with the necessary qualifications. It was noted that employers failed to find engineers for municipal work of many kinds and those specially skilled or trained in the field of electronics.

A number of these vacancies still exist.

The volume of correspondence dropped from last year's figure, despite the fact that 2,000 letters were sent out. One reason seemed to be that letters from Europe showed a decline. However, letters from the United Kingdom requesting information were still very numerous.

As in the past the Institute's Employment Service is more than willing to be of assistance to engineers presently resident in Canada. It does not actively encourage non-residents, as Canadian employers hesitate to hire technical personnel prior to a personal interview. Exception to this rule is made only when a vacancy is requiring specialized training, which the department is unable to fill from existing records.

As in former years we offer our services to the graduating classes. We have noted in the past few years that very few have found it necessary to take advantage of this offer. Due to low enrolment in our universities, employers find it difficult to fill their anticipated needs. The greatest demand is still for the young engineer in all fields.

The employment service bulletin, introduced six years ago has proved to be of great value. It still enjoys a wide circulation, not only in Canada but also the United Kingdom and it is our sincere hope it will continue to be of help to the employer and employee during the coming year.

The employment situation was fairly active during the early part of 1953, as many large projects reached their peak during this period. The latter months showed a distinct levelling off of activity. The year ahead from all indications will again be a tremendous one, in the field of construction.

It is most gratifying to receive letters from many of our members and member-employers expressing their appreciation of the department's services. We do hope it will continue to be of service during 1954.

(Miss) A. Summers,
*Employment Service*

## Prairie Water Problems Committee

The report of the Royal Commission on the South Saskatchewan River Development, of which your chairman was a member, was published early in the year and the findings of this Commission are, therefore, a matter of record.

Irrigable land is being added to the existing acreage as the Province of Alberta proceeds with the construction of the distribution works of the St. Mary River Project, as the Canada Land and Irrigation Project, recently acquired by the Dominion Government, is extended, and as minor projects are undertaken by the P.F.R.A. As a result, irrigable land is now becoming available at least as rapidly as effective colonization can be carried out.

G. A. Gaherty, M.E.I.C.,
*Chairman*

## Committee on Professional Interests

No special problem was placed before this Committee during the year 1953.

It is particularly gratifying to record the establishment of five new branches in the Institute, bringing the total to 48. The new branches are as follows:

Corner Brook, Newfoundland
Huronia, Ont., (Orillia)
North Nova Scotia, (New Glasgow)
Northern New Brunswick (Bathurst)
Amherst, Nova Scotia

In addition, applications were approved by Council for the establishment of branches in the Yukon and at Brockville, Ont.

One of the original terms of reference of this Committee was the promotion of co-operation between the Institute and the provincial professional associations. In this respect, the Committee feels that, although the time is not yet opportune to press for the signing of agreements in provinces where there is no such form of co-operation, progress is being made towards that objective.

During the year, an offer of space in *The Engineering Journal* for reporting their news was made to provincial associations. Although no definite answers had been received at the end of the year, it seems that some of the Associations will avail themselves of this offer which should further promote co-operation.

Louis Trudel, M.E.I.C.,
*Chairman*

## Committee on the Training and Welfare of the Young Engineer

During the year 1953 the Committee on the Training and Welfare of the Young Engineer, by virtue of the untiring energy of Col. L. F. Grant, has continued to sponsor Professional Development Courses for young engineering graduates. The program is aimed to implement in part the report of the E.C.P.D. Training Committee "The First Five Years of Professional Development" known as the Monteith Report and recommended by Engineers' Council for Professional Development.

Professional Development Courses

The courses include such subjects as public speaking, management, labour relations, economics, finance, international affairs, what the employer expects of the young engineer, technical subjects, and others.

A comparison of the number of courses operating in the various E.I.C. branches during the past year shows a falling off during the year 1953:

1950-51—One course.
1951-52—Eight courses — Halifax to Saskatoon.
1952-53—Twenty-one courses—Sydney to Vancouver.
1953-54—Six courses in operation. Three courses will probably come into being. Three further courses are possibilities.

The chief reason for the decrease in the number of courses is that Colonel L. F. Grant, the mainspring of this movement, has not been able to visit all the branches that he wanted to during the past year. A second reason is that a good many branches having finished one course have not been able to lay out a program for another course.

Col Grant believes that he could have helped the branches had he been able to visit them in time.

### High School Level

The Canadian Committee on Counselling in Engineering and Science (C.I.C., C.I.M.M., E.I.C., and Prof. Assoc.'s) is currently organizing the counselling in engineering and science at the high school level throughout the Dominion. Counsellors have been appointed in most of the principal centres from coast to coast from among the members of the constituent bodies. A new guidance pamphlet entitled "After High School What?" has been prepared by the committee and 25,000 English and 10,000 French copies have been printed.

### Montreal Branch Guidance Committee

The Montreal Branch Guidance Committee merits special mention having completed another successful year under the chairmanship of Professor Jacques Laurence of Ecole Polytechnique.

During the year two French forums and one English forum were held. The speaker at both French forums was Dr. Huet Massue whilst Mr. I. R. Tait was the speaker at the English forum.

A total of approximately six hundred and twenty-five (625) high school students attended the forums.

### Undergraduate and Graduate Levels

The Canadian Committee on Counselling in Engineering and Science is fully occupied in organizing the counselling of high school students. It is the intention of the committee to expand in the future into the fields of counselling among undergraduates and graduates recently out of college. There is, however, a possibility that the work of counselling in engineering and science at high school, undergraduate and graduate levels cannot be successful without a permanent paid secretariat.

It is assumed that the Professional Development Courses for young engineers now being sponsored by our Committee on the Training and Welfare of the Young Engineer will eventually be taken over by the Canadian Committee on Counselling. This in effect is the understanding between the two committees so that there will be no overlapping of efforts.

### ECPD Regional Guidance Committee in Canada

In the natural course of developing the overall picture of guidance and counselling in Canada the Canadian Committee on Counselling in Engineering and Science will now function as the ECPD Regional Guidance Committee in Canada as shown in the Twenty-first (1953) Annual Report of Engineers' Council for Professional Development, page 65. R. F. Shaw should have been listed as the Chairman of the Regional Committee for the current year.

### Conclusion

The Training and Welfare Committee continues to sponsor Professional Training Courses for young engineers.

The committee encourages branch guidance committees to co-operate with the Canadian Committee on Counselling and with the guidance committees of the Chemical Institute of Canada and the Canadian Institute of Mining and Metallurgy.

In establishing programs for the guidance and training of the young engineer the committee aims to provide the opportunity and environment for professional development. The final responsibility for his professional advancement rests with the individual himself.

George B. Moxon, m.e.i.c.,
*Chairman*

## Report of the Field Secretary

During 1953 the Field Secretary made two trips to Western Canada. The first one in April and May during which he visited the branch executives of the Winnipeg, Saskatchewan, Edmonton, Calgary, Lethbridge, Kootenay, Central British Columbia, Vancouver Island and Vancouver branches. He also met "Orphan Groups" at Nelson (third visit), Nanaimo (second visit), Yellowknife (first visit) and Whitehorse (first visit). There is now a flourishing Yukon branch with headquarters at Whitehorse.

The second trip to the West in November and December included meetings with the executives of the Winnipeg, Saskatchewan, Lethbridge, Calgary and Edmonton branches, and orphan groups at Pine Falls (first visit), Dauphin (second visit) in Manitoba; Flin Flon (second visit) which is in either Manitoba or Saskatchewan depending on what part of the town one is in; Lloydminster (second visit) where the visitor is likewise uncertain as to his provincial locality; Yorkton (first visit), Moose Jaw (second visit) and Swift Current (second visit), all of which Saskatchewan can claim without reference to any other province. There are now strong sections of the Saskatchewan Branch at Moose Jaw, Swift Current and Lloydminster, the latter of which will no doubt cause several headaches to the secretaries of the Edmonton and Saskatchewan branches in settling the question of who owns who!

In Alberta, Medicine Hat (second visit), Blairmore (second visit), and Red Deer (second visit). In British Columbia, Kimberley for the first time, and Fernie and Cranbrook each for the second time.

In Ontario, the branches at Hamilton, Huronia, Niagara Peninsula, London, Border Cities and Sarnia were visited. It was also a pleasure to attend meetings arranged by the Lakehead Branch for its orphan groups at Dryden and Marathon.

A visit was also paid to the Quebec Branch.

The Field Secretary regrets that he was not able to make a Maritime trip in 1953, but in February of 1954 a tour will be made which will include beside the branches in the Atlantic Provinces, the Saguenay and Lower St. Lawrence branches and some orphan groups.

The custom has been instituted of taking photographs of orphan groups for reproduction in the *Journal*. This has resulted in the Field Secretary himself being photographed more than anybody in North America except Marilyn Monroe.

A large part of the work of the Field Secretary's office has been concerned with the starting of professional development courses. At present a proposed Dominion-wide programme is in preparation, whereby good speakers may be obtained for the professional development meetings across Canada.

Finding engineering positions, especially for young engineers newly arrived in Canada from other countries is another important feature of the work of the Field Secretary's office, and nearly all of these young men show their appreciation by becoming, in due course, members of the Institute.

The Field Secretary takes this opportunity of thanking the branch executives and the members of the orphan groups for the warm reception and the friendly hospitality which he has received from them. It makes his visits thoroughly enjoyable to him at least. If there are anywhere in Canada orphan groups, however small, which have not been visited and who would like the doubtful pleasure of a visit from the Field Secretary (or Assistant Field Secretary) he hopes that they will inform him. He will be happy to visit them as soon as possible.

The Assistant Field Secretary, Mr. James A. Ogilvy, whose duties began on September 16th, has been of great assistance in visiting other branches and groups.

L. F. Grant, m.e.i.c.,
*Field Secretary*

## Life Members' Committee

At the meeting of Council in 1946 it was decided that members who had been in good standing in the Institute for thirty-five (35) years or who had been members for thirty (30) years and had reached the age of seventy (70), should be granted Life Membership and be exempted from payment of further annual fees.

By the end of 1953 the number of Life Members was five hundred and thirty (530). Of these four hundred and ninety-six (496) reside in Canada, twenty (20) in other British Commonwealth countries, thirty-eight (38) in the United States and four (4) in other foreign countries.

After communicating with all members in Canada and learning their opinions, it was decided to establish a yearly Life Members' Fund to which each member could voluntarily contribute if he desired.

The contributing members felt that this money should be used to help defray the expenses of student representatives from our universities to the annual meeting and also to help obtain speakers for the smaller branches.

The response of the members was most encouraging. Two hundred and twelve (212) members contributed a total of $1,855 during the past twelve months.

J. A. Freeland, m.e.i.c.,
*Secretary*

## Canadian Chamber of Commerce

The 24th Annual Meeting of the Canadian Chamber of Commerce at Edmonton, September 14th to 17th, inclusive marked the termination of another very active year.

On January 20th a delegation of

officials of the Chamber, headed by President Lewis W. Simms, called upon the Prime Minister and members of his cabinet in Ottawa to lay before them the policy statements and resolutions approved by the delegates at the previous annual meeting. The matters brought to the attention of the Prime Minister and his cabinet comprised 38 policy statements and resolutions covering a wide range of subjects, from "administrative law" to "voting procedures".

In its statement on administrative law the Chamber expressed concern at the extent to which the legislative, administrative and judicial powers of Parliament are being exercised under orders in council or by officials or boards. It urged the government to limit such delegation of the powers of Parliament to the minimum degree "consistent with good government and in no case to deny access to the courts".

Another highlight of the policy declarations was that dealing with international trade relations in which reference was made to the continued restrictions limiting Canada's trade with the sterling area, and to the necessity for simplification of customs procedures in trade with the United States.

Following the presentation of the Policy Declarations and Resolutions to the Prime Minister and his cabinet, a delegation from the Executive Council presented a brief concerning the government's fiscal policy to the Ministers of Finance and of Internal Revenue. To summarize, the brief recommended "that the fiscal policy should be concerned with reducing government expenditures, which are both large and relatively inflexible; with reducing a tax burden that leaves little reserve for taxing power and is dulling incentive; with encouraging a volume of savings which will be adequate to meet the requirements of our investment program, and with keeping down a cost structure which might otherwise make the meeting of competition in foreign markets more difficult.

On March 3rd a Town Meeting of the Air was broadcast from Montreal under the sponsorship of the Canadian Chamber, the Chambre de Commerce de Montreal and the Montreal Board of Trade. The discussion of the subject "How Can We Strengthen the Canadian-U.S. Partnership" was led by Mr. Lionel A. Forsyth, Q.C. of Montreal and Mr. R. L. Bowditch of Boston. This broadcast, a regular Tuesday evening feature of the Columbia Broadcasting System in the United States, is believed to have made an important contribution to the development of a greater measure of understanding between citizens of Canada and of the United States.

A joint meeting of the Boards of Directors of the Canadian Chamber of Commerce and of the Chamber of Commerce of the United States was held in Montreal on June 18th. This was an historical occasion as it inaugurated what is expected to be an annual event between the boards of the two organizations. It is a logical outgrowth of the meetings of the Canada-U.S. Committee which has been held periodically for several years, and of the close and friendly relations that exist between the two organizations.

The annual meeting, as noted above, was held in Edmonton September 14th to 17th incl. A special feature was the tour that was arranged to enable the delegates to get acquainted with the west. Special trains left Montreal and Toronto and stopped at Winnipeg, Wainwright and Saskatoon on the way out, toured the Peace River country after the meeting, with stops at Bycroft, Grande Prairie, and Peace River town, and returned via C.P.R., stopping en-route at Red Deer, Calgary, Medicine Hat, Regina, the lakehead cities and Sudbury. As an alternative to the Peace River tour a plane load of the delegates flew up to Yellowknife and saw the real frontier.

Most of the stops that were made were of several hours' duration, affording the delegates an opportunity of seeing the town and the surrounding country and of sampling western hospitality provided by the local Chamber of Commerce. The experience of seeing that country and getting acquainted with its people is one that the delegates will long remember.

This report closes my tour of duty as the representative of the E.I.C. on the Canadian Chamber of Commerce. As a member of the Board of Directors, I have had an opportunity of getting acquainted with many of the leaders of Canadian business and I want to express my appreciation to the Institute for affording me this opportunity.

J. A. McCrory, M.E.I.C.,
*Institute Representative*

## Canadian Standards Association

The year 1953 was a very eventful, as well as active one for the Canadian Standards Association. A new set of by-laws for the Association became effective in April, 1953. Two basic changes in the administrative arrangements of the Association have been made, the first dealing with business administration which, under the new by-laws, is in the hands of a Board of Directors of 20 members, and secondly, concerning the acceptance and authorization of CSA standards, the final acceptance of technical details of draft standards is now the responsibility of a Technical Council of 100 members representing a broad range of diversified interests and distributed geographically throughout Canada. Authority to publish these drafts, as CSA standards, is now the responsibility of the Board of Directors. Furthermore, in connection with constitutional questions, the voting power has been extended to all members of the Association and Sustaining Members now have voting privileges commensurate with the number of membership that each such organization holds in the Association.

Under the guidance of 19 Sectional Committees work on 241 projects was carried out, necessitating 59 technical meetings and 8 administrative meetings. During the year, the Association published 54 standards, 40 of which were completely new standards and the remainder comprised new editions of existing standards. In this report it will also be noted that 27 projects have reached the near publication stage, 13 of which concern new standards and 14 new editions of existing standards. Under development were 128 standards, comprising 97 new and 31 revised editions. In addition, revision slips were published for 16 standards and revision slips for 16 other standards have reached the publication stage. It should also be mentioned that 51 reprints of existing standards were made to meet increasing demand for CSA standards.

The Association has also been very active in international standardization. In this field are the ABC — America-Britain-Canada standardization projects, which concern the development of unified screw threads, limits and fits and drawing practice. In the broader international field the CSA has "Observer" or "Participating" membership in 44 technical committees of the International Organization for Standardization (ISO). In the International Electrotechnical Commission (IEC) the CSA is actively participating or observing in the work of 39 technical committees dealing with international standards in the electrical field. These international standardization activities are carried on in the interests of better mutual understanding between nations engaged in international trade — particularly in relation to terminology and test procedures. It should be noted that in this particular field, no commitments as to the adoption of international standards will be made by the CSA without the approval of producer and consumer interests in Canada.

The two very active divisions, Approvals Division and Canadian Welding Bureau, have shown very satisfactory progress.

Under the Sectional Committee on Building Materials, 32 projects have been under active development. Sixteen standards for Asphalt and Tar Roofing Materials and a new edition of the standard for Vitrified Clay Pipe, were published, as well as a new standard for Gypsum Products. In addition, projects reaching the near publication stage are 4 on Gypsum Products and 6 for Brick and Hollow Tile. Under development were a new edition of a Gypsum standard and a new standard on Plastic Tile.

Six projects concerning the general revision of CSA Specification A23 on Concrete and Reinforced Concrete, Masonry Cement, Precast Concrete Units; revision slips for Specification A5 on Portland Cements, and 2 standards on Reinforced Concrete Poles, comprise the year's work for the committees under the jurisdiction of the Sectional Committee on Concrete. The 2 specifications for Concrete Poles — A14.1 on Concrete Poles (Not Prestressed) and A14.2 on Concrete Poles (Prestressed), were published.

In connection with the Sectional Committee on Mechanical Work, 17 projects were brought to various stages of completion. One standard, B96 for Compressed Gas Cylinder Valve Outlet and Inlet Connections (2nd Edition) was published. The new edition of Specification B97 for Limits and Fits for Engineering and Manufacturing reached the publication stage, and 12 other proposed standards are in various stages of development. Revision slips were issued for the CSA Code B51 on Boilers and Pressure Vessels, and a review was made of proposed revision slips for Specifications B12 on Galvanized Steel Wire Strand and the Code B44 on Passenger and Freight Elevators. Fifteen committee meetings were held concerning developments and projects for screw threads, screw products and small rivets, wire rope for marine purposes, identification of piping systems and conduit, cast iron pipe, drawing practice, limits and fits, marine aluminum valves, and boilers and pressure vessels.

The Sectional Committee on Fire Prevention and Protection held one meeting and meetings were held by subsidiary technical committees on Fire Tests on Building Construction and Materials, Automobile Fire Fighting Apparatus, Fire Hose, and Forestry Hose. One new edition of a standard was published — B89.3 for Automobile Fire Fighting Apparatus.

Under the Sectional Committee on Electrical Work a new edition of Specification C21, for Control Cable for Electrical Power Plant Equipment, was published and a new edition of Specification C68A, for Insulated Power Cable, neared the publication stage. In addition, considerable development work was carried on regarding 14 other projects concerning distribution transformers, galvanized steel line wire, electricity meters, aluminum cable, transformer and switch oils, oil circuit breakers, pivot-type transformers, magnet wire, safety equipment for linemen, fibre and asbestos cement conduit, instrument transformers, lightning rods, and oil-less circuit breakers.

In the field of Illumination, considerable progress was made in the development of proposed CSA Specifications for Industrial Lighting, School Lighting, and Street and Highway Lighting.

The 6th edition of the Canadian Electrical Code, Part I — Inside Wiring Rules, was published during August. In addition, a special pamphlet was published providing a very useful comparison of the 5th and 6th editions of the Code. The Committee on the Canadian Electrical Code, Part I, held 2 meetings during the year. The Committee on Canadian Electrical Code, Part II, held 3 meetings during the year. Thirty-six Part II projects were under development during the year, 9 of which resulted in published standards, 11 standards reached the publication stage, the others moving along normally.

Considerable progress was shown on projects under the Canadian Electrical Code, Part III — Outside Wiring Rules, where a new Standard C22.3 No. 1(D) "Joint Use of Poles to Support Supply and Communication Crossarms," was published. Seven other projects reached varying degrees of development.

One new Standard C22.4 No. 101 for Interference Measuring Instruments and Methods of Measurement, was published under the Canadian Electrical Code, Part IV — Radio. Attention was also given to the development of 7 other projects concerning general requirements; interference from vehicles using internal combustion engines; interference from electrical appliances and equipment; private and commercial receivers; transformers and RF transmission lines; antennae towers and antennae supporting structures; and amateur and domestic antennae supporting structures. Committees held 5 meetings during the year.

Under the Sectional Committee on Ferrous Metals, 8 new standards were published; one for Wire Nails, Spikes and Staples; and 7 in the G110 Series for Stainless Steel. One new edition of G38 — Carbon Steel Forgings, was also published. Three standards for Reinforcing Materials for Concrete are nearing the completion stage, while 3 other projects have reached various phases of development.

Some activity was reported by the Sectional Committee on Non-Ferrous Metals, which held one meeting during the year and at which 9 projects were reported in varying degrees of development, including revisions in the HN Series on Nickel and Nickel Alloys.

The Sectional Committee on Timber held its annual meeting in December. A new edition of Specification 043 for Structural Timber and 4 new standards, 0116 "Crossarms and Wood Pins for Power and Communication Lines"; 0118 "Western Red Cedar Shingles and Machine Grooved Shakes"; 0121 "Douglas Fir Plywood and Western Softwood Construction Plywood"; and 0122 "Glued-Laminated Structural Timber", were published. Considerable activity occurred in the development of a new edition of Specification 056 for Wood Piling; 35 new standards for Preservative Treatment of Timber; 2 standards for Millwork; and a new standard for Wood Insulator Pins. The total number of projects for the year was 48 and 3 committee meetings were held.

With regard to the Sectional Committee on Steel Construction, the proposed new edition of Specification S16 for Steel Structures for Buildings, neared completion after prolonged discussion, while a start has been made on the proposed new edition of the Specification S20 for Movable Bridges.

Specification W48.2, for Corrosion-Resisting Chromium and Chromium-Nickel Steel Welding Electrodes, was published under the Sectional Committee on Welding. A new standard W55.2 for Resistance-Welding reached the publication stage and a revision slip for Specification W47 "Welding Qualification Code", was published.

A meeting of the recently organized Sectional Committee on Marine Welding was held, during which a number of pertinent sub-committees were organized with a view to having consideration given first to the preparation of an appropriate Code for Marine Welding.

In the Miscellaneous field, 22 projects were under development and 9 committee meetings were held. In the general field, considerable progress was made in the development of appropriate standards for Hydraulic Lifts, Convector Radiation and Insecticide Vapourizers. Investigational work was carried on under the guidance of the Sectional Committee on Abbreviations.

Under Protective Packing, the new Standard Z102.12T for Corrugated Fibreboard Boxes and Products for Use by the Defence Services, was published. The proposed Standard Z102.10 for Skidding of Machinery has reached the publication stage, while 10 other projects have reached various stages of development.

Two new standards, one on Still Photography and the other on Survey Photography, were published under the Sectional Committee on Photographic Equipment. A new standard for 16-mm Projectors has reached the draft stage, and a committee meeting was held in this connection.

In conection with Oil Burning Equipment, considerable progress has been made in the proposed new edition of the Specification Z93.3 for Atomizing Type Domestic Oil Burning Equipment.

To repeat the opening sentence it has been a very active year.

P. L. Pratley, M.E.I.C.,
*Institute Representative*

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c/o Canadian Westinghouse Co.
Ltd., Hamilton, Ont.

# Abstracts of Reports from Branches

**Note—For Membership and Financial Statements see pages 154-156**

## Amherst District Branch

The Amherst District Branch came into being on March 6th, 1953, climaxing over two years' effort on the part of Institute members in this area to obtain a charter. Some of the men instrumental in organizing support for the idea during the early stages are now in other parts of Canada while others are no longer with us. The Branch, however, owes these men a debt of gratitude and would like to pay public recognition to the role they played in its formation. We have in mind men like W. G. Muir, J. F. MacKenzie, E. G. DeWolf, D. J. Bird and S. W. Crowell.

The Branch was highly honoured this year in having two presidential visits. The March inaugural dinner when the charter was presented by Dr. J. B. Stirling, immediate past-president, E.I.C. together with the November visit of President Ross Dobbin and Dr. Wright, were the highlights of the year's activity.

Enthusiastic plans for the coming year are now in preparation and include an iron ring ceremony scheduled to take place in January. The Branch has also contacted the Field Secretary requesting assistance in launching a Professional Development Course sometime in the new year.

## Belleville Branch

There were seven general meetings throughout the year, the minutes of which have been reported in the Journal. The topics of the various addresses represented a wide variety of engineering subjects. The attendance was exceptionally good at all meetings and particularly so at the March meeting when Dr. G. N. Patterson, Director of the Institute of Aero-Physics at the University of Toronto, addressed the Branch on "Shock Waves and Supersonic Flight". Many guests from the R.C.A.F. Station at Trenton were present for this meeting.

The annual visit of the President took the form of a dinner and dance. Mr. Dobbin delighted his audience with his stories of the Coronation. Several members of the Peterborough Branch were present for this meeting.

A very successful Professional Development Course, sponsored by the Junior Members of the Branch, was concluded in the Spring.

The Branch sponsored a $25.00 prize to be given to a Grade XIII student at the Belleville Collegiate who planned to take an engineering course and who had the highest standing in English, Algebra, Trigonometry, Geometry, Physics and Chemistry. This prize was won by William Campbell and presented by Mr. C. R. Whittemore at the commencement exercises.

## Border Cities Branch

The Professional Development course, which last year was very active with a great variety of topics, has lain dormant this fall due to the fact that many members prefer to take one course that would result in a more detailed and comprehensive coverage. This has been difficult to arrange primarily due to the very heavy workload most members in this area are subjected to. We hope to create more activity in this item in 1954.

This year, as last, the operation of the Ladies' Auxiliary was very successful, the membership this year being 95.

Our meetings were varied, all quite successful, with only three this year at Assumption College, two dinner meetings at the Prince Edward Hotel, one in a school auditorium, and one at Hiram Walker's Distillery. The Dinner Dance for the President's visit was very successful.

## Calgary Branch

During the year nine general meetings were held. Technical subjects included were, "Television" and "Influence of Future Power Requirements on the Science of Transmission". General interest subjects included "Colonization of Irrigated Areas in Alberta", "Refugee Problems in the Middle East", and "The Heritage of Western Canadian Exploration". Two film nights were also held. In addition, a panel discussion was held on the topic of Industrial Development in the Calgary Area. This panel discussion was very well received and the Program Committee is considering more meetings of this nature.

Attendance at the general meetings has been very good, averaging about 100 and on some occasions as high as 200.

A Men's Smoker was held this fall in order that the members might get more acquainted with one another.

The Luncheon Club has enjoyed phenomenal success this year and meets every Monday during the year with the exception of June, July and August. The attendance averages well over 50.

A very successful Ladies' Night was held last February. This was a formal affair and held under the name of "Slide Rule Soiree".

There was no presidential visit to the Branch during 1953.

In general, the Branch has enjoyed a very successful year and interest in the various activities has been high.

## Cape Breton Branch

There were seven meetings in 1953, six of them being held in the Isle Royale Hotel, Sydney, N.S. Apart from the two meetings, one in March on the occasion of President Stirling's visit and the other when President Dobbin visited us in November, attendance averaged 31. Inclement weather reduced attendance at the February meeting and also at the June Lobster Party. Attendance at two other meetings was affected by the closeness of other prominent functions taking place either the day before or the day after the Branch meetings.

The Professional Development Course sponsored by the Branch was organized and run by the Juniors under the capable chairmanship of Mr. Vince Palmer and keen interest was shown by all grades of membership.

The Cape Breton Branch was well represented by members and wives at the Annual General Meeting in Halifax. The decision to hold the 1953 meeting in Halifax was greatly appreciated by this Branch.

The decrease in membership in the year was largely due to the formation of the New Glasgow Branch. Previously, the Cape Breton Branch had several members resident in the mainland of North Nova Scotia.

## Central British Columbia Branch

There have been no achievements of note during the past year. From the viewpoint of getting together, in joint meetings, with the Central B.C. Branch of the Engineering Society, these have been generally successful. Excellent addresses and illustrated talks on a variety of subjects have been enjoyed, and with the exception of one meeting, attendance has been good.

The last Annual Meeting was highlighted by the visit of President Stirling and Mrs. Stirling, accompanied by Mr. and Mrs. Jubien of the Montreal Branch. We have not yet had a visit from President Dobbin this year, so we still have this pleasure to look forward to.

During the year we had a very enjoyable visit from our Field Secretary Past-President Grant. He entertained the members at Penticton, and was entertained by the members in Kamloops. Past-President Vance, on his way through, also favoured our Branch with a visit. The members in Kamloops, who could get together on short notice, spent a very enjoyable and informative evening with Mr. Vance and Mr. M. W. Maxwell of the C.N.R., Montreal.

Unfortunately the Student Guidance Committee, after a very auspicious start last year, did not get operational this year, as a committee. Due to a delay in the earlier part of the year waiting for promised help in the way of pamphlets and films from the E.C.P.D., which did not materialize, the committee was not organized in time to give assistance through the school career days, as was done last year. Several of our members, however, did participate in the career day talks at Kamloops and Penticton school. It is hoped that this committee will become active again next year, and that promised assistance will be forthcoming from the E.C.P.D.

## Corner Brook Branch

Since the inception of this Branch in May 1953 there have been three business meetings and three technical discussions. The attendance at these meetings was fair and with the Winter approaching it was hoped to plan regular meetings both technical and business and better attendance was expected.

During the short life of the Branch, we have lost both a secretary, Mr. Tasker, and a vice-chairman. Mr. J. N. Franklin. Both these gentlemen were active in the Branch and were missed very much on their departure. In both cases a farewell party was held and suitable presentations made.

The main highlights of the year's activities were the Inaugural Dinner and Dance held at the Community Center and the Banquet and Dance held at Wellon's Night Club in honour of the President's visit.

The Inaugural Dinner was well attended, there being twenty-four members and their partners and nine guests accompanied by their wives. After a very pleasant dinner and the usual after dinner speeches, a dance followed. During the dance "Muriel's Room" supplied liquid refreshments of a suitable nature.

Twenty-seven members and their partners attended the banquet held in honour of Mr. Dobbin's visit. The evening consisted of cocktails at 7.30 p.m. followed by dinner. The Chairman, Mr. E. Hinton, introduced the President, who gave a very interesting account of his attendance at the Coronation. At 9.45 p.m. the banquet adjourned and dancing followed for the balance of the evening.

This gives an outline of the main year's activities and the Branch looks forward to a more active year in 1954.

## Cornwall Branch

The Executive of the Cornwall Branch considers that the past year has been very successful. Meetings were well attended and a wide variety of subjects were offered. The Program Committee has established a pattern which it recommends be followed by future Committees. The pattern set out by the Program Committee calls for two Joint Meetings per year, one with the Chemical Institute of Canada, and the other with the local section of the American Institute of Electrical Engineers. The speaker for the Joint Meeting held in January with the Chemical Institute of Canada was Professor F. K. Hare, of McGill University, who spoke on "Canada's Natural Resources". The speaker for the Joint Meeting with the American Institute of Electrical Engineers held in October was Mr. J. R. Montague of the Hydro-Electric Power Commission of Ontario, who spoke on "The St. Lawrence Power Project."

In addition to the above, a Smoker, a Ladies' Night, a Branch Night and a Dinner are established customs. This year I. R. Tait and Colonel H. G. Thompson were present to discuss Institute affairs at the Smoker. The Ladies' Night was a well-received Supper Dance.

The Branch Night provided an opportunity for one of the Branch members to present a paper. This year Mr. L. Snelgrove spoke on "Plant Maintenance."

The Dinner was held prior to the summer recess. Air Vice-Marshall James presented an interesting talk on "Canada's Air Defences".

Two other meetings were reserved for obtaining speakers to present subjects of particular interest. Mr. J. Lefort of J. Edgar Dion, Consulting Management Engineers presented a paper on "Job Evaluation and Merit Rating"; Mr. R. W. Foster-Pegg, of the Gas Dynamics Laboratory of McGill University spoke on "Coal Burning Gas Turbines". The first meeting was held in May, and the second in September.

This year the Presidential Visit and Annual Dinner were combined to make a very enjoyable meeting which was the highlight of the year.

## Eastern Townships Branch

The year 1953 has been an outstanding one for the Eastern Townships Branch. Highlights of the many meetings were the visits of two presidents of the Institute, one in the spring and one in the fall.

On April 23rd the members and their lady guests entertained at the Tuque Rouge Club with J. B. Stirling, President, and L. A. Wright, Secretary, as the principal speakers. Also at the head table were His Worship, Mayor Emile Levesque, and Mr. G. M. Dick, Chairman of the Branch. A group of some 150 attended, and the affair was pronounced a great success.

Again on December 7, 1953, we were honoured with a visit from President R. L. Dobbin and the Assistant General Secretary, Colonel H. G. Thompson. For Mr. Dobbin this was the first visit to Sherbrooke, but Colonel Thompson came to renew many old acquaintances made on previous visits. The meeting was held at the New Sherbrooke Hotel, with some 85 ladies and gentlemen in attendance. The program included dinner and dancing, as well as short speeches by various notable guests. Included at the head table with Mr. Dobbin and Colonel Thompson were The Honorable Johnny Bourque and Mrs. Bourque, Mr. Deslauriers, representing the Mayor of Sherbrooke, and Mrs. Deslauriers, and Mr. J. C. Critchley, the Branch chairman.

An election of officers took place at the meeting on May 16, 1953. The nominating committee proposed the following names as members of the Executive Committee:

Chairman—John C. Critchley, Vice-Chairman—Gaston Masse, Committee Member—T. W. Houghton, Committee Member—Bruce R. Bradley, Committee Member—George P. Cote, Secretary—T. E. Chalmer.

The membership unanimously approved these proposed names.

One of the most interesting meetings of the year was a visit to the underground workings of the Ascot Metals, Suffield Mines, and the mill at Moulton Hill. The tour was personally conducted by the mine and mill executives, and the group was able to see and hear about the processing of the copper, lead and zinc ore from mine to mill. The outstanding feature of the trip was, of course, seeing the miners operate at the ore face, some 800 feet underground.

It was our pleasure to co-operate in a joint meeting with the Corporation of Professional Engineers of Quebec on the occasion of the visit of their President, Mr. R. F. Shaw, to Sherbrooke. As a majority of engineers in the Eastern Townships belong to and participate in the activities of both the Corporation and the E.I.C., this meeting was well attended.

This year, as in the past, many local industries graciously sponsored the buffet lunches which always add that final grand touch to each meeting.

## Fredericton Branch

The Branch has had a very successful year with ten general meetings and ten executive meetings being held. The executive meetings were usually held on the first Monday of each month and the general meetings on the third Monday.

Resolutions were presented to various Government bodies supporting the appointment of qualified professional engineers to vacant positions which required men with engineering training.

The Branch enjoyed the close cooperation of the Student's Society at the University of New Brunswick and is doing everything possible to assist the Engineering Departments of the University in their celebration of the centennial of engineering instruction at the University.

During the year Professor H. W. McFarlane addressed the Branch on the general topic of "Soil Mechanics" and Mr. Ketchen of Fraser Companies, Edmundston, gave a very interesting talk on the Pulp and Paper Industry. A very spirited panel was conducted on Collective Bargaining.

In May the graduating engineers from the University of New Brunswick were entertained and in June our ladies joined us in a very enjoyable dance.

The November meeting was held in Perth for the convenience of our non-resident members in the Saint John River Valley and Mr. J. L. Feeney, Chief Engineer, N.B. Electric Power Commission, spoke on "Coal vs. Water".

A successful Professional Development Program was conducted; six lectures were heard in this series.

## Halifax Branch

The year 1953 was unique in the history of the Halifax Branch in that we had an official visit from two Presidents. We held our first Field Meeting which we hope will be an annual event; and the Sixty-seventh Annual Meeting of the Institute was held in Halifax. Also during this past year, Branches were opened in Amherst and New Glasgow with the result the Halifax Branch lost many active and loyal members. The opening of these Branches has resulted in the Halifax Branch district being reduced to Halifax County and that part of Nova Scotia from Halifax through to Yarmouth.

The year started off with the Joint Annual Meeting of the Engineering Institute of Canada and the Association of the Professional Engineers of Nova Scotia which was held in the Nova Scotian Hotel on Monday, January 26.

Dr. Will R. Bird was the guest speaker. There were 236 present.

On Thursday, February 19, Mr. Hugh L. Pratley spoke on the Lions Gate Bridge. In view of the construction of the Halifax-Dartmouth bridge this was a most popular subject and there were 135 present.

Dr. J. B. Stirling made his presidential visit on Monday, March 9, and this was made the occasion of a ladies' night. The dinner was well attended, there being 164 present.

On April 8, Mr. R. M. Richardson, President of the Dominion Council of Professional Engineers, spoke on the "History of Engineering in Canada". There were 40 present.

The annual meeting was held in Halifax from May 20 to May 22 inclusive. From the statistics we have obtained from this annual meeting we understand the Wednesday dinner at which the recorded attendance was 492 was the largest Wednesday dinner in the history of the Institute. The total registration for the convention was 770, the second largest on record and we understand the Banquet and Dance, which approached the 1,000 mark in attendance, was the largest ever. We would also like to pay tribute to the Royal Canadian Navy for their co-operation and assistance without which we could not have held the Banquet and Dance.

The next meeting was our first Field Meeting held in the Paramount Hotel in Wolfville on Thursday, October 22, at which our guest speaker was Mr. Manning K. Ells. There were 87 present including a number of engineering students from Acadia University. From the enthusiasm expressed we hope this will become an annual event.

We had a second official presidential visit from Ross L. Dobbin who spoke to us on Thursday, November 12. This was also a combined meeting with the Nova Scotia Technical College Alumni Association, and there were 92 present.

The Annual Meeting was held in the Nova Scotian Hotel on Tuesday, December 15 at which the various yearly reports were read; the retiring chairman gave a brief account of the year's activities and the incoming executive was installed.

## Hamilton Branch

During 1953 membership in the Branch increased from 456 to 465.

The eight meetings held this year were well supported by the membership. A visit to the Steel Company of Canada in September commanded the largest attendance. Again this year the November meeting was held in conjunction with a buffet supper which proved very popular with a result that the executive are considering holding all meetings on this basis.

The Annual Engineers' Ball was held in October and the attendance was above all expectation. This was due to holding the ball on a Friday evening and in the city of Hamilton, whereas in the past it was held on a Thursday and approximately ten miles from the centre of the city.

Three committees deserving special mention were the Students' and Juniors' Paper Competition Committee, the Professional Development Program Committee and Budget Committee. Five contestants participated in the paper competition, all of whom presented excellent papers. The third session of the Professional Development Program was organized into four groups with approximately seventy-five Branch members participating. The organization of this committee was exceptionally good through the efforts of G. L. Schneider and E. W. Hill. Their annual meeting consisted of an employer's night which was well attended by local business men, all of whom expressed keen interest in the course. The Budget Committee are to be commended for their efforts in drawing up a practical budget which was closely matched by the expenditures for the year.

We record with regret the passing of J. T. Thwaites and A. G. Riddell.

## Huronia Branch

Our Branch was inaugurated on September 11. This occasion which took place at a summer resort near Orillia proved to be very memorable and pleasant. The Huronia Branch is truly grateful to the many people who have assisted in the organization of our Branch.

The inauguration was followed by a meeting in October and one in November. The October meeting was in the form of a visit through the Barrie plant of Canadian General Electric. This was made possible through the kindness of Mr. J. A. Mitchison. The November meeting consisted of the showing of two films and a discussion on Branch activities etc., to the many prospective members who were in attendance. The one film was technical, the other pertained to human relations.

For the coming year the Branch is looking forward to further plant visits and interesting speakers.

## Kingston Branch

The Kingston Branch enjoyed another very successful year. Interest and attendance were high at all eight meetings. Branch membership reached an all-time high with a total of 349 Members, Juniors and Students being registered. One buffet supper meeting and one dinner meeting were held. The dinner meeting was held in December and was the first such venture other than Ladies' Night. Because of the favourable comments received two more dinner meetings are planned for the spring program.

A joint dinner meeting was held in March with the local Branches of the Chemical Institute of Canada and the Junior Chamber of Commerce. Another joint meeting is being planned in the 1954 spring program.

The Branch also sponsored a Student papers by Queen's students and R.M.C. Cadets.

## Kitchener Branch

The total income for the year was $440.08 with disbursements $496.19, leaving a deficit of $56.11 for the year's operation.

The executive of the Kitchener Branch feel that we have had a most successful year regardless of the above financial statement. A pattern of meetings has now been set up and it is expected that this system will be continued as long as the Branch exists.

During the year we had a very successful field trip to General Motors at Oshawa, a Ladies' Night at Leisure Lodge, Preston, and a Stag in September just outside of Kitchener. In addition, a golf tournament was held in August.

We now have an annual joint meeting between the Grand Valley group of engineers and ourselves, alternating between Kitchener and Brantford and a joint meeting with the Kitchener Rubber groups is planned for December.

All regular meetings are held at the Officers' Mess, Knollwood Park, Kitchener, and excellent facilities are provided for conducting the engineering meeting along with the social hour afterwards. Our usual practice has been to provide a light lunch of cold meats, cheese and pickles, etc., to provide the members with an opportunity to get to know each other.

## Kootenay Branch

During 1953 the Kootenay Branch continued its policy of holding different types of meetings as much as possible. In a small, relatively isolated branch such as ours, this policy has proved necessary to stimulate continued attendance.

Five Dinner Meetings and a Smoker were held during the year. The Smoker drew the largest attendance: 120 members and guests. The program consisted of showing two 45 minute films followed by the usual smoker, refreshments and discussions. The two films which were shown, "Information at Work" by the Taylor Instrument Companies and "Oil Across the Rockies" by Trans Mountain Oil Pipeline Company, are highly recommended.

"Junior Nite" again drew forth some interesting papers by the Juniors and a very attentive audience.

A "Ladies' Nite" was tried to give the wives of members a chance to see what goes on at a Branch meeting. A large attendance, a good dinner, a snappy business session and an excellent address on current affairs by Sir Patrick Hamilton, the British Industrialist, all contributed to making this a very successful evening. "Ladies' Nite" will no doubt become an annual event.

## Lakehead Branch

The Lakehead Branch had a very successful year with a special effort being made to bring the members together. Ten meetings were held, five in Fort William, three in Port Arthur, one in Dryden and one in Marathon.

The meeting in May was held in Dryden, 220 miles west of Fort William. Marathon, 200 miles east of Fort William, was visited in October. Both meetings included a tour of the towns' leading industry and a dinner. Col. L. F. Grant was guest speaker at the October meeting.

The annual dance, held in January, was very well attended.

During the year Mr. S. E. Flook, a member, gave an interesting talk about the early history of this area, Mr. Lorne Goodall spoke on "Some Economic Aspects of the Paper Industry" and Mr. B. G. Ballard discussed the work of the Radio and Electrical Engineering Division of the National Research Council. Films about recent engineering achievements were also shown.

The Student Guidance Committee continued a program similar to that of 1952.

## Lethbridge Branch

The Branch held six regular meetings during the year with an average attendance of 54. Five Executive meetings were held for the transaction of Branch business.

During 1953 the Branch held two ladies' nights which were well attended and proved to be quite popular with the members.

A very enjoyable and successful field trip to the Calgary Power Limited Spray Lakes Project near Banff was held during September.

## London Branch

The largest and most enthusiastic meeting of the spring session took place on May 26th, when Mr. H. E. Rice, manager, Electronics Division, Canadian Westinghouse, discussed "Television". In view of the anticipated T.V. station for London the members and Association members were greatly interested in the topic.

During the fall term Mr. W. Hogg, M.E.I.C., described, with the assistance of excellent slides, "Sir Adam Beck No. 2". Both these meetings proved to be the most popular of the regular meetings. However we had a wide range of subjects for our meetings. Mr. E. V. Buchanan spoke at the February meeting on industrial applications of isotopes. Prof. A. E. Allcut, University of Toronto, spoke on Fuel Conservation at the April meeting.

Opening the fall meetings Dr. A. E. Misener, University of Western Ontario, spoke on "Possibilities for Commercial Heat Pumps in Canada".

One plant tour was held this year, almost 90 turned up for an interesting trip through General Motors Diesel, Ltd., London.

A golf tournament and dinner closed our spring sessions but the expected golfers failed to turn up. It is unlikely this experiment will be repeated. Many missed T. M. Medland's after dinner speech.

The year was highlighted by the President's visit in November. We took this opportunity to hold a dinner in his honour and were gratified to welcome members of many of the Ontario and Montreal Branches who were present at the afternoon Council session.

The new executive will be introduced at a Supper Dance to be held in Hotel London on Tuesday, January 19th.

## Lower St. Lawrence Branch

The executive of the Branch held three meetings and four various meetings took place in February, March, September and December, 1953.

On February 13, a group of sixty attended the Annual Ladies' Night, presided by Mr. and Mrs. Leo McLaren, chairman of the Branch.

The Institute President, Dr. J. Stirling and his wife visited our Branch. The group, including Dr. Wright and some members of the executive, were shown the installation of The Canada Wire and Cable Company, which is assembling the submarine cables for the transportation of electrical power between both shores of the St. Lawrence River, a distance of 32 miles. They also visited the New Marine School. A cocktail was served, followed by a dinner and a dance. The President and the General Secretary addressed the meeting.

The new President of the Institute, R. L. Dobbin, and the General Secretary spent a whole week with the Branch, visiting various centres of our territory on the first day. A meeting of the executive in Rimouski was attended by the President, followed by a visit to The Canada Wire and Cables' plant and a dinner with Messrs. Dobbin and Wright.

The next day, the President with the General Secretary and the Branch Secretary flew across the St. Lawrence to visit the Branch sections on the North, i.e., Seven Islands, Baie Comeau and Forestville. At these various centres, the group was warmly entertained and a great number of engineers attended all social events.

The President and the General Secretary had the opportunity to observe "de visu" the gigantic projects which are under way in this region.

It took a full week to rush through these important centres and yet the section around Gaspe and the new site of Gaspe Noranda Mines could not be visited this year. This shows the immensity of the territory covered by this Branch and the problem of inter-communications. Every possible means of transportation was used during their stay within the limits of our Branch. Railway, planes, boat and cars (a month later, they could have used snowmobiles and dog-sleighs).

It is the first time in the Institute history that a president spent so many days with a Branch and saw so much.

This was an experience enjoyed by everybody and we hope that it will be repeated.

On December 7, a meeting was held where four interesting films were shown. The showing of these films was made possible due to an agreement between "La Société des Ingénieurs Civils de France and Geo. Demers, Consulting Engineer.

## Moncton Branch

During the year, the Branch was host to two presidents of the Institute. On January 27th, the then president, Dr. J. B. Stirling, addressed a dinner meeting of the Branch and on September 23rd the Branch was visited by President R. L. Dobbin.

There were three technical meetings held. An address on the History of Engineering in Canada, was given, on April 14th, by R. M. Richardson, president of the Dominion Council. In October, M. A. Forbes, of the Chrysler Corporation, addressed the Branch on the subject, the Design of New Car Models. On November 30th, a record meeting for the year, heard Dr. P. L. Pratley, assisted by H. H. L. Pratley, speak on the Design and Construction of the Halifax Harbor Bridge.

The social events of the season were, a ladies' night and dance, in February, and, a yachting trip on Shediac Bay, on July 18th, when Branch members were the guests of Mr. and Mrs. R. L. Parsons.

## Montreal Branch

The policy of promoting cooperation with other societies has been very actively pursued during the past year.

Under a mutual agreement between the British Institutions of Civil, Electrical and Mechanical Engineers, and the Engineering Institute of Canada, resident members of the British Institutions have been given a six months free membership in the E.I.C. Welcoming letters from the Executive have been sent out to more than 150 such resident members in the Montreal area.

The Electrical Section of the Branch once again worked in close cooperation with the local section of the American Institute of Electrical Engineers in providing a complete joint program for the two sections. Members of the American Society of Mechanical Engineers and The American Institute of Chemical Engineers received notices of Branch meetings and were cordially invited to attend. Joint meetings were also arranged with the Institute of Radio Engineers, the Illuminating Engineers Society, the American Society of Heating and Ventilating Engineers and the Instrument Society of America.

A very successful meeting was also held with the Province of Quebec Association of Architects.

Recently the I.E.E. combined forces with the local branches of the I.R.E. and E.I.C. to hold a unique joint meeting via a two-way radiotelephone link between London, England and Montreal.

Members of the C.P.E.Q. and Montreal Branch once again enjoyed the annual golf tournament sponsored jointly by the two organizations.

During the latter part of the year the Executive Committee gave considerable thought to the workability of the present by-laws with regard to the Junior Section. Plans are being formulated to ensure that the young engineers have adequate representation on the Executive and other committees of the Branch.

The Executive met eleven times during the year to conduct the business of the Branch.

The Program Committee held three dinner meetings during the year at which plans for the year's program were arranged.

Average attendance at meetings for this year has been approximately 91.

The chemical section was responsible for two Branch meetings and six section meetings. The civil section arranged three Branch meetings and six section meetings. The electrical section organized one Branch meeting and held fourteen section meetings. The management section contributed five Branch meetings and held three section meetings. Five meetings of the mechanical section were held. That section also arranged four Branch meetings. The transportation section organized four Branch meetings.

Three forums for high school students were held during the year, one in English and two in French. Approximately 625 students attended the meetings.

## Newfoundland

Two presidential visits highlighted the activities of this Branch. President J. B. Stirling visited the Branch in April and President Ross L. Dobbin in November.

Col. R. F. Schirmer, U.S.A.F., spoke to the Branch at the January meeting on "Master Planning of Air Bases".

At the February meeting Capt. M. Perkins, U.S.A.F. took his audience on a tour, via colour photographs, of Greenland air bases, parts of Newfoundland and finally Berlin and Northern Germany.

Approximately 100 couples attended the second Annual Dance held on Feb. 5 at the Old Colony Club.

Three students from Memorial Uni-

*(Continued on page 157)*

# Membership and Financial Statements of

| BRANCHES | Amherst | Belleville | Border Cities | Calgary | Cape Breton | Central British Columbia | Corner Brook | Cornwall | Eastern Townships | Edmonton | Fredericton | Halifax | Hamilton | Huronia | Kingston |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MEMBERSHIP** | | | | | | | | | | | | | | | |
| **Resident** | | | | | | | | | | | | | | | |
| Hon. Members | .. | 1 | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 1 | 4 | .. | 2 |
| Members | 27 | 35 | 71 | 209 | 43 | 19 | 17 | 25 | 34 | 273 | 67 | 245 | 162 | 20 | 71 |
| Juniors | 24 | 24 | 104 | 128 | 23 | 25 | 11 | 14 | 41 | 242 | 8 | 72 | 191 | 22 | 60 |
| Students | 6 | 7 | 22 | 48 | 7 | 8 | 3 | 7 | 19 | 99 | 71 | 79 | 96 | 6 | 154 |
| Affiliates | .. | 2 | 2 | .. | 1 | .. | .. | 11 | .. | 24 | .. | 1 | 7 | .. | 10 |
| Total | 37 | 69 | 199 | 385 | 74 | 52 | 31 | 57 | 94 | 619 | 146 | 398 | 460 | 48 | 297 |
| **Non-Resident** | | | | | | | | | | | | | | | |
| Hon. Members | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Members | .. | 3 | 18 | 16 | 5 | 2 | .. | 8 | 24 | 17 | 18 | 51 | 1 | .. | 16 |
| Juniors | . | 6 | 13 | 19 | 3 | 3 | .. | 6 | 29 | 24 | 7 | 18 | 1 | .. | 24 |
| Students | | 2 | 10 | 9 | 3 | 4 | .. | 4 | 13 | 17 | 4 | 16 | 3 | .. | 12 |
| Affiliates | .. | .. | .. | .. | .. | 1 | .. | 1 | .. | . | .. | .. | .. | .. | .. |
| Total | | 11 | 41 | 44 | 11 | 10 | .. | 19 | 66 | 58 | 29 | 85 | 5 | .. | 52 |
| Grand Total Dec. 31st, 1953 | 37 | 80 | 240 | 429 | 85 | 62 | 31 | 76 | 160 | 677 | 175 | 483 | 465 | 48 | 349 |
| " " Dec. 31st, 1952 | .. | 71 | 242 | 406 | 105 | 56 | 27 | 67 | 157 | 608 | 151 | 588 | 456 | .. | 322 |
| Branch Affiliates, Dec. 31st, 1953 | .. | 9 | .. | 50 | 24 | 15 | .. | 12 | 20 | .. | .. | .. | 8 | .. | 10 |
| **FINANCIAL STATEMENT** | | | | | | | | | | | | | | | |
| Balance as of Dec. 31st, 1952 | .. | 200.69 | 556.47 | 481.66 | 703.40 | 135.04 | 110.12 | 142.93 | 431.52 | 983.98 | 260.75 | 825.09 | 25.76 | .. | 263.33 |
| **Income** | | | | | | | | | | | | | | | |
| Rebates from E.I.C. Hq. | 75.00 | 260.10 | 543.30 | 227.75 | 58.80 | 120.20 | 100.00 | 205.20 | 248.00 | 303.00 | 186.10 | 127.00 | 868.50 | 139.50 | 681.80 |
| Payments by Prof. Assns. | 30.80 | .. | .. | 666.98 | 176.40 | .. | .. | .. | .. | 983.15 | 140.00 | 725.70 | .. | .. | .. |
| Branch Affiliate Dues | .. | 92.99 | .. | 271.00 | 240.00 | 68.15 | .. | 33.00 | 205.22 | 50.00 | .. | .. | 68.00 | .. | 108.00 |
| Interest | .. | .. | .. | .. | .. | .. | .. | .. | 2.06 | .. | .. | 3.56 | 49.66 | .. | 4.16 |
| Miscellaneous | 150.00 | 304.41 | 568.65 | 31.11 | 727.00 | 1.31 | 332.81 | 7.50 | .. | 2,284.40 | 774.25 | 629.23 | 125.00 | 280.86 | 118.37 |
| Total Income | 255.80 | 657.50 | 1,111.95 | 1,198.84 | 1,202.20 | 189.66 | 432.81 | 388.63 | 537.88 | 3,620.55 | 1,100.35 | 1,485.49 | 1,111.16 | 420.36 | 912.33 |
| **Disbursements** | | | | | | | | | | | | | | | |
| Printing, Notices, Postage① | 17.96 | 60.42 | 140.04 | 561.20 | 53.41 | 10.00 | 1.50 | 31.18 | 49.28 | 595.75 | 136.29 | 343.51 | 480.69 | 14.51 | 160.37 |
| General Meeting Expense② | 61.60 | 209.25 | 773.15 | 348.77 | .. | 29.11 | 16.65 | .. | 399.30 | 25.70 | 87.47 | 28.50 | 222.65 | 3.48 | 270.76 |
| Special Meeting Expense③ | 115.75 | 284.40 | 11.65 | 186.89 | 1,413.05 | .. | 342.63 | 137.97 | .. | 2,152.03 | 833.56 | 450.54 | .. | .. | 50.00 |
| Honorarium for Secretary | .. | .. | .. | 25.00 | .. | .. | .. | .. | .. | 100.00 | .. | 100.00 | .. | .. | .. |
| Stenographic Services | 10.00 | .. | 31.06 | .. | .. | .. | .. | .. | .. | 5.00 | .. | 30.00 | 50.00 | 3.77 | .. |
| Travelling Expenses④ | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 50.00 | .. | .. | .. |
| Subs. to other organizations | .. | .. | .. | .. | .. | .. | .. | 5.00 | .. | .. | .. | .. | .. | .. | .. |
| Subs. to *The Journal* | .. | 25.65 | .. | 48.30 | 40.15 | 32.15 | .. | 6.03 | 40.00 | .. | .. | .. | 8.00 | .. | 18.00 |
| Special Expenses | .. | 36.00 | .. | .. | 149.75 | .. | .. | 7.18 | 9.75 | 64.00 | .. | 80.00 | 50.00 | .. | .. |
| Miscellaneous | 0.60 | 5.48 | .. | 6.90 | .. | 0.54 | 75.41 | 17.50 | .16 | 17.87 | 4.02 | .. | 84.70 | 10.00 | .. |
| Total Disbursements | 205.91 | 621.20 | 1,013.27 | 1,177.06 | 1,656.36 | 71.80 | 436.19 | 204.86 | 498.49 | 2,960.35 | 1,061.34 | 1,082.55 | 896.04 | 31.76 | 499.13 |
| Surplus or *Deficit* | 49.89 | 36.30 | 98.68 | 21.78 | *454.16* | 117.86 | *3.38* | 183.77 | 39.39 | 660.20 | 39.01 | 402.94 | 215.12 | 388.60 | 413.20 |
| Balance as of Dec. 31st, 1953 | 49.89 | 236.99 | 655.15 | 503.44 | 249.24 | 252.90 | 106.74 | 327.70 | 388.31 | 1,644.18 | 299.76 | 422.15 | 240.88 | 388.60 | 676.53 |

①Includes general printing, meeting notices, postage, telegraph, telephone and stationery.

②Includes rental of rooms, lanterns, operators, lantern slides and other expenses.

③Includes dinners, entertainments, social functions, and so forth.

④Includes speakers, councillors or branch officers.

# the Branches as at December 31, 1953

| Kitchener | Kootenay | Lakehead | Lethbridge | London | Lower St. Lawrence | Moncton | Montreal | Newfoundland | Niagara Peninsula | Nipissing and Upper Ottawa | Northern Nova Scotia | Northern New Brunswick | North Eastern Ontario | Ottawa | Peterborough | Port Hope |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *.. | .. | .. | .. | .. | .. | .. | 6 | .. | .. | .. | .. | .. | .. | 1 | 1 | 1 |
| 33 | 25 | 40 | 30 | 64 | 24 | 50 | 1,604 | 36 | 109 | 24 | 33 | 20 | 24 | 374 | 50 | 12 |
| 32 | 32 | 38 | 21 | 51 | 31 | 24 | 1,082 | 25 | 111 | 12 | 11 | 32 | 26 | 223 | 58 | 11 |
| 13 | 11 | 15 | 6 | 19 | 18 | 12 | 970 | 26 | 34 | 5 | 7 | 12 | 16 | 118 | 16 | 2 |
| 5 | .. | 5 | .. | 1 | 1 | 1 | 16 | .. | 2 | 4 | .. | 1 | .. | 4 | .. | .. |
| 83 | 68 | 98 | 57 | 135 | 74 | 87 | 3,678 | 87 | 256 | 45 | 51 | 65 | 66 | 720 | 125 | 26 |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. |
| .. | 15 | 14 | 18 | 12 | .. | .. | 79 | 7 | 6 | 7 | 2 | .. | .. | 48 | 3 | 2 |
| .. | 17 | 25 | 11 | 10 | .. | .. | 73 | 14 | 5 | 12 | .. | .. | .. | 47 | 7 | 2 |
| .. | 11 | 8 | 8 | 5 | .. | .. | 54 | 16 | 1 | 1 | .. | .. | .. | 25 | 2 | 1 |
| .. | .. | .. | .. | .. | .. | .. | 1 | .. | 2 | .. | .. | .. | .. | .. | .. | .. |
| .. | 43 | 47 | 37 | 27 | .. | .. | 207 | 37 | 14 | 20 | 2 | .. | .. | 121 | 12 | 5 |
| 83 | 111 | 135 | 94 | 162 | 74 | 87 | 3,885 | 124 | 270 | 65 | 53 | 65 | 66 | 841 | 137 | 31 |
| 63 | 116 | 147 | 87 | 195 | 76 | 182 | 4,027 | 153 | 244 | 77 | .. | .. | 77 | 859 | 117 | 28 |
| 5 | 14 | 6 | 46 | .. | 1 | 3 | 4 | .. | 4 | 4 | .. | .. | .. | 10 | 9 | .. |
| 231.83 | 124.75 | 235.26 | 142.85 | 672.06 | 61.47 | 877.61 | 6,992.82 | | 641.84 | 282.38 | .. | .. | 347.64 | 779.47 | 177.32 | 22.74 |
| 229.80 | 250.50 | 354.30 | 91.70 | 489.30 | 212.00 | 159.00 | 7,925.60 | | 570.00 | 341.90 | 27.90 | 83.70 | 194.00 | 1,363.80 | 428.20 | 204.40 |
| .. | .. | .. | 142.82 | .. | .. | 76.00 | .. | | .. | .. | 107.80 | 22.00 | .. | .. | .. | .. |
| 20.00 | 100.00 | 60.00 | 135.00 | .. | 10.00 | 12.50 | 24.00 | | .. | 45.85 | .. | .. | .. | .. | 10.00 | .. |
| .54 | .. | 3.00 | .. | 3.00 | .. | 10.94 | 90.00 | | 16.93 | .. | .. | .. | .28 | 42.07 | 2.41 | .. |
| 189.74 | 356.75 | 14.74 | 61.10 | 722.15 | 325.00 | 439.68 | 187.33 | | 354.40 | 686.71 | 125.00 | 493.68 | 1.85 | 199.65 | 2.30 | 5.31 |
| 440.08 | 707.25 | 432.04 | 430.62 | 1,214.45 | 608.47 | 698.12 | 8,226.93 | | 941.33 | 1,074.46 | 260.70 | 599.38 | 196.13 | 1,605.52 | 442.91 | 209.71 |
| 98.93 | 16.84 | 84.02 | 80.80 | 285.68 | 31.94 | 23.61 | 3,135.81 | | 229.20 | 127.35 | 4.73 | .. | 10.44 | 506.36 | 151.99 | 1.46 |
| 60.45 | 26.00 | 66.50 | 89.60 | 95.95 | 3.00 | 60.26 | 141.91 | | .. | 116.06 | .. | 35.00 | 39.88 | 40.00 | 18.00 | 1.75 |
| 277.46 | 440.47 | 100.65 | 2.82 | 770.52 | 444.65 | 588.09 | 978.92 | | 418.30 | 772.31 | 92.90 | 442.74 | 37.23 | 296.50 | 194.10 | 6.80 |
| .. | .. | 17.15 | 25.00 | .. | .. | 50.00 | 500.00 | | 75.00 | .. | .. | .. | 25.00 | .. | .. | .. |
| 16.00 | .. | 20.00 | .. | 2.00 | 6.25 | .. | 400.00 | | 21.75 | 1.90 | 10.50 | .. | 20.00 | 75.00 | .. | 2.70 |
| .. | .. | .. | | 20.30 | 10.90 | .. | .. | | .. | .. | .. | . | .. | .. | 14.13 | .. |
| .. | .. | .. | | .. | .. | .. | .. | | .. | 25.00 | .. | .. | .. | .. | .. | .. |
| 10.15 | 52.15 | 12.45 | | .. | .. | 5.15 | 4.00 | | .. | 11.00 | .. | .. | .. | .. | .. | .. |
| 33.42 | .. | 20.50 | | 89.77 | 16.00 | .. | 985.28 | | 50.25 | .. | .. | 42.32 | .. | 210.00 | 45.78 | .. |
| 5.78 | 14.10 | 1.03 | 65.06 | 2.00 | 1.20 | 68.79 | 351.22 | | 25.93 | .. | 10.60 | .99 | 3.05 | 12.24 | 3.59 | .31 |
| 496.19 | 549.56 | 322.30 | 263.28 | 1,266.22 | 513.94 | 795.90 | 6,497.14 | | 820.43 | 1,053.62 | 118.73 | 521.05 | 135.60 | 1,140.10 | 427.59 | 13.02 |
| *56.11* | 157.69 | 109.74 | 167.34 | *51.77* | 33.06 | *97.98* | 1,729.79 | | 120.90 | 20.84 | 141.97 | 78.33 | 60.53 | 465.42 | 15.32 | 196.69 |
| 175.72 | 282.44 | 345.00 | 310.19 | 620.29 | 94.53 | 779.83 | 8,722.61 | | 762.74 | 303.22 | 141.97 | 78.33 | 408.17 | 1,244.89 | 192.64 | 219.43 |

*For voting purposes only, there should be added to Montreal Branch, an additional 562 members, 384 resident in the United States, 181 in British possessions and 97 in foreign countries.

| BRANCHES | Prince Edward Island | Quebec | Saguenay | St. John | St. Maurice Valley | Sarnia | Saskatchewan | Sault Ste. Marie | Sudbury | Toronto | Vancouver | Vancouver Island | Winnipeg | Yukon |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MEMBERSHIP** | | | | | | | | | | | | | | |
| **Resident** | | | | | | | | | | | | | | |
| Hon. Members | .. | .. | | 1 | .. | .. | 1 | .. | .. | 2 | .. | .. | 16 | |
| Members | 19 | 132 | 62 | 71 | 74 | 64 | 167 | 23 | 35 | 699 | 278 | 84 | 269 | 5 |
| Juniors | 8 | 122 | 57 | 20 | 108 | 73 | 87 | 11 | 24 | 648 | 208 | 42 | 180 | 6 |
| Students | 5 | 276 | 18 | 12 | 49 | 13 | 14 | 5 | 7 | 272 | 148 | 11 | 143 | 2 |
| Affiliates | 1 | 1 | . | 1 | 1 | 1 | .. | 1 | 2 | 8 | 2 | .. | 26 | |
| Total | 33 | 531 | 137 | 105 | 232 | 151 | 219 | 40 | 68 | 1,629 | 636 | 137 | 634 | 13 |
| **Non-Resident** | | | | | | | | | | | | | | |
| Hon. Members | .. | .. | | | .. | .. | .. | .. | 1 | .. | .. | .. | 3 | |
| Members | .. | 8 | 1 | 9 | 8 | .. | 155 | 3 | 4 | 45 | 30 | 16 | 11 | |
| Juniors | 3 | 15 | 4 | 5 | 8 | .. | 20 | 5 | 5 | 69 | 51 | 17 | 44 | |
| Students | 2 | 20 | 2 | 6 | 9 | .. | 87 | 4 | 1 | 17 | 28 | 5 | 18 | |
| Affiliates | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 | .. | .. | 6 | |
| Total | 5 | 43 | 7 | 20 | 25 | .. | 262 | 12 | 12 | 132 | 109 | 38 | 82 | |
| Grand Total Dec. 31st, 1953 | 38 | 574 | 144 | 125 | 257 | 151 | 481 | 52 | 80 | 1,761 | 745 | 175 | 716 | |
| " " Dec. 31st, 1952 | 34 | 518 | 182 | 117 | 244 | 154 | 430 | 57 | 68 | 1,610 | 798 | 185 | 709 | |
| Branch Affiliates, Dec. 31st, 1953 | .. | .. | 4 | 11 | 1 | 1 | .. | 10 | 4 | 1 | .. | 1 | 32 | |
| **FINANCIAL STATEMENT** | | | | | | | | | | | | | | |
| Balance as of Dec. 31st, 1952 | 46.40 | 664.53 | 562.07 | 638.72 | 487.84 | 335.81 | 271.29 | 470.76 | 513.19 | 2,833.09 | 676.95 | 320.70 | 2,218.79 | |
| **Income** | | | | | | | | | | | | | | |
| Rebates from E.I.C. Hq | 125.00 | 735.50 | 432.00 | 89.70 | 596.40 | 434.40 | 131.17 | 168.00 | 234.90 | 1,858.00 | 885.75 | 396.30 | 264.00 | |
| Payments by Prof. Assns | . | .. | .. | 108.00 | .. | .. | 804.02 | .. | .. | .. | .. | .. | 800.75 | |
| Branch Affiliate Dues | .. | .. | 21.00 | 71.00 | | .. | .. | 47.00 | 36.00 | 5.00 | 25.00 | 3.00 | 170.00 | |
| Interest | . | .. | .. | .. | .76 | .. | . | 9.00 | 2.78 | 42.64 | 16.72 | .. | 33.00 | |
| Miscellaneous | 22.69 | 327.83 | 453.00 | 80.25 | 569.75 | 239.85 | .. | 175.00 | 16.28 | 1,130.79 | 1,291.36 | 18.02 | 28.35 | |
| Total Income | 147.69 | 1,063.33 | 1,181.73 | 348.95 | 1,166.91 | 674.25 | 935.19 | 399.00 | 289.96 | 3,011.43 | 2,218.83 | 412.32 | 1,296.10 | |
| **Disbursements** | | | | | | | | | | | | | | |
| Printing, Notices, Postage① | .. | 301.07 | 24.05 | 60.37 | 118.53 | 30.99 | 68.64 | 36.88 | 44.45 | 1,289.53 | 505.77 | 84.23 | 579.35 | |
| General Meeting Expense② | .. | 14.30 | 62.16 | .. | 14.15 | 132.50 | 451.50 | 9.00 | 58.15 | 296.78 | 166.94 | 13.20 | 101.60 | |
| Special Meeting Expense③ | 142.75 | 500.59 | 954.22 | 210.23 | 1,089.11 | 234.81 | .. | 182.00 | .. | 1,177.58 | 1,250.67 | 146.98 | .. | |
| Honorarium for Secretary | .. | 125.00 | 60.00 | 60.00 | 12.29 | .. | 120.00 | .. | .. | 100.00 | 100.00 | 50.00 | 100.00 | |
| Stenographic Services | .. | 40.00 | .. | 30.00 | 10.00 | .. | 29.17 | .. | 8.85 | 2.00 | 40.00 | .. | 2.50 | |
| Travelling Expenses④ | . | .. | .. | .. | 1.35 | .. | 134.85 | .. | 18.00 | .. | .. | 17.40 | 25.00 | |
| Subs. to other organizations | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3.00 | |
| Subs. to *The Journal* | . | .. | 8.00 | 14.00 | .. | .. | .. | 14.00 | 6.00 | . | 4.00 | .. | 90.00 | |
| Special Expenses | | 56.04 | 83.50 | .. | 120.15 | .. | .. | 13.00 | 88.10 | .. | 292.78 | .. | 20.00 | |
| Miscellaneous | . | 29.50 | .. | 10.97 | .. | 211.25 | .. | .97 | 6.25 | 491.20 | 120.12 | .. | 8.29 | |
| Total Disbursements | 142.75 | 1,066.50 | 1,191.93 | 385.57 | 1,365.58 | 609.55 | 804.17 | 255.85 | 229.80 | 3,357.09 | 2,480.28 | 311.81 | 929.74 | |
| Surplus or *Deficit* | 4.94 | *3.17* | *10.20* | *36.62* | *198.67* | 64.70 | 131.02 | 143.15 | 60.16 | *345.66* | *261.45* | 100.51 | 366.36 | |
| Balance as of Dec. 31st, 1953 | 51.34 | 661.36 | 551.87 | 602.10 | 289.17 | 400.51 | 402.31 | 613.91 | 573.35 | 2,512.43 | 415.50 | 473.21 | 2,585.15 | |

①Includes general printing, meeting notices, postage, telegraph, telephone and stationery.

②Includes rental of rooms, lanterns, operators, lantern slides and other expenses.

③Includes dinners, entertainments, social functions, and so forth. ④Includes speakers, councillors or branch officers.

(*Continued from page 153*)

versity presented papers at the March meeting. A. Ryan chose as his subject "The Kitimat Power Development", G. Staples spoke on "The Preparation of Wood Pulp" and W. Tucker's topic was "C.O.T.C. Summer Practical Training Phase". Prizes of $20, $15 and $10 were awarded to the speakers.

On April 27, R. W. Pike spoke on "The Bailey Bridge". Dr. J. B. Stirling, who was to arrive on this day, was grounded at Gander because of weather conditions. He arrived the next day and spent two very busy days with members of the Branch.

Meetings were adjourned for the summer months on May 11.

C. H. Conroy, chief engineer of the Buildings Division of the provincial Department of Public Works, spoke on "Control of Moisture in Frame Buildings" at the meeting held on October 19. A lengthy discussion period followed.

President Ross L. Dobbin paid a visit to the Branch Nov. 8. He concluded his visit on Nov. 10 with a joint meeting of the local branches of the Institute and the Association of Professional Engineers of Newfoundland. Matters of common interest were discussed, and continued friendship and co-operation between the two bodies stressed.

## Niagara Peninsula Branch

The highlights of the Niagara Peninsula Branch for the year 1953 were its Branch meetings and plant tours. The largest turnouts were to the joint meetings with the Niagara Chapter of the Association of Professional Engineers of Ontario. The first joint meeting was held on Tuesday, March 24th, with Col. L. F. Grant, M.E.I.C., Field Secretary, giving a very timely talk, "Canada—How Big or How Good".

On September 24th a joint tour of the Sir Adam Beck Generating Station No. 2 Project was held and the 350-odd members in attendance proved its tremendous success. The steak dinner Hydro treated us to was also a great success. We are indeed fortunate to have such a great engineering project in our area.

A third Professional Development Course is under way and it will, no doubt, be as successful as its predecessors. This year's program centres around Personal Development, Leadership, Supervision and Professional Ethics. The senior members of the Branch are very proud of the success of the past courses and they themselves are partly responsible for this by attending some of the courses' lectures.

A high attendance at each meeting, despite hazardous winter driving conditions, illustrates the enthusiasm supporting this course. The members from each centre pooled their transportation to overcome the difficulties encountered on the winding roads leading from centres such as Port Colborne, Fort Erie and Welland to the Queenston Gate House of the Sir Adam Beck Generating Station No. 1.

## Nipissing and Upper Ottawa Branch

The first full year of operation of the Branch showed a total of eight meetings. All of these meetings were dinner meetings, with an average attendance of 55%.

Three meetings proved most popular. One, in February at North Bay, showed an interest in Colonel Grant's address on the "St. Lawrence Waterway and Power Project": Another in March at Temiskaming had two speakers, H. H. Watson, who spoke on "Safety Records and Programs" and Richard H. Foy, on "Electronic Trends." Members of the Gateway Amateur Radio Club were invited to attend.

With the beginning of activities in the Fall, the members again appeared in force to be treated to a preview of the new Ontario Northland Railway Diesel-shops to be opened in North Bay. Mr. J. W. Millar, Chief Mechanical Officer for the C.N.R., and Branch Vice-Chairman, also delivered an informative address on "Railway Diesel Locomotives".

Speakers at other meetings were Frank Hayward, "Boiler Water Treatment," J. G. A. Stevenson, "Developing a Successful Mining Operation"; E. J. Howard, "From Wood to Rayon"; and H. R. D. Graham, "Sir Adam Beck No. 2 Generating Station". Of the eight meetings, five were held in North Bay and three in Temiskaming.

The Annual Meeting and Ladies' Night was held in May in Temiskaming, at which time the Committee Reports were read and the election of officers was conducted.

## North Eastern Ontario Branch

There were two Branch meetings held during 1953, both of which were held at Iroquois Falls. The first meeting (March, 1953) was held primarily to elect a new slate of Branch officers. The business meeting was followed by dinner and a novelty curling bonspiel. The second Branch meeting was held in December. Guest speaker for the evening was the Hon. T. P. Kelly, Minister of Mines for the Province of Ontario.

Numerous section meetings were held throughout the year with the Western (Kapuskasing) section being the most active.

The Western section held six meetings throughout 1953. The average attendance was between 25-30 which was excellent representation since the total membership is 43. The meetings included a talk by Col. L. F. Grant, Field Secretary of the E.I.C. on "Engineering Achievement in Canada"; an address by T. C. Keefer, Field Secretary of the Professional Engineers, Ontario, who spoke on the growth of the engineering profession and an address by Kapuskasing Mill Manager G. M. Minard who spoke on "Impressions of India" where he served during World War II.

The Western section has also set up a committee for Professional Development. The committee is attempting to offer courses on Investing and Public Speaking.

The Eastern (Iroquois Falls) section has lost a number of its executive personnel over the past year and as a result its program has suffered. However, in addition to being host for the two Branch meetings the Eastern section has held two organizational meetings to fill vacant posts on their executive. The last meeting of the "Industrial Management" series was held in February when Mr. G. Sharp of Abitibi's Industrial relations department spoke on Job Evaluation.

The total Branch membership has been reduced from 77 to 66 over the past year, a drop of eleven, ten of whom have been lost by the Eastern section.

The problem of distance and difficult winter travelling conditions has been apparent again this year. Thus the Western section which includes Smooth Rock Falls as well as Kapuskasing has had very poor representation from Smooth Rock since the meetings are held in Kapuskasing. A similar situation occurs in the Eastern section which embraces Timmins, Cochrane and Iroquois Falls. Most of the meetings have been held in Iroquois Falls. The members from Cochrane have been very interested and are attending the meetings very well although a road trip of about 40 miles is necessary.

## Northern New Brunswick Branch

The early months of 1953 were spent on ground work leading to the formation of our Branch, called the Northern New Brunswick Branch. This Branch includes the counties of Restigouche, Gloucester, and most of Northumberland in the Province of New Brunswick.

The outstanding meeting was our Inaugural Dinner meeting on March 12, which coincided with President Sterling's annual visit and that of the General Secretary, Dr. Wright. Members of the Moncton and Fredericton Branches were in attendance.

A dinner meeting was held on September 30, the occasion being the visit from the new President of the Institute, Mr. R. L. Dobbin, accompanied by Dr. Wright, General Secretary. Mr. Dobbin spoke on his visit to the Coronation, which was well received by the members.

A very interesting meeting was held at the Chatham station of the R.C.A.F. on November 6. The tour of the base, a paper by Mr. W. A. Purdy of Maritime Cement, and an oyster smoker proved very popular with the members.

Due to the late start there were only four general meetings during the year. Two in Bathurst, one in Dalhousie, and one in Chatham. Attendance was very good considering the travelling which is necessary to attend all meetings. Three executive meetings were held and it appears as though our Branch has consolidated its position and great things are expected in future years.

## Ottawa Branch

The policy of arranging the majority of the programs as noonday luncheons was maintained and again proved to be most popular from attendance aspects.

The Committee endeavoured to make each program financially self supporting. Only small expenses were evident due mainly to complimentary tickets for guests of honour and the press.

Although there were no joint meetings with other technical societies, your Committee cooperated with the Engineers' Wives Association for an evening dinner meeting in December and with the Junior Section for a luncheon meeting in February.

The Committee attempted to vary the year's program with as many engineering topics as possible.

At the Management Committee meeting of November 12th Mr. Claude Howard was made Branch Editor to attend to publicity of Branch events in the local press and *The Engineering Journal*.

All ten luncheon meetings were held at the Chateau Laurier. The highest attendance was 115; the lowest was 69 and the average was 92. Four evening meetings were held, including the annual meeting. Although accurate figures were not recorded, the approximate attendance was 75 per meeting. One field trip was arranged to the International Fibreboard and Plywoods Plant at Gatineau, P.Q. Approximately 70 attended.

Following the President's Dinner in October, a dance was held in the N.R.C. Cafeteria. Dinner and Golf at the Tecumseh Golf Club was a sequel to the Field Trip at Gatineau in September.

It was recommended that a smoker should be arranged for the spring, perhaps in cooperation with the Junior Section and that a meeting might be organized in one of the towns of the Ottawa Valley within the Branch limits with our Proceedings Committee to arrange for a speaker.

General arrangements of programs seemed satisfactory and a similar pattern is recommended for the following year.

## Peterborough Branch

During the past year eight papers were presented to the membership at eight separate meetings. The average attendance at these meetings was approximately 30% of our membership.

The annual meeting was held late in February and took the form of a smoker at the Kawartha Golf and Country Club. This meeting was attended by approximately 40% of the membership.

On the last Saturday in May the Branch visited the Marmortan Iron Mines development at Marmora. The morning was spent at the site of the mining development. At noon a group of women in Marmora prepared a meal for the group for a very reasonable charge. The afternoon was spent at a summer camp on Crow Lake where the members were able to demonstrate their various talents at sporting events. Attendance was about 30%.

In October we opened our winter season with a smoker. The feature of the evening was a symposium on the Labrador Iron Ore development by local members. Fifty-five per cent of the membership was on hand.

The highlight of the season of course was the reception and dance held for President Dobbin on November 27th. Fifty-six couples attended this event.

Representation was made at the Inauguration of the Orillia Branch in September. Six of our members attended the party held for President Dobbin in Belleville in early October.

## Prince Edward Island Branch

The Branch enjoyed a successful year. Five regular meetings and three special meetings were held. The latter included two presidential visits and the summer outing with wives and families invited.

The general form of the regular meetings has been dinner meetings with guest speakers or informal discussions among the members.

Three of the regular meetings were held in Summerside, the balance in Charlottetown.

## Quebec Branch

The Executive Committee held nine meetings for the transaction of Branch business. The average attendance was eight.

The program of activities this year was varied. Meetings were well attended.

The Branch has continued a series of lectures under the general title "The Engineer and His Activities". Eighty members have registered to attend these lectures. Part of the lectures were given in the months of October and November of last year. The balance of these lectures were delivered from January 3, 1953, to the end of April of 1953.

The Faculty of Science of Laval, at the request of the Quebec Branch, has established a series of lectures on Steel Structure and Concrete, 50 graduate engineers attended these lectures. The Provincial Government of Quebec has contributed financially to the organization of these lectures in a very generous way. We are thankful to the Honourable Paul Sauvé, Minister of Social Welfare and Youth, for his great help in this matter.

The program of activities was as follows: (Attendance is given in brackets.)

Jan. 13, 1953—Seventh of the series "The Engineer and His Activities". Title: The Engineer and Labour (Point of view of the government). Speaker: Donat Quimper, Assistant to the Deputy-Minister of Labour for the Province of Quebec (15).

Jan. 20, 1953—Eighth of the series "The Engineer and His Activities". Title: The Engineer and Labour (Point of view of the Employer). Speaker: P. Filteau, Canadian Johns Manville (25).

Jan. 27, 1953—Ninth of the series: "The Engineer and His Activities". Title: The Engineer and Labour (Point of view of the employee). Speaker: M. Jean Marchand, sec. of C.T.C.C. (35).

Feb. 21, 1953—Curling competition between Architects and members of the Institute at the Jacques-Cartier Curling Club (125).

Feb. 24, 1953—Tenth of the series "The Engineer and His Activities". Title: The Engineer and Private Practice. Speaker: Geo. Demers, M.E.I.C., Consulting Engineer of Quebec (45).

March 21, 1953—Eleventh of the series: "The Engineer and His Activities". Title: "The Engineer and National Harbours". Speaker: Brig. Maurice Archer, M.E.I.C., Vice-President of the National Harbour Board (60).

May 8, 1953—Visit of President Stirling (50).

May 19, 1953—Paper: "Certaines Applications de la Mécanique des Sols dans la Construction des Barrages". Speaker: M. Armand Mayer, M.A.S.C.E., Consulting Engineer of France (50).

Sept. 4, 1953—Annual Golf Tournament (119).

Oct. 8, 1953—Paper: Les Merveilles Inconnues de l'Hydraulique". Joint meeting with ACFAS. Speaker: M. Pierre Danel, Ph.D., Consulting Engineer of France.

Oct. 22, 1953—Twelfth of the Series. "The Engineer and His Activities". Title: The Engineer and His Professional Responsibilities. Speaker: Colonel F. K. Grant, M.E.I.C., Field Secretary of the Institute.

Nov. 12, 1953—Joint meeting with ACFAS. Paper: "John Hopkinson, Ingénieur et Physicien Anglais. Speaker: Mr. James Grieg, professor at London University.

Nov. 14, 1953—Retraite Fermée pour les Ingénieurs à la Villa Manrèse.

Dec. 3, 1953—Films: 1: Reconstruction de l'Ilet V-4 au Hâvre; 2: Pipe-Line au Maroc; 3: Galerie de dérivation de la Rhue; 4 Construction de Hangars d'avions à Marignane (120).

Dec. 9, 1953—Visit of President Dobbin (60).

## Saguenay Branch

The general pattern of the year's activities was similar to last year's. The mixed dinner meeting appeared to be very popular and was very well attended. The informal smoker type meetings with coffee and sandwiches at the close of business were well received. Extra costs of this type of meeting above room rental were defrayed by a small admission charge. The social period so provided was enjoyed by all and gave new members a chance to become acquainted.

A particularly successful Student Guidance meeting was held at which students from the Arvida High School were present to listen to short talks by a group of senior members, and obtained answers to their questions on the engineering profession as a career. The keen interest of the students was revealed by the number and variety of questions asked.

Study groups, patterned after those in existence several years ago, were organized by the Junior Section after a visit by Col. Grant regarding the possibility of starting a Professional Development Course. These commenced after the New Year and ran until spring with very good success. A new series for this season has been arranged.

Field trips are always popular. There was only one trip held during 1953 which was a follow-up to a paper presented to the Branch a week before. This idea of follow-up field trips allowed all to benefit to a greater extent from both paper and trip.

## Saint John Branch

During the past year this Branch held five dinner meetings and five Professional Development Lectures. Plans are being made to continue with more of these lectures in the coming year.

The speakers at the dinner meetings were: R. M. Richardson, M.E.I.C., who spoke on the "Necessity of a Strong Dominion Council", Harold Issacs who spoke on "The History of Communications", and J. G. Bishop, M.E.I.C., whose subject was "Television".

We were visited by two presidents during the year—President Stirling in the spring and President Dobbin in the fall.

## St. Maurice Valley Branch

During the past year this Branch with its Junior Sections in Shawinigan Falls and Three Rivers, held sixteen meetings with fair attendance. These meetings included technical addresses, three technical film nights and two presidential visits. The technical topics covered a wide field of subjects in order to be of interest to all, e.g. rubber in conveying materials, arc welding, stainless steels, fluidization, problems facing engineers as a whole, the "ins" and "outs" of centrifugal pumps, job satisfaction to the engineer and cellophane.

Social events consisting of two stag parties, a film on the 1952 Canadian Open Golf Championship and two Engineering Balls were also held.

Four local plant tours were especially well attended and appreciated by the new engineers in our valley.

Perhaps one of the most interesting meetings was that with Dr. Lillian M. Gilbreth, noted consulting engineer, who graciously came to our Branch and discussed with us the part that engineers are playing in world and national affairs and also some of the problems that we are encountering within our engineering profession.

## Saskatchewan Branch

Ten Executive meetings were held during the year for the transaction of Branch business.

Two events of note which occurred during the year were the increase in representation from one to two members on the Council allowed due to the increased membership; and the election of Mr. Stewart Young to Honorary Membership, believed to be the first to be granted to a Saskatchewan member while resident in the Province.

Dean I. M. Fraser, Zone Vice-President, attended the Annual Meeting of the Institute held in Halifax in May.

The visit of Col. L. F. Grant between November 12 and December 5, to Yorkton, Regina, Moose Jaw, Swift Current, Lloydminster, and Saskatoon, did much in contributing to a feeling of unity, not only between the members of the Branch, but between the Branch members and Institute members all across Canada.

All lecture meetings were held jointly with The Association of Professional Engineers of Saskatchewan, with an average attendance of 50.

## Sudbury Branch

Eight general meetings were held during the year with an average attendance of forty. No meetings were held from June to September.

One Ladies' Night was held during the year, on the occasion of the annual meeting.

The December meeting featured a trip through the ONR shops at North Bay.

## Toronto Branch

The interest of the membership in the general activities of the Toronto Branch and in the technical meetings is increasing. A full measure of credit must go to the various committees, who, in some cases ended as a one man committee, for the service they gave in providing interesting programs.

The increased interest of the younger engineers stemmed largely from participation in the Professional Development Courses. This fall an advanced course was inaugurated in addition to the regular course and was well attended. The directors of these courses are to be congratulated.

Of the six technical meetings which followed our Annual Meeting during the winter and spring program, it was generally felt that Students' Night held in February, and the panel discussion held in March, were outstanding, the latter drawing many favourable comments from the membership, who requested a similar meeting next year.

The inauguration of the Huronia Branch in Orillia during the summer gave many of our members an opportunity to spend a very sociable and enjoyable time at Fern Cottage, where the inaugural ceremonies were held. The Toronto Branch appreciated the opportunity to assist in the inauguration of this the newest branch of the Institute.

The interest shown at the meetings during the fall program reflected the efforts of the committees responsible. The interest in the hydraulic tunnel at Niagara and in the Toronto Metropolitan area brought many more members out to these meetings than were expected.

The President's Visit and Ladies' Night was a very enjoyable evening. Everyone there found Mr. Dobbin's remarks on 'The Coronation From an Engineer's Point of View' interesting and all enjoyed his humorous anecdotes of his visit to England.

During the fall an amendment to the Branch By-Laws was passed to enable four Junior Members to be added to the executive committee. The executive is looking forward to their joining the committee, and to an even more active participation by all members in Branch activities.

## Vancouver Branch

The past year has been a rewarding one for the membership of the Branch. Monthly meetings on technical subjects have been held usually jointly with the Vancouver Branch of the Engineering Society. To be long remembered is the visit from the Seattle Chapter of the American Association of Civil Engineers in May when the Vancouver Branch of the E.I.C. were hosts. An afternoon of sightseeing covered the new Granville Street Bridge, the Cleveland Dam and the Fraser River Model. This was followed by an evening of fellowship and fun during which new and old friendships with the American guests were firmly cemented.

## Vancouver Island Branch

The Branch held nine meetings during the year, seven of which were joint meetings with the Victoria Branch of the B.C. Engineering Society. All of the meetings were of an instructional nature, with addresses by guest speakers or the showing of interesting films on wide and varied subjects.

The Branch Executive met on five occasions during the year.

Three field trips were taken, one to the Douglas Fir Plywood Plant of B.C. Forest Products Company and another to the shipyard of Yarrows Limited where the fabrication of tubular aluminum power transmission line towers proved to be of great interest. These towers were being shipped North to the Aluminum Project at Kitimat, B.C.

A third field trip was made to H.M.C. Dockyard at Esquimalt where, after an explanatory talk by our host Commodore (E) B. R. Spencer, Superintendent of the Dockyard, the members were taken on a tour through the various shops and departments. This was followed by a short trip to sea in H.M.C.S. *Sault St. Marie* the first Algerine Class Minesweeper built in Canada in 1943 at Port Arthur, Ontario.

## Winnipeg Branch

There were more meetings of the Winnipeg Branch in 1953 due to keener interest on the part of the members and to the formation and operation of a Civil Section.

The attendance was considerably better than in the previous year and the public came in larger numbers. It was gratifying to note the interest shown by non-members at the meetings. Many of the questions put to the speakers during the question period were asked by them.

Branch meetings have, in general, been devoted to the presentation of engineering subjects handled in a non-technical manner and speakers have been chosen specifically for this purpose. The description of the carrying out of well known national and local, public and private projects, and the showing of films illustrating the work being done has always struck a responsive note.

The meetings of the Sections of the Branch, however, have been largely given over to the consideration of purely technical subjects and those attending are in the main, engineers who are engaged in particular fields in line with the subject being dealt with or in those allied with them.

Entertainment has not been neglected in the year's operation. The Electrical Section held another successful dinner and dance and the Branch as a whole again co-operated with the Association of Professional Engineers in holding a Supper Dance. This is recognized as one of the important social events of the winter season in Winnipeg.

The Branch also held two golf tournaments in conjunction with the Association of Professional Engineers. This is an annual affair and a Silver Cup, donated by the late J. G. Sullivan, a past-president of the Engineering Institute of Canada, is a yearly competition.

## Yukon

The first annual meeting of the Yukon Branch was held at Whitehorse on November 13 at the Whitehorse Inn.

Ballots for officers for the coming season, which had been previously mailed out to members, were reported by the scrutineers, Brig. H. W. Love and E. O. Greening. The following officers were elected: president, Lt.-Col. M. C Sutherland-Brown; secretary, John L. Phelps; directors, C. E. White, Lt. K. Baker, and F/L G. H. Hicks.

Lt.-Col. Sutherland-Brown gave a short talk on the aims of the Institute. A general discussion followed, during which it was decided that meetings should be held at approximately one month intervals, at the discretion of the executive.

Twenty-eight persons were present at the dinner.

# From Month To Month

**Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers**

## Seventh Annual Meeting of IAESTE

The seventh annual meeting of the International Association for the Exchange of Students for Technical Experience took place in Stockholm, Sweden, starting on Monday, January 11 and continuing until Saturday, January 16. The National Committee for Canada which is a Member of IAESTE was represented by the general secretary of the Institute. This is the first time that Canada has been represented although the activities of the association were started here more than a year ago. The transportation to Stockholm was provided by UNESCO. The expenses of all delegates while in Sweden were taken care of by the Swedish Federation of Industries. This included hotels, meals, entertainment, transportation and so on. The delegate from the United States also travelled under these auspices.

As has been explained before in the *Journal*, the purpose of IAESTE is to find employment opportunities in any one of the eighteen participating countries for students in engineering and science who have one year to go to complete their university courses. Last year over 3,800 students were exchanged but at this year's conference it was indicated that the numbers for 1954 would amount to over 4,200.

The member nations represented were Austria, Belgium, Canada, Denmark, Finland, France, Germany, Great Britain, Israel, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, the United States and Yugoslavia. The eighteenth member country, Iceland, was not represented.

In addition to the delegates from the member countries, there was a delegate from Portugal, who submitted an application on behalf of their national committee for admission to the Association. This was accepted. Also there were observers from India and Pakistan. During the course of the conference a cable was received from Turkey to say that they would be joining the Association this year.

The purpose of the annual meeting is to negotiate exchanges and as well to discuss matters of business and of policy. The exchange of this many people has developed many complications. For instance, arrangements have to be made in all the countries with the departments of immigration, also adjustments made with regard to income tax and unemployment insurance; also accident and health insurance has to be placed on each student so that in the event of anything of the serious nature developing while the student is away from his own country, money would be provided to take care of his needs.

When one considers the permutations and combinations of eighteen

**The students of the Royal Institute of Technology entertain the convention in their air raid shelter. This is the head table.**

nations, exchanging 4,200 students, it is possible to see some of the complexities of the exchange business. The actual negotiating between nations took up almost three days of the conference, and even at that some of the countries had not completed their negotiations, but will have to do so through correspondence.

The Canadian Committee had 21 offers of employment at the time the general secretary left Canada. However it is expected that more offers will be received and it is planned that fifty students from abroad will be taken care of this summer in this country. Also it is hoped that fifty Canadian students will be found who will be prepared to go abroad for their experience.

All meetings were held in the premises of the Swedish Institute of Technology. These splendid facilities were very much appreciated by all delegates. Within the society's headquarters there are splendid club facilities including a beautiful auditorium, where the meetings were held, club rooms, a general dining room, private dining rooms, bar, library and so on. Such a location was ideal for a meeting of this kind.

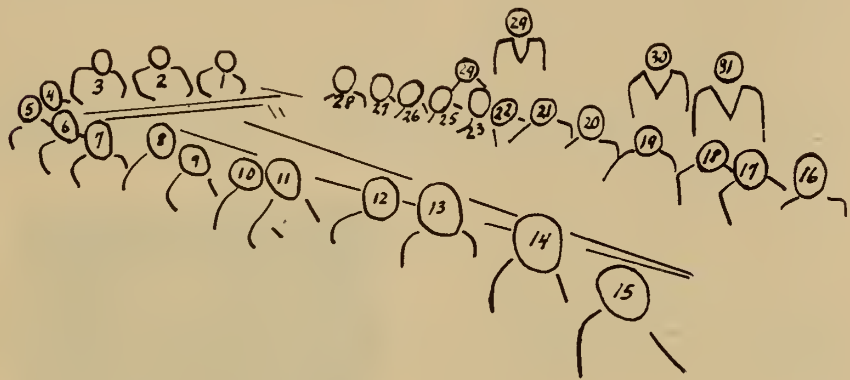
The hospitality of the Swedish people was all that it is reputed to be. Not only were all costs taken care of, but every detail of the delegates' comfort was attended to almost in advance of his needs.

The conference was presided over by Mr. R. A. Beijer, of Stockholm. In spite of the many complications that can develop between delegates of that many nations, Mr. Beijer carried off every meeting smoothly and without incident. He was very substantially supported by Mr. J. Newby of The Imperial College, London, England, the British delegate who is also the general secretary of the association. These two gentlemen deserve great credit for all the advance organization work and for the conduct of the meeting itself.

An opportunity to attend an annual meeting has given the general secretary a much greater appreciation of the work done by this association. Although it is set up primarily to obtain technical experience for students, its greatest

## Cover Picture

The Cover Picture shows the Seventh Annual Conference of IAESTE in session in Stockholm, Sweden, in January 1954. The conference is reported on these pages.



The delegates can be identified by means of the chart. They are, from left to right around the table, starting at the chairman's left:

1. Mrs. Ingrid Petterson, Sweden.
2. Mr. R. A. Beijer, Sweden.
3. Mr. J. Newby, Great Britain.
4. Mr. R. Kratochwill, Austria.
5. Mr. J. T. Bollansee, Belgium.
6. Dr. L. Austin Wright, Canada.
7. Mr. H. V. Dahlerup-Petersen, Denmark
8. Mr. Y. Toivola, Finland.
9. Mr. K. Fernstrom, Finland.
10. Miss Vidal-Hall, France.
11. Inspector-General Legay, France.
12. Mr. M. Roth, France.
13. Mr. K. H. Tessmann, Germany.
14. Mr. K. Wyneken, Germany.
15. Dr. Rozario, India.
16. Mr. R. Hammer, Norway.
17. Mr. A. Thorssen, Norway.
18. Prof. M. Correa de Barros, Portugal.
19. Mr. J. Eden, Israel.
20. Mr. O. Janssen van Raay, Netherlands
21. Mr. G. E. Candiani, Italy.
22. Prof. A. Capocaccia, Italy.
23. Prof. A. Tichenor, United States of America.
24. Mr. B. Blomstad, Sweden.
25. Mr. M. Milosavljevic, Yugoslavia.
26. Mr. J. Bogdanovic, Yugoslavia.
27. Mr. F. Zschokke, Switzerland.
28. Dr. H. Bosshardt, Switzerland.
29. Mr. G. Fredrikson, Sweden.
30. Mr. N. Klingenberg, Spain.
31. Prof. J. Pazo Montes, Spain.

Missing from photograph—Mr. A. A. Shaikh from Pakistan.

**At left—Left to right, J. Newby, general secretary of IAESTE, Mr. Anderson, representing the Federation of Swedish Industries.**

**At right—At Sandvikens the Steel Company entertained the delegates. Left to right, J. Newby, Great Britain; P. Carlberg, the host; Dr. H. Bosshardt, Switzerland; P. Ackerman, secretary, Swedish Technical Society.**

value lies in its ability to move students from one country into another where in addition to the technical experience they also learn something of the people and their ways. Thousands of young men moving about this way must have a great beneficial influence on international relations. When it is considered that these young men are likely to become leaders in their own country it is more than ever apparent that the influence of IAESTE is tremendous.

In Canada the work is carried out by a committee set up by the Engineering Institute. On it are represented two universities, several divisions of industry and the student body itself. It is now proposed to enlarge the committee somewhat in order to get an ever broader representation. Up to the present time the Engineering Institute has done all the office work and has borne the entire expense of the operation. Council has felt that this activity is good for Canada and therefore has given support to it.

In order to fulfil Canada's commitments it is necessary to find about twenty-five more openings here for students from abroad. Many industries who have been circularized have not yet replied, but it is hoped that shortly some word will be received from them and without too much difficulty the objective of fifty openings in Canada will be attained. If any persons interested in this activity have any employment opportunities it would be appreciated if they would communicate with the Institute headquarters in Montreal.

As well students are being sought who wish to go abroad for their summer experience. Openings are available in Great Britain, France, the Netherlands, Switzerland, Denmark, Norway, Sweden, Finland and Italy. Students who are interested should communicate with the Deans of their faculty who in turn will advise headquarters of the committee in Montreal.

Here is an unusual opportunity to aid in the improvement of International relations which of course is a great aid to maintaining a permanent peace. At the same time employers who accept these young students are receiving something in return for the wages they pay. It has been the experience of many employers that they have not been able to get an adequate supply of students from Canadian universities. Perhaps their temporary needs can be met by students from other lands.

# Canadian Awarded Kelvin Medal

### Dr. C. J. Mackenzie Wins Coveted Science Prize

Dr. C. J. Mackenzie, past president and honorary member of the Institute has been awarded the Kelvin Medal, the most coveted prize in the world of science-engineering.

The retired president of Atomic Energy of Canada Ltd., and former president of the National Research Council, is the ninth scientist to receive the medal. The decoration is awarded every three years in recognition of achievement in the field of science-engineering and commemorates the life-work of Lord Kelvin, the distinguished British physicist.

*Copyright by Karsh*

**Dr. C. J. Mackenzie, M.E.I.C.**

The medal is awarded after consultation among officials of the major engineering institutions of the world. They include the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Electrical Engineers, the Institution of Naval Architects, the Institution of Mines and Metallurgy, the Institution of Mining Engineers and the Institution of Engineers and Shipbuilders in Scotland.

Dr. Mackenzie is the first Canadian to receive the medal since the decoration was instituted in 1920.

Lord Kelvin, was the most outstanding British physicist, scientist and engineer of the 19th century. He is recognized as the man who made the electrical age possible through his work with the telephone, the electric light and the cable.

The medal was awarded in 1920 to Dr. W. C. Unwin, British physicist; Marconi the inventor of radio received it in 1932, and Sir Frank Whittle, inventor of the jet engine, in 1947.

The other award winners include Dr. Elihu Thomson, American physicist, in 1923; Sir Charles Parsons, British inventor of the steam turbine, in 1926; Andre Blondal, French physicist, in 1929; Sir John A. Fleming, British engineer, in 1935; Sir J. J. Thompson, British physicist, in 1938; and Prof. Theodore von Karnan, aeronautical engineer at the California Institute of Technology, in 1950.

Dr. Mackenzie succeeded Gen. A. G. L. MacNaughton as president of the National Research Council in 1944. He held that post until 1952, when he was named president of Atomic Energy of Canada Ltd., and retired at the end of October.

Now, Dr. Mackenzie holds the post of chairman of, the Atomic Energy Control Board.

# Athlone Fellowships — 1954

Thirty-eight of Canada's young engineering graduates are to be selected to go to Britain in 1954 as Athlone Fellows. Mr. John Hunt, of the United Kingdom High Commissioner's Office, and Dr. William Abbott left Ottawa on January 17 to undertake a coast-to-coast tour, visiting Canadian universities to make the selection. Dr. Abbott, representing the United Kingdom Ministry of Education, was crossing the continent for his fifth consecutive year, as they visited Halifax, Fredericton, Quebec, Montreal, Kingston, Toronto, Winnipeg, Saskatoon, Edmonton and Vancouver.

The first Athlone Fellows, selected in 1951, are now beginning to make their mark in Canadian industry. Many of them have paid tribute to the value of the Fellowships, thirty-eight of which are offered each year —28 to students in their final year, and 10 to graduates who have spent some time in industry.

The Athlone Fellowships are financed by the United Kingdom Government, and the award covers all travel costs, living expenses, and any academic fees that have to be met, during the two-year stay. The complete list of provisions and conditions appeared in the November 1953 issue of the *Journal.*

# 68th ANNUAL GENERAL

and

# PROFESSIONAL MEETING

## MAY 12-13-14

Registration and hotel reservation cards will be mailed to all members with advance copies of our program on or about April 1st.

All rooms will be allotted in accordance with reservation cards as received at Headquarters.

*No reservations can be accepted by the Chateau Frontenac, so please do not write this hotel.*

Also, members are requested not to write Headquarters beforehand for reservations.

## CHATEAU FRONTENAC, Quebec City

The complete program will be printed in the March issue of the *Journal.*

# James A. Ogilvy Joins Institute Staff

Since many of our members are going to meet him sooner or later, it is fitting that we should introduce the new assistant field secretary, James A. Ogilvy, M.E.I.C., whose picture appears on this page.

Mr. Ogilvy is the son of R. Forrest Ogilvy, M.E.I.C., and was born in Westmount, Quebec, in 1907, but spent most of his early years in Hamilton, Ontario. Graduating from the Central Collegiate there, he entered McGill University's course in mining engineering and received his bachelor's degree in 1930.

James A. Ogilvy, M.E.I.C.

Like most engineering students, Mr. Ogilvy spent his summers working with such employers as the City of Hamilton, the Fraser-Brace Engineering Co., Ltd., and Dome Mines, Ltd. Joining McIntyre-Porcupine Mines, Ltd., after graduation, he rose to acting mine captain when he left in 1934, to spend the next eighteen months in mining development work and in travel.

In 1936 he was with Robinson Deep, Ltd., in Johannesburg, S.A., and from 1937 to 1940 again in mining development work. In the latter year he joined the General Engineering Co., Ltd., of Toronto as assistant job superintendent, leaving in 1941 to became assistant chief of the Naval Gun Production Branch of the Department of Munitions and Supply. He enlisted in the Royal Canadian Navy in 1944, was assigned as assistant supply officer (guns and mountings) and was honourably discharged in 1946.

After a third short interlude of mining development, he became plant engineer for National Gypsum, Ltd,. at its mine at Dingwall, N.S., and then sales engineer with Canadian Allis-Chalmers, Ltd., in Toronto. In 1949 he joined the Toronto Transportation Commission as office engineer in charge of work records and payment certificates for the Toronto subway. This is the post he left to join the Institute.

# Sixty-eighth Annual General Meeting

Notice is hereby given, in accordance with the by-laws, that the annual general meeting of The Engineering Institute of Canada for 1954 will be convened at the Chateau Frontenac, Quebec City, at ten o'clock a.m. on Wednesday, May 12, 1954.

# Professional Associations Elect 1954 Officers

### Association of Professional Engineers of Ontario

One of Canada's foremost authorities on soils and construction materials, William Lister Sagar, M.E.I.C., professor of civil engineering at the University of Toronto has been elected president of the 12,000-member Association of Professional Engineers of Ontario.

He succeeds J. Herbert Smith, M.E.I.C., general manager of the Wholesale Division of Canadian General Electric Co. Ltd. in Toronto, to the top post in the engineering organization which under provincial charter serves as the licensing body for registering professional engineers in Ontario.

Professor Sagar is also vice-president of the Dominion Council of Professional Engineers. A member of the engineering faculty of the University of Toronto since 1937, he continues to serve as a consultant in construction work taking place in Ontario.

Coincidentally, his election as president of the Association comes at a time when the central theme of the Association's current program is vocational guidance, a program aimed at encouraging more high school students to enroll in engineering courses at universities.

Professor Sagar is a veteran member of the Association of Professional Engineers of Ontario, having joined it in January, 1923, about six months after it was given a provincial charter. He has been actively associated with its work during the past eight years.

The officers elected to the Association's Executive Council for 1954 are: John R. Montague, M.E.I.C., director of engineering for the Hydro-Electric Power Commission of Ontario, first vice-president; John H. Waghorne, engineer in charge of electrical research of the Hydro-Electric Power Commission of Ontario, second vice-president; councillors, John S. Ellis, Jr.E.I.C., design engineer with H. G. Acres and Co. Ltd., Niagara Falls, and Robert C. McMordie, Jr.E.I.C., program planning and control engineer of the Hydro-Electric Power Commission (civil branch); Gordon W. Ames, M.E.I.C., process engineer with Polymer Corp., Ltd., Sarnia, and James M. King, M.E.I.C., of Canadian General Electric Co. Ltd., Peterborough (chemical and metallurgical); Gordon M. McHenry, western region consumer service engineer for the Hydro-Electric Power Commission of Ontario, London, and Harold R. Osborne, chief engineer for Ferranti Electric

William Lister Sagar, M.E.I.C.

Limited, Mount Dennis (electrical branch); John H. Fox, M.E.I.C., general sales manager of Minneapolis-Honeywell Regulator Co. Ltd., in Toronto, and John H. Ross, M.E.I.C., Toronto consulting engineer (mechanical and industrial branch); Duncan R. Derry, chief geologist of Ventures Limited, Toronto, and Reginald C. Mott, manager of the Mining and Reduction Division of Falconbridge Nickel Mines Ltd., Falconbridge.

The executive director of the Association is T. M. Medland; the registrar is J. Murray Muir; and the field secretary is Thomas C. Keefer, M.E.I.C.

### Association of Professional Engineers of British Columbia

Charles Bentall, M.E.I.C., president and general manager of Dominion Construction Co. Ltd., and president of New Building Finance Co. Ltd., Vancouver, was elected 1954 president of the Association of Professional Engineers of British Columbia. He succeeds John C. Oliver, M.E.I.C., city engineer of Vancouver.

Dr. H. C. Gunning, dean of the faculty of Applied Science and head of the department of geology and geography of the University of British Columbia, was elected vice-president.

The new councillors of the Association are F. R. Phillips, M.E.I.C., of Pearson, Phillips & Barrat, Vancouver; J. D. McMynn; Col. G. M. Letson, M.E.I.C., of Letson & Burpee Ltd., Vancouver; and Jack L. Miller, M.E.I.C., Vancouver consulting engineer. Councillors appointed by the Government of British Columbia are E. C. Roper, manager of the Britannia Mining and Smelting Company; Professor W. O. Richmond, M.E.I.C., of the University of British Columbia; J. H. Steele of the B.C. Electric Company; and William Hall, chief engineer of the surveys division of the Department of Lands and Forests.

Membership in British Columbia's Association, which came into existence through a legislative act passed in 1921, has grown from 586 to 3,333. Of this number 1,444 are registered engineers, 1,302 are engineers-in-training, and 587 are engineering pupils.

J. A. Merchant, M.E.I.C., is registrar of the Association, and H. M. McManus serves as assistant registrar.

## Canadian Soils Mechanics Conference

Ninety engineers, geologists, and soil scientists came from points across Canada to attend the seventh annual Canadian Soil Mechanics Conference in Ottawa on December 10 and 11, 1953. This meeting was sponsored by the Associate Committee on Soil and Snow Mechanics of the National Research Council in order to discuss soils as engineering materials.

Many interesting activities in Canadian work in this field were reported. C. F. Ripley, M.E.I.C., consulting engineer from Vancouver, described various soil formations encountered in British Columbia and the engineering problems associated with such soils. Dean R. M. Hardy, M.E.I.C., dean of engineering of the University of Alberta, spoke of studies made under his direction in the electro-osmosis of soils. He cited one instance where this principle was used successfully in the excavation of a deep shaft in which a layer of water-bearing sand was encountered. Other work involved the application of electro-osmosis to assist in the injection of lignosol into soil to limit frost heaving.

R. Peterson, M.E.I.C., soil mechanics and materials engineer of the Prairie Farm Rehabilitation Administration, discussed the stability of slopes in plastic clays, with particular reference to earth dam construction. The Department of Transport, Ottawa, has prepared a freezing index map of Canada from which it should be possible to predict frost depths for many areas. E. B. Wilkins, M.E.I.C. of that Department explained this map and its uses but pointed out that it is based on only five years' observations and does not include areas of Ungava and large sections of the Northwest for which there were no records available.

Dr. G. G. Meyerhof, M.E.I.C., of the Foundation Company of Canada described an investigation his Company had conducted for the Quebec Streams Commission on the landslide at Rimouski, Quebec. Dr. Meyerhof discussed the causes and mechanism of this slide which occurred in August 1951 and resulted in the damming of the Rimouski River for a short time.

Canadian delegates to the Third International Conference on Soil Mechanics and Foundation Engineering reported on the proceedings of that Conference. Dr. N. W. McLeod, M.E.I.C., consultant to the Department of Transport, and N. D. Lea, M.E.I.C., Foundation Company of Canada; G. C. McRostie, M.E.I.C., consulting engineer, Ottawa, and W. R. Schriever of the Division of Building Research, National Research Council, reviewed the technical and business sessions of the International Conference. Six Canadian papers had been presented to the international gathering which was held in Switzerland in August, 1953.

A record of the Canadian meeting will be prepared as a Technical Memorandum of the Associate Committee and should be available in the spring of 1954. Requests for copies should be directed to the Secretary, Associate Committee on Soil and Snow Mechanics, National Research Council, Ottawa.

## American Power Conference

The sixteenth annual meeting of the American Power Conference, formerly Midwest Power Conference, will be held on March 24, 25 and 26, 1954, at the Sherman Hotel in Chicago. The Conference is sponsored by the Illinois Institute of Technology in co-operation with twelve universities and ten local and national engineering societies.

Briefly the program will include papers on the following subjects:

*Wednesday, March 24, 1954:*

2.00-5.00 p.m.
Central Station Steam Generation.
Hydroelectric Power Development in the United States.
Industrial Plant Session.

2.00-3.30 p.m.
Station Apparatus.

3.30-5.00 p.m.
Industrial Electrical Session.

*Thursday, March 25, 1954:*

9.00-12.00 noon
Central Station Steam Turbines.
Fuel Economics.

9.00-10.30 a.m.
Year Round Air Conditioning.

10.30 a.m.-12 noon
Water Technology Number 1. Distribution Systems.

2.00-5.00 p.m.
Central Station Steam Power Plants.
Water Technology Number 2, Symposium on Demineralization.

2.00-3.30 p.m.
Industrial Power Plants.
Electrical Systems.
3.30-5.00 p.m.
Cables for Transmission and Distribution.

*Friday, March 26, 1954:*
9.00-12.00 noon
Nuclear Energy.
9.00-10.30 a.m.
Water Technology Number 3.
Steam and Diesel Power Plants.
Electronics.
10.30-12.00 noon
Water Technology Number 4.
Gas Turbines for Power Generation.
Circuit Breakeis.
2.00-5.00 p.m.
Developments in Gas Turbines and Diesel Engines.
Industrial Steam Generation.
Symposium on Network Analyzers and Computing Aids.
Electrical Circuit Breakers.

For further information, write to E. R. Whitehead, Secretary, American Power Conference, Illinois Institute of Technology, Technology Center, Chicago 16, Illinois.

# Montreal Thinks About a Subway

Whatever the advantages to Montreal of having Mount Royal in its midst, the mountain could hardly be in a worse place, so far as transportation for Montrealers is concerned. In the area which it occupies, roughly a mile and a quarter east and west by a mile north and south, there are no streets. Add to this the narrow and sometimes crooked streets in the business district inherited from colonial times, some steep grades, an annual snowfall greater than any other large city save Leningrad, steadily mounting traffic density, and it is no wonder that the city was long ago forced to take its transportation difficulties seriously.

Studies began early in the automobile era and led to many suggestions for improvement, such as street widening and extensions, one-way streets, the abolition of railway grade crossings, vehicular tunnels under the Lachine Canal, highspeed freeways, off-street parking, and increasingly severe parking regulations. Some of these suggestions have become actualities. The city is doing much to put its street system in order, but it is quite apparent that improvements of this kind, no matter how extensive, are not the final answer to the problem.

When the Montreal Transportation Commission was set up in 1951 and took over the Montreal Tramways Company's street car and bus services, it was specifically charged with the duty of producing by 1953 a scheme for better mass transportation. Its report on this matter has just been submitted to the city authorities. Nobody is surprised to learn that the Commission feels that the only practicable scheme is the construction of a subway and the rearrangement of surface lines to feed it. The Commission is already committed to the abolition of street cars; several important routes have already been shifted to bus operation and others will follow as rapidly as practicable. The complete change-over is expected to take about ten years.

The routes of the proposed system are shown in Fig. 1. The section recommended for immediate construction starts at the Commission's Youville yard and shops (Legendre St.), where there is room for a terminal and new yards and shops for the maintenance of subway rolling stock, runs south under St. Denis St. and swings west under the Champ de Mars to St. James St., thence west under the latter to Victoria Sq., then northwest under private property to Dominion Sq. and the intersection of Peel and St. Catherine Sts., and then west again under St. Catherine St. to Atwater Ave., where there is now unoccupied land available for turnaround cross-overs and a terminal. The total length of the proposed line is 7.78 miles, 3.15 miles of which will be in rock tunnel (Fig. 2), 0.24 mile in earth tunnel and the rest, 4.39 miles, built by cut-and-cover methods (Fig. 3).

There would be 16 stations, with mezzanines where the subway is deep enough to permit it. All would have reversible escalators. There would be a pedestrian tunnel northward from the Place d'Armes station to the present Tramways Terminal on Craig St., where many surface lines originate, and a similar connection at Atwater Ave. to the Forum, the home of "Les Canadiens" and the site of many sports events. Similar connections to other buildings along the route might also be made, though none are apparently provided for. The Atwater Ave. (Western Sq.), de Fleurimont and Youville (Legendre St.) stations would also have surface bus shelters and the St. Catherine and St. Denis St. station would be arranged for the interchange of traffic with the future east-west subway in the former street.

This east-west extension would extend from Peel St. eastward to Viau St. under St. Catherine and Ontario Sts. Its western section would run from Atwater Ave. to Girouard Ave. under Sherbrooke St. The distance from Girouard Ave. to Viau St. is 6.56 miles. A further component of a comprehensive system is a line northward on Frontenac and Iberville Sts. from Ontario St. to Jean Talon St., thence under the latter to Pie IX Blvd. This would be 3.90 miles long.

The western extension would ultimately be further extended to Church St. in Ville St. Laurent, under Girouard Ave. and Decarie Blvd., a distance of 4.42 miles. The completed system, then, would comprise something over 22 miles of subway, with 37 stations.

Routes were selected only after prolonged and careful study of all practicable locations. Those chosen will give the best service to the greatest number of passengers. It is estimated that in about half the area tributary to the initial subway, travelling time will be reduced by from 30 to 45 per cent, while the time saving in the rest of the area will be of the order of from 15 to 30 per cent. In addition, of course, subway travel is incomparably faster than surface transportation, can offer much more frequent service and is unaffected by the weather.

It is proposed to operate eight-car trains during the rush hours and four or six-car trains at other times, with either three- or six-minute headways. The schedule contemplated will handle about 400,000 passengers per day and capacity can easily be increased by running more long trains and by using more of the short headways.

Details of construction, of rolling stock, of power supply and of control would conform generally to standards found satisfactory by other subway systems. The piston action of trains would generally be relied upon for ventilation, but fans would be installed at some ventilation outlets. Nine drainage sumps would be provided, each with duplicate 750 g.p.m. pumps.

Six-hundred-volt direct current would be used for traction power, produced from 12,000 v. alternating current at seven substations. A protected over-running third rail would be used for delivering current to trains. Station and tunnel lighting and power for pumps, fans, etc., would be from alternating current circuits.

There would be a complete private telephone system, and, of course, the most modern of block

Comprehensive Plan of Proposed Subway System, with Possible Pattern of Surface Routes. : : Forecast of population distribution, 1971. ▬ Initial subway project. - - - - Future subway. ⁻O Subway stations. —— Surface transit routes. ++++ Passenger railway lines.

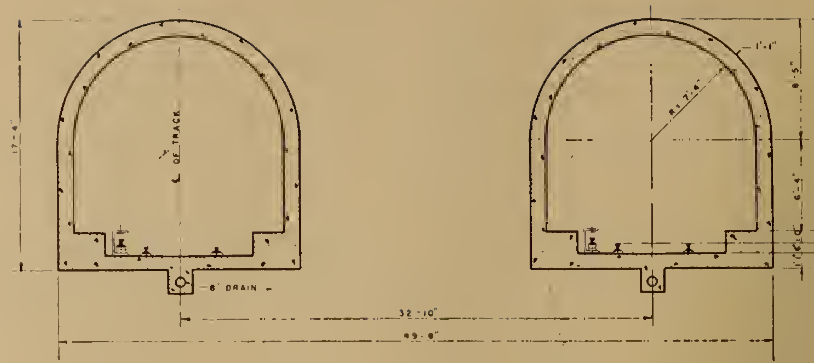
signal systems, with automatic stops. All electrical equipment, except that on the trains themselves, would be controlled from a supervisory station in the vicinity of the Tramways Terminal on Craig St. Those on duty there would know at all times the position of every train and of every switch and the condition of every signal, as well as the state of all the auxiliary apparatus. In short, every precaution which would contribute to safety would be taken.

The subway cars proposed are practically duplicates of those already purchased for the Toronto subway. They would be from 55 to 60 ft. long by about 10 ft. wide, with thermostatically - controlled constant-temperature heating, good ventilation, a lighting system that would give 20 foot-candles at reading level and emergency lighting for use in case of power failure. Two cars would make up a unit and any number of units could be combined into a train. Pneumatic tires are being used experimentally in the Paris Metro; perhaps they could be used in Montreal.

For purposes of study, Montreal and its environs were divided into two areas, inner and outer. The inner area includes Montreal itself and 17 nearby communities, with a 1951 population of 1,273,540 and an estimated 1971 population of 1,750,000. The corresponding figures for the 29 communities of the outer area are 123,434 and 450,000.

There is little doubt that Montreal needs a subway, though there are those who think that there are other and less costly methods of meeting its mass transportation needs. This is not the opinion of the majority of the Montreal Transportation Commission, nor do we think it is the opinion of most citizens of the Montreal metropolitan area. Most of them want a subway. The question is, "How is it to be paid for?"

The Commission suggests that the $87 million estimated cost of the subway structure proper, without equipment, should be borne by the public benefited, i.e., by the citizens of Montreal and of the 45 suburbs included in the inner and outer areas. The Commission does not start with $30 million in hand,



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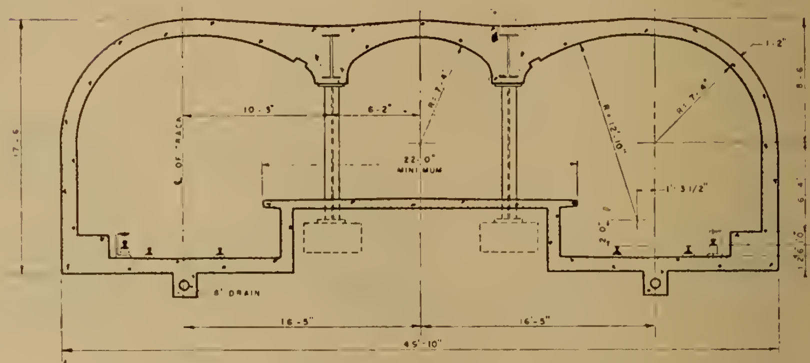
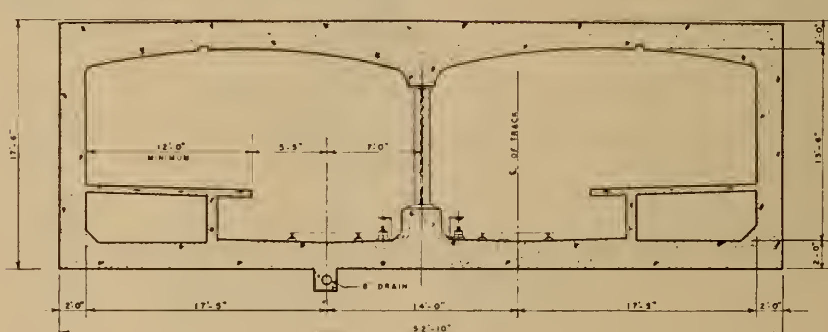


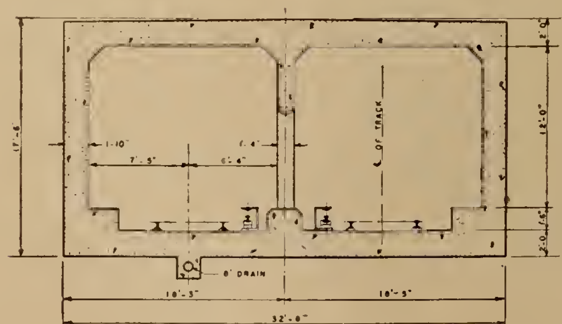
SECTION AT STATIONS

**Above. Typical Construction in Rock Tunnel.**

**Below. Typical Construction in Open Cut.**



SECTION AT STATIONS



SECTION BETWEEN STATIONS

as did Toronto. What method of distributing this cost fairly should be used, the Commission does not say. It is suggested that the Commission itself find the $30 million which would be required to equip the subway with track, and third rail, power distribution and control, telephone and signal systems, cars, yards and storage and repair facilities, in short, all that would be needed to turn the bare structure into an operating entity.

If the $87 million referred to were borrowed at 4½ per cent, it would take $4.4 million annually to amortize it in 50 years, and if this latter sum were assessed equally on each of the 1,396,974 people in both inner and outer areas in 1951, it would amount to about $3.15 per capita annually, or perhaps $12.50 per family. Of course, an even distribution is not proposed; it would be manifestly unfair. The further one lives from the subway, the less one should contribute. As a guess, the annual family contribution might run from $5 to $25, surely not exhorbitant figures.

As to meeting the annual cost of servicing the Commission's debt of $30 million and that of operating the subway as part of a comprehensive mass transportation system, it is estimated that this would add about six-tenths of a cent to each fare.

The people of the Montreal area have a very direct interest in seeing that the city's mass transportation problem is solved as promptly and in as satisfactory and economical manner as possible. Even if they will not benefit directly from such a solution, they will benefit indirectly through reduction in street congestion.

The report is accompanied by 111 sheets of general plans, by Appendix A, "Subsurface Investigations for the Initial Subway" (447 pages and 2 maps) and by Appendix B, "Estimate of Costs for the Initial Subway" (110 pages).

In the preparation of the report on which these notes are based, the Commission was advised by Charles E. DeLeuw, M.E.I.C.; Robert F. Legget, M.E.I.C., director, Division of Building Research, National Research Council, Ottawa, assisted in the subsurface investigations. The Commission consists of Arthur Duperron, M.E.I.C., chairman and general manager, Richard F. Quinn, vice-chairman, Jean Constantin, Leonard Leger and C. A. Sylvestre. One commissioner disagreed with the recommendations of the report and hence did not sign it.

# Elections and Transfers

At the meeting of Council held at Brockville on Friday, January 15, 1954, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

*Members:*

P. A. Beckerich, *Montreal.*
E. W. Blackmore, *Cornwall.*
S. S. de Kottas, *Montreal.*
W. L. Gibson, *Toronto.*
A. A. Goldes, *Winnipeg.*
R. C. Golding, *Toronto.*
H. Loo, *Vancouver.*
T. J. McQuaid, *Belleville.*
N. Roehberg, *Montreal.*
K. Tubbesing, *Montreal.*

*Juniors:*

M. Boruta-Spiechowicz, *Copper Cliff.*
C. R. Cupp, *Copper Cliff.*
R. J. Fletcher, *Montreal.*
J. L. Gordon, *Montreal.*
E. T. Hilbig, *Belleville.*
G. R. McLinton, *Valleyfield.*
H. A. Mitchell, *Fort Erie.*
V. A. O'Kelly, *Montreal.*
D. L. Paterson, *Hamilton.*
C. J. Purcell, *Montreal.*
G. B. Taylor, *Montreal.*
W. A. Turmeau, *Montreal*

*Transferred from the class of Junior to that of Member:*

F. Belshaw, *Sarnia.*
P. W. Bishop, *Victoria.*
G. A. E. Campbell, *Winnipeg.*
J. R. Daye, *Montreal.*
W. M. Gow, *Ft. Frances.*
G. W. Herzog, *Peterboro.*
G. M. Nixon, *Vancouver.*
J. E. Pickering, *Maitland.*
E. T. Quirk, *Montreal.*
W. C. Robertson, *Sao Paulo.*
F. A. Ross, *Montreal.*
W. A. Stocker, *Montreal*
F. R. Thompson, *Asbestos.*
E. A. Walker, *Windsor.*
D. F. Williamson, *Pt. Mellon.*

The following Students were admitted:

R. J. Couture, *Queen's University.*
E. A. Eriksen, *Queen's University.*
J. B. Fenton, *Nova Scotia Tech. Coll.*
C. A. Freitag, *Queen's University.*
D. W. R. George, *Queen's University.*
E. C. Hill, *University of Toronto.*
B. G. Roy, *Laval University.*
I. V. Silgailis, *Nova Scotia Tech. Coll.*
R. P. Winstall, *Sir George Williams.*

### Applications through Associations

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

ALBERTA

*Member:*

T. K. Fowler

*Junior to Member:*

G. N. Campbell
R. S. White

SASKATCHEWAN

*Members:*

R. B. Dupuis
G. O. P. Handegord
G. E. Johnson

*Students:*

L. G. Andrego
P. A. Baker
A. P. Belyk
D. J. Coward
D. M. Derworiz
M. E. Famulak
W. C. Highet
B. A. Holmlund
G. N. Listwin
D. E. J. McGrath
R. Petrowitsch
L. S. Wilson

*Junior to Member:*

R. J. Larson

QUEBEC

*Member:*

W. S. Leggat

*Junior:*

D. A. Findlay

# The *Journal* Thirty-five Years Ago

What strikes one forcibly on looking over the February, 1919, issue of the *Journal* is how different from current numbers it appears. Cover illustrations are things of the future. In 29 pages of advertising there are only 24 cuts, but apparently all the type faces the printer had in stock were used. Many of the advertisers are still with us, but the emphasis on their products has changed.

The Pratt & Whitney Co., known today for its airplane engines, was boosting small tools, Imperial Oil was making a drive to "improve our country roads, too", and so were the Canada Cement Co. and the Barrett Co. Imperial Oil also extolled the virtues of oil as a fuel, a promotional effort long ago rendered quite unnecessary. The Nova Scotia Construction Co. used a page to inform readers that "Hydrostone" would be used by the Relief Commission in rebuilding "devastated Halifax". The Department of Public Works of Nova Scotia had half a page asking someone to undertake a hydroelectric development "in the immediate vicinity of extensive and well-proven gold areas". "Leather, like gold, has no substitute", according to Sadler & Haworth, belting makers.

One of the few illustrations in the advertising pages shows a tank, one would say about 15 feet in diameter by 20 feet deep, being hauled on a sled drawn by four horses and driven by a man in a bowler hat. Shawinigan Power's map shows its system ending at Shawinigan Falls in the north.

This *Journal* was printed by the Modern Printing Co., which used half a page to say so, and the Institute uses another half to announce that "The *Journal* of the Engineering Institute of Canada is the medium to strengthen your contacts with the engineering profession."

A good part of this February number was taken up by the report of Council for 1918, by committee reports and the like. Council's report was short and to the point; it occupied less than a single page. It expressed thankfulness for the ending of the war and paid homage to Institute members who lost their lives in that great struggle. It noted the adoption of a set of new by-laws and the legal change of the Institute's name to its present form. It spoke of three professional meetings—in Toronto, in Saskatoon and in Halifax—held during 1918 and of the formation of the Montreal, Halifax and Saint John branches.

Council's report gave considerable space to reviewing the Institute's efforts to "place the engineering profession on a higher plane" and approved of the "principle of securing legislation for this purpose . . . originated with the western provinces". The *Journal* had "received the hearty approval and commendation of the membership". It prided itself on having secured permission to publish the Engineering Index month by month, 21 pages of which appeared elsewhere in the number, an easy way to fill it which the present editors would probably welcome.

Council thought that interviews with the Civil Service Commission, at which the Institute was asked to "make recommendations regarding salaries will be a powerful factor in raising the standard . . . throughout the Dominion."

Council's report was signed by H. H. Vaughan, president, and Fraser S. Keith, secretary.

Total membership was reported at 3,203, of whom 175 were admitted during 1918. Seventeen casualties among members on active military service were reported. Fourteen branches were listed, all functioning except that at Kingston, where activities were suspended during the war. The Montreal Branch took over the responsibility for February, 1918, for meetings at Headquarters.

In reading over the list of committees, the frequency with which the same names occur is noticeable. The willing horse carried the load, then as now. Many of the 1918 committees have disappeared—by-laws, electro-technical, Board of Examiners (Quebec Act), Gzowski medal and students' prizes, fuel power, steel bridge specifications, steam boiler specifications, roads and pavements, and honour roll. The last committee reported 871 members on active service. The library and house committee reported accessions of about 40 volumes, including "Voyages en Egypte et Planche des Voyages dans la Basse et la Haute Egypte".

The finance committee set the cost of producing the *Journal* for 1918 at $6,032. Our total income was $30,644.19 and we finished the year with a deficit of $1,707.34.

The writer finds he read a paper before the Montreal Branch in 1918; it was later published in the *Journal*. This he remembers very well. He prepared drawings especially for reproduction and headquarters lost them, so the illustrations had to be made from a set of white prints which he had been lucky enough to have made. These were probably the worst illustrations the *Journal* ever published.

The first paper of the February, 1919, *Journal* was one on "Mean Sea Level as a General Datum for Canada", by W. Bell Dawson, arguing that, since precise level bench marks were now becoming available throughout Canada, the Institute should encourage their use, except for dredging operations, where low tide "must be used". Col. R. W. Leonard, president for 1919, followed with a description of the "Mining and Metallurgy of Cobalt-Silver Ores". He thought the Pre-Cambrian Shield "offers to prospectors better chances of locating valuable mineral deposits than can be found in any other country in the world." How right he was!

In "National Highways and Good Roads", Capt. J. A. Duchastel de Montrouge appeals for Federal aid, comparable to that provided in the United States. His plea fell on deaf ears; except for small appropriations many years ago and for the present Trans-Canada Highway scheme, the Federal government has left highway finance strictly to the provinces. Another transportation paper was the "Design and Construction of Reinforced Concrete Viaducts", by B. O. Eriksen and H. S. Deubelbeiss, dealing with two trestles for the Canadian Pacific Ry. between Leaside and North Toronto, Ont. They are notable as early examples of the combination of poured-in-place bents and pre-cast deck slabs. The unit prices on this job are interesting:

Materials:

| | |
|---|---|
| Lumber . . . . | $38.50 M |
| Stone . . . . . | .993 ton |
| Sand . . . . . | .295 ton |
| Cement . . . . | 2.00 bbl. |

Labour:

| | |
|---|---|
| Carpenters . . . . | 0.51 hr. |
| Helpers . . . . . | .40 hr. |
| Labourers . . . . | .37.5 hr. |
| Mixer operators . . | .55 hr. |
| Cement finishers . | .41 hr. |

J. M. R. Fairbairn, later president of the Institute, was then chief engineer of the C.P.R., and P. B. Motley its engineer of bridges.

H. S. Carpenter, Deputy Minister of Highways of Saskatchewan, asked "Can Earth Roads be Made Satisfactory?" and answered himself by saying that they can if properly built and maintained, with the emphasis on maintenance.

A. W. Robinson's "Economy in Ocean Transportation" supports the thesis that ocean shipping and ocean ports should be standardized in a complementary way. He seems to have felt that Canada was headed toward being a great maritime nation. Anyone who has read the newspapers over the past six months knows the present answer to this prophecy.

F. A. Combe, now a consulting engineer in Montreal, but then the Canadian engineer for Babcock & Wilcox, Ltd., discussed "Modern Boiler Practice". This paper strikes the writer as being an excellent one even today, though it is probably somewhat out of line with today's practice.

Legislation was much in the limelight. The Saskatchewan Branch had an act ready for presentation to the provincial legislature, but was asked to hold its hand until all branches had had an opportunity to study the draft. Later, at a special meeting of Council, it was decided that Council could not support the Saskatchewan draft without a special mandate from Institute members. In accordance with requests from several branches, it was also decided to ask representatives from each branch to meet as soon as practicable to discuss the whole matter of legislation. It is quite apparent what was uppermost in the minds of all members in 1919.

The establishments of the Ontario Provincial Division was announced, with Peter Gillespie (Toronto) as chairman pro-tem and an executive committee of Mr. Gillespie, J. R. W. Ambrose (Toronto), E. D. Lafleur (Ottawa), G. A. McCarthy (Toronto), John Murphy (Ottawa), James White (Ottawa), and N. H. McLeod (Toronto). The branch representatives were J. B. Challies (Ottawa), George Hogarth (Toronto), E. R. Gray (Hamilton) and W. S. Wilson (Sault Ste. Marie), and the non-resident members were W. H. Magwood (Cornwall), G. R. Munro (Peterboro), J. L. Morris (Pembroke), R. J. McClelland (Kingston), G. H. Bryson (Brockville), A. C. D. Blanchard (Niagara Falls), T. H. Jones (Brantford), J. L. Weller (St. Catharines), S. B. Clement (North Bay), J. A. Bell (St. Thomas), R. L. Dobbin (Peterboro), L. K. Jones (Port Arthur), and V. A. Belanger (L'Orignal).

There was a spirited letter from John Taylor continuing a controversy begun in October 1918, over priority in the use of a diving bell, and there were a score of letters of thanks for cigarettes sent by the Institute's tobacco fund to members in the services.

The report of the January Council meeting shows that Council instructed the secretary to summarize the legislation situation and to publish the summary in the *Journal*, approved the attempts of the Institute to secure salary increases for engineers in the Civil Service and accepted the design of the Institute emblem—the familiar beaver—as submitted by a committee of which Walter J. Francis was chairman.

The branch reports contain little of interest to us now, save that one from Sault Ste. Marie appears for the first time, that branch having been inaugurated on January 9, 1919.

From two columns of personals we learn that W. A. Mather has been appointed general superintendent of the C.P.R. at Moose Jaw, that A. W. Haddow is the new professor of civil and municipal engineering at the University of Alberta and that Stewart F. Rutherford has been elected to the city council of Westmount, Que., leading the poll.

The employment bureau offered one job—"Splendid opening . . . must be young . . . speak French fluently . . . have business instincts (!) . . . very desirable position". For all this no salary is mentioned nor even hinted at.

## News of Other Societies

The **Canadian Institute of Timber Construction** was formed recently in Ottawa.

The Association's activities will be directed toward standardization of constants of size, quality and terminology of materials in the glulam timber engineering industry; promotion of C.S.A. and N.B.C. Codes shortly to be adopted; the provision of high quality workmanship; the dissemination of information; co-ordination with the construction industry, through statutes and regulations; and the establishment of equitable fire regulations.

Information concerning membership can be obtained from the Association's temporary offices, c/o W. A. Nicholson, 68 Ontario Street, Burlington, Ont.

Pro-tem officers serving until the first annual meeting, are president D. D. Millar, vice-presidents, R. F. DeGrace, and W. Thornber, and secretary-treasurer, W. A. Nicholson.

It is tentatively proposed that the first annual meeting will be held in New Orleans, March 28 to April 4, in co-operation with that of the American Institute of Timber Construction.

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The **Canadian Industrial Safety Conference**, a new organization, will work on a national basis for the prevention of industrial accidents and the safety of workers in industries covered by Workmen's Compensation in each province.

Officers are, president, Wills Maclachlan, Electrical Employers Association of Ontario, Toronto; vice-presidents, R. C. Patterson, N.B. Accident Prevention Association, Saint John; E. E. Owen, Workmen's Compensation Board, Edmonton; secretary-treasurer, R. G. D. Anderson, Industrial Accident Prevention Associations, Toronto; and executive member, T. H. Miller, Quebec Association for the Prevention of Industrial Accidents, Montreal.

Membership will include associations primarily concerned with the prevention of industrial accidents, as well as large organizations such as the C.P.R., C.N.R., and Bell Telephone Company of Canada. Three organizational meetings have been held, and the next meeting will be on April 7, 1954 at the Royal York Hotel, Toronto.

# The ASME Boiler Code

### Interpretations

The Boiler Code Committee meets monthly to consider "Cases" where users have found difficulty in interpreting the Code. These pass through the following procedure: (1) Inquiries are submitted by letter to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.; (2) Copies are distributed to Committee members for study; (3) At the next Committee meeting interpretations are formulated to be submitted to the ASME Board on Codes and Standards, authorized by the Council of the Society to pass upon them; (4) They are submitted to the Board for action; (5) Those which are approved are sent to the inquirers and are published in Mechanical Engineering.

(The following Case Interpretations were formulated at the Committee meeting October 30, 1953, and approved by the Board on January 12, 1954.)

**Case No. 1164-1**

(Reopened)

Special Ruling

***Inquiry:*** When carbon steel plates, forgings, pipes, tubes and castings conforming to an approved specification and having a specified minimum yield strength of 30,000 lb. per sq. in. are used for the construction of vessels under external pressure, under what rules shall they be designed and fabricated?

***Reply:*** It is the opinion of the Committee that carbon steel plates, forgings, pipes, tubes and castings that conform to the requirements of an approved specification and have a specified yield strength of at least 30,000 lb. per sq. in. may be used for the construction of vessels under external pressure and the vessels may be stamped with the Code symbol provided the following requirements are complied with:

(1) The applicable rules in the 1952 Edition of Section VIII of the Code covering vessels under external pressure when constructed of carbon steel shall be adhered to;

(2) The thickness of shells and heads and the required moment of inertia for stiffening rings shall be determined from the chart in Fig. UCS-28.2.

NOTE: The chart in Fig. UCS-28.2, "Chart for Determining Shell Thickness of Cylindrical and Spherical Vessels Under External Pressure When Constructed of Carbon Steel (Specified Yield Strength 30,000 to 38,000 lb. per sq. in.)" is the same chart published previously as Addenda to 1952 Sec. VIII for carbon steel with specified yield strength 31,000 to 40,000 lb. per sq. in., it will also be included in the published Interpretations.

**Case No. 1177**

Special Ruling

***Inquiry:*** Expansion joints are being used in pressure vessel installations. The Code makes no specific provisions for them. Under what conditions may an expansion joint be used as an integral part of a Code pressure vessel?

***Reply:*** It is the opinion of the Committee that, pending the adoption of Code rules for expansion joints they may be used as integral parts of Code pressure vessels provided they satisfy the following conditions:

1) The combined bending and direct stress due to flexing and pressure in the flexing elements shall be controlled as follows:

The manufacturer of the joint shall submit to the authorized inspector satisfactory evidence, in the form of certified test data supplemented by service records if applicable and available, that:

(I) The joint will withstand the hydrostatic test prescribed for the vessel;

(II) The joint, while subject to the design pressure and design temperature will withstand four times the number of design amplitude direct flexings or other form of movement required by the purchaser of the vessel;

(III) The joint, while at the design temperature, is capable of withstanding a single application of four times the design pressure without rupturing the joint and regardless of the amount of distortion.

(2) All of the requirements of Part UW of the 1952 Section VIII with the exception of the higher stresses implied in (I) of the Reply, shall be complied with.

(3) The expansion joint shall not be stamped with the Code symbol but in addition to the certified data of (1) of this Reply the manufacturer of the joint shall execute a partial data report as required by Par. UG-120 (b) using Form U-2 insofar as applicable in order that the final inspector of the completed vessel may have the information necessary to satisfy him that the expansion joint is adequate for the vessel in which it is to be used and that the materials and welding are in accordance with Code rules.

The certified data of (1) of this Relay and the partial data report shall be the final inspector's authority to witness the application of a Code symbol to the completed vessel.

### Case No. 1178

Interpretation of Tables A-5, A-6 and P-15 of Section I and Tables UA-451 and UA-452 of Section VIII

***Inquiry:*** Section I, Tables P-15, A-5 and A-6; Section VIII, Tables UA-451 and UA-452 contain pressure temperature ratings for flanged fittings, flanges and valves produced in accordance with ASA B16e-1949 Supplement No. 1. This standard has been revised and reissued as ASA B16.5-1953. May the pressure temperature ratings contained in the revised standard be used in place of the tables currently in the Code?

***Reply:*** It is the opinion of the Committee that the pressure temperature ratings contained in ASA B16.5-1953 meet the intent of the Code, and may therefore be used.

### Case No. 1179

Special Ruling

***Inquiry:*** When nickel, nickel-copper alloy, or nickel-chromium-iron alloy plates, sheets, pipes, tubes, and shapes conforming to an approved specification are used for the construction of vessels under external pressure, under what rules shall they be designed and fabricated?

***Reply:*** It is the opinion of the Committee that nickel, annealed nickel-copper alloy, or annealed nickel-chromium-iron alloy plates, sheets, pipes, tubes and shapes that conform to the requirements of an approved specification may be used for the construction of vessels under external pressure and the vessels may be stamped with the Code symbol provided the following requirements are complied with:

(1) The applicable rules in the 1952 Edition of Section VIII of the Code covering vessels under external pressure when constructed of non-ferrous materials shall be adhered to.

(2) The thickness of shells and heads, and the required moment of inertia for stiffening rings shall be determined from the charts in Fig. UNF-28.6 for nickel, Fig. UNF-28.7 for annealed nickel-copper alloy, or Fig. UNF-28.8 for annealed nickel-chromium-iron alloy.

Note: The following charts are available from the Secretary of the Boiler Code Committee, and will also be included in the published Interpretations:

Fig. UNF-28.6—Chart for Determining Shell Thickness of Cylindrical and Spherical Vessels Under External Pressure When Constructed of Nickel.

Fig. UNF-28.7—Chart for Determining Shell Thickness of Cylindrical and Spherical Vessels Under External Pressure When Constructed of Annealed Nickel-Copper-Alloy.

Fig. UNF-28.8—Chart for Determining Shell Thickness of Cylindrical and Spherical Vessels Under External Pressure When Constructed of Annealed Nickel-Chromium-Iron-Alloy.

### Case No. 1154

Case Annulled

Case No. 1154 can be annulled as a result of the revision to Table UCS-23 of Sec. VIII.

## Proposed Revisions and Addenda to Boiler and Pressure Vessel Code

As need arises, the Boiler Code Committee entertains suggestions for revising its Codes. Revisions approved by the Committee are published here as proposed addenda to the Code to invite criticism. If and as finally approved by the ASME Board on Codes and Standards, and formally adopted by the Council, they are printed in the annual addenda supplements to the Code. Triennially the addenda are incorporated into a new edition of the Code.

In the following the paragraph numbers indicate where the proposed revisions would apply in the various sections of the Code.

Comments should be addressed to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.

### Material Specifications, 1952

The Boiler Code Committee has approved adding to Section II the following new specifications: SA-6-52aT and SA-20-52T.

The following four specifications have been superseded by SA-335-52aT:

SA-158-51T
SA-206-51T
SA-280-51T
SA-315-51T

Specification SA-157-50T has been superseded by SA-351-52T.

### Unfired Pressure Vessels, 1952

***Members of Committee:*** Add "George S. Chadwick, Jr." to the membership of the Subcommittee on Unfired Pressure Vessels.

***Contents "Appendix A — Porosity Charts"*** should be listed under the Mandatory Appendixes as "Appendix IV—Porosity Charts". The change from "Appendix A" to "Appendix IV" should be made in Par. UW-51(m) (4) and throughout.

***Par. UG-32(l).*** Revise to read:

(1) An ellipsoidal torispherical or toriconical head which is attached to a shell by a butt joint need not be provided with a skirt when the nominal head thickness does not exceed 1¼ times the nominal shell thickness. When the nominal head thickness exceeds 1¼ times the nominal shell thickness, a skirt shall be provided having a length not less than three times the nominal head thickness or 1½ in., whichever is smaller. When a skirt is used it shall meet the requirements for shell thickness in Par. UB-27 (c).

***Par. UG-41 (d).*** In line 3 change "section" to "parts".

***Par. UG-44.*** Revise the last sentence to read: "Other flanges shall be designed in accordance with the rules in Appendix II, except that flanges within the size and pressure ranges of the above Standards may be designed by interpolation."

***Par. UG-45.*** Revise subparagraph (1) to read:

(1) The required thickness of the shell or head assuming E=1, plus the design corrosion allowance.

***Par. UG-101 (o).*** Change "deformation" to "displacement" in the first line of subparagraph (3) and the fourth line of subparagraph (4).

***Par. UG-99 (g).*** Revise to read: "Following the application of the hydrostatic test pressure an inspection shall be made of all joints and connections. This inspection shall be made at a pressure not less than 2/3 of the test pressure."

***Fig. UW-9(c).*** Change "Hemispherical Shape" to "Heads Thinner than Shell".

***Par. UW-(2b).*** Revise the first sentence to read: "Vessels that are to operate below —20F. shall have all longitudinal and circumferential joints of the double-welded butt type or its equivalent when impact tests in accordance with Par. UG-84 are required for the material or weld metal."

***Table UW-12.*** In footnote 4, change "UA-61" to "UA-60".

***Fig. UW-16.1.*** This figure has been revised; copies can be obtained from the Secretary of the Boiler Code Committee, and will also be included in the published Addenda.

***Fig. UW-16.2.*** A minor change has been made in the dimensioning of this figure; copies can be obtained from the Secretary of the Boiler Code Committee, and will also be included in the published Addenda.

***Par. UW-16.*** Revise to read:

UW-16. Minimum requirements for Attachment of Welds.

(a) General. The location and minimum size of attachment welds for nozzles and other connections shall conform to the requirements in this paragraph.

(b) Symbols. The notations used in this paragraph and in Figs. UW-16.1 and 16.2 are defined as follows:

$t$ = nominal thickness of vessel shell or head less corrosion allowance, inches;
$t_n$ = nominal thickness of nozzle wall less corrosion allowance, inches.

$t_e$ = thickness of reinforcing element, inches;

$t_w$ = dimension of partial-penetration attachment welds (fillet, single-bevel, or single-J) measured as shown in Fig. UW-16.1 inches;

$t_c$ = the smaller of ¼ inch or $0.7t_n$; (inside corner welds may be further limited by a lesser length of projection of the nozzle wall beyond the inside face of the vessel wall);

$t_{min}$ = the smaller of ¾ inch or the thickness less corrosion allowance, of either of the parts joined by a fillet, single-bevel, or single-J weld, inches;

$t_1$ or $t_2$ = not less than ⅓ $t_{min}$ or ¼ inch.

(c) Necks Abutting the Vessel Wall. Necks abutting the vessel wall shall be attached by a full-penetration groove weld. Backing strips shall be used with welds deposited from only one side when the shell thickness is over ⅜ in. or when complete joint penetration can be verified by visual inspection (see Fig. UW-16.1 (a) and (b).)

Necks or tubes recessed into thick-walled vessels or headers may be welded from only one side by cutting a welding groove in the vessel wall to a depth of not less than $t_n$ on the longitudinal axis of the opening. It is recommended that a recess 1/16 in. deep be provided at the bottom of the groove in which to center the nozzle. The dimension $t_w$, of the attachment weld shall be not less than $t_n$ or less than ¼ in. (For examples see Figs. UW-16.1 (y) and (z).)

(d) Inserted Necks without Added Reinforcing Elements. Necks inserted into or through a hole cut in the vessel wall and without additional reinforcing elements shall be attached by a full-penetration groove weld or by two partial-penetration welds, one on each face of the vessel wall. Permissible types of welds are shown in Fig. UW-16.1 (c) to (h).

Backing strips shall be used with full-penetration welds deposited from only one side when the shell thickness is over ⅜ in. or when complete joint penetration can not be verified by visual inspection. The two partial-penetration welds may be any desired combination of fillet, single-bevel, and single-J welds. The dimension $t_m$ to each weld shall be not less than ⅓ $t_{min}$ nor less than ¼ in. and their sum shall be not less than 1¼ $t_{min}$. (See Fig. UW-16.1).

(e) Inserted Necks with Added Reinforcement. Inserted-type necks having added reinforcement in the form of one or more separate reinforcing plates shall be attached by welds at the outer edge of the reinforcement plate and at the nozzle-neck periphery. The weld at the outer edge of the reinforcement shall be a fillet weld with a minimum throat dimension of ½ $t_{min}$. The welds attaching the neck to the vessel wall and to the reinforcement shall consist of one of the following combinations:

(1) A single-bevel or single-J weld in the shell plate and a single-bevel or single-J weld in each reinforcement plate. The dimension, $t_w$ of each weld shall be not less than 0.7 $t_{min}$ (Fig. UW-16.1(n).)

(2) A full-penetration groove weld in the shell plate, and a fillet, single-bevel or single-J weld with a weld-dimension, $t_w$, not less than 0.7 $t_{min}$ in each reinforcement plate (Fig. UQ-16.1(m).)

(3) A full-penetration groove weld in each reinforcement plate, and a fillet, single-bevel, or single-J weld with a weld-dimension, $t_w$, not less than 0.7 $t_{min}$ in the shell plate (Fig. UW-16.1 (l).)

(f) Nozzles with Integral Reinforcement. Nozzles and other connections having integral reinforcement in the form of extended necks or saddle-type pads shall be attached by a full-penetration weld or by means of a fillet weld along the outer edge and a fillet, single-bevel, or single-J weld along the inner edge. The throat dimension of the outer weld shall be not less than ½ $t_{min}$. The dimension $t_w$ of the inner weld shall be not less than 0.7 $t_{min}$ Fig. UW-16.1(k), (r), (s) and (t).)

(g) Fittings with Internal Threads. The attachment of internally threaded fittings shall meet the following requirements.

(1) Except as provided for in (2), (3), and (4), internally threaded fittings shall be attached by a full-penetration groove weld, or by two fillet or partial-penetration welds, one on each face of the vessel wall. The minimum weld dimensions shall be as shown in Fig. UW-16.1(u), (v), (w) and (x).

(2) Fittings shown in Fig. UW-16.1 (u2), (v2), (w2) and (x) not exceeding 3 in. pipe size may be attached by welds that are exempt from size requirements other than those specified in Par. UW-15(a).

(3) Internally threaded fittings or equivalent bolting pads not exceeding 3 in. pipe size may be attached to vessels having a wall thickness not greater than ⅜ in. by a fillet weld deposited from the outside only, having the minimum dimensions shown in Fig. UW-16.2.

(4) Internally threaded fittings not exceeding 3 in. pipe size may be attached by a fillet groove weld from the outside only as shown in Fig. UW-16.1 (w3). The groove weld $t_w$ shall not be less than the thickness of schedule 160 pipe (ASA B36.10 — 1950).

***Fig. UW-19.1.*** Delete diameter of staybolt d = ⅞″ max. from each of drawings (a), (b), (c), (d), and (e).

***Par. UW-52(g).*** In the second line of the second column, change "operator" to "welder".

***Table UCS-23.*** In the stress values for Low-Alloy Steels SA-193-B7, add "8500" in the 950 F column and "4500" in the 1000 F column.

***Par. UCS-28(a).*** Revise to read:
(a) Cylindrical and spherical shells under external pressure shall be designed by the rules in Par. UG-28, using Fig. UCS-28.

***Par. UCS-56(a) (1).*** Add "SA-301 Grade B" and change "SA-302 Grade B" to "SA-302".

***Par. UCS-56(a) (2).*** Add "SA-301 Grade A".

***Par. UNF-28(a).*** Revise to read:
(a) Cylindrical and spherical shells under external pressure shall be designed by the rules in Par. UG-28, using Fig. UNF-28.

***Par. UHA-28(a).*** Revise to read:
(a) Cylindrical and spherical shells under external pressure shall be designed by the rules in Par. UG-28, using Fig. UHA-28.

***Par. UCI-28(a).*** Revise to read:
(a) Cylindrical and spherical shells under external pressure shall be designed by the rules in Par. UG-28, using Fig. UCI-28.

***Par. UA-250.*** Delete subparagraph (d).

***Par. UA-276(a).*** In the last line of Step 1, change "2.44" to "244".

***Par. UA-48(a) (3).*** Revise to read: "This classification covers types of construction where the attachment of the flange to the neck or vessel wall is such that the assembly is considered to act as a unit which should be calculated as an integral flange. For simplicity the designer may calculate the construction as a loose-type flange provided none of the following values is exceeded.

$g_o = \frac{5}{8}$in; $\frac{B_o}{g_o} = 300$; $P = 300$ psi.; operating temperature = 700 F.

***Par. UA-280.*** Revise Example 4 to read:

Example 4

A 16-inch, 600-pound welding-nozzle conforming to Specification SA-105, Grade II, is attached to a vessel that has an inside diameter of 96 in. and a shell-thickness of 2 in. The shell-material conforms to Specification SA-212, Grade A. The vessel operates at 425 psi. and 800 F. An allowance of 1/16 in. for corrosion is included in the shell and nozzle thickness. The vessel is stress-relieved and radiographed. Check the adequacy of the attachment welds shown in Fig. UA-280.4. Wall thickness required.

Shell $t_r$

$$= \frac{425 \times 48.06}{11{,}400 \times 1.0 - 0.6 \times 425} = 1.833 \text{ in.}$$

Nozzle $t_{rn}$

$$= \frac{425 \times 8.06}{{}^{*}11\,400 \times 1.0 - 0.6 \times 425} = 0.308 \text{ in.}$$

Size of weld required (see Par. UW-16(f).)

Outer perimeter weld = 1.41 × 0.5 × 0.75 = 0.53 in.

Inner perimeter weld = 0.7 × 0.75 = 0.53 in.

The weld sizes used are satisfactory.

Area of reinforcement required.

A = 16.125 × 1.833 = 29.56 sq. in.

Area of reinforcement provided.

$A_1 = 16.125\ (1.937 - 1.833) = 1.68$ sq. in.

$A_2 = 2 \times 4.84 (1.687 - 0.308) = 13.35$ sq.in.

$A_3 = 2 \times \frac{1}{2} \times (0.75)^2 = 0.56$ sq. in.

$$A_4 = 2 \times 2.0 \frac{(26 - 19.5)}{2} + 2 \times \frac{1.5}{2} \frac{(26 - 19.5)}{2} = 17.87 \text{ sq. in.}$$

Total area furnished = 33.46 sq. in.

Load to be carried by welds (Par. UG-41 (b) (2).)

$W = (29.56 - 1.68)\ 11{,}400 = 317{,}800$ lb.

Unit stresses

Shear in fillet weld = 0.49 × 11,400 = 5590 psi.

Shear in groove weld = 0.60 × 11,400 = 6840 psi.

Strength of connection elements

*A* Fillet weld in shear = 1.57 × 26.0 × 0.75 × 5590 = 171,100 lb.

*B* Groove weld in shear = 1.57 × 17.0 × 0.875 × 6840 = 159,700 lb.

The connection elements *A* and *B* have a design strength of 330,800 lb., which exceeds the required strength of 317,800 lb.

*See Par. UG-41(a).

***Par. UA-500.*** In the first line of the second paragraph on page 162 insert "the" before "transition".

## Announcement

Addenda for the 1952 (Ferrous) Edition of Section IX, ***Welding Qualifications***, has been printed and is available from the Society.

# Personals

## News of the Personal Activities of Members of the Institute

### Associations Elect Officers

**William Lister Sagar,** M.E.I.C., professor of civil engineering at the University of Toronto, and one of Canada's foremost authorities on soils and construction materials, has been elected 1954 president of the Association of Professional Engineers of Ontario. Professor Sagar is also vice-president of the Dominion Council of Professional Engineers.

A member of the engineering faculty of the University of Toronto since 1937, he continues to serve as a consultant in construction work taking place in Ontario.

During the earlier years of Professor Sagar's career, he worked in the construction field as a contractor and helped in the construction of such buildings as the T. Eaton Company College Street Store, and the Robert Simpson Company store in downtown Toronto. He also took part in the building of the Humber River Bridge, and has served as a consultant on foundation projects at the Imperial Oil Limited refinery at Sarnia.

In the 1930's he assisted in the soil work undertaken by the old Department of Northern Development (now absorbed into the Ontario Department of Highways) and Brunner, Mond (Canada) Ltd., in carrying out early highway building in Northern Ontario. During that time he became interested in mining, and served as president of Monarch Mines Ltd., operating in both the Great Bear Lakes and Quebec mine fields.

He is a veteran of both world wars, and holds the rank of lieutenant-colonel in the R.C.E.M.E.

Professor Sagar joined the Association of Professional Engineers of Ontario in January, 1923, about six months after it was given a provincial charter. He has been actively associated with its work during the last eight years.

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The following officers were elected to the executive council of the Association of Professional Engineers of Ontario for the year 1954:

First vice-president, **John R. Montagne,** M.E.I.C., director of engineering of the Hydro-Electric Power Commission of Ontario; second vice-president, **John H. Waghorne,** engineer in charge of electrical research of the Hydro-Electric Power Commission of Ontario; councillors, **John S. Ellis,** JR.E.I.C., design engineer with H. G. Acres and Co. Ltd., Niagara Falls, Ont,, and **Robert C. McMordie,** JR.E.I.C., program planning and control engineer with the Hydro-Electric Power Commission of Ontario (civil branch); **Gordon W. Ames,** M.E.I.C., process engineer with Polymer Corp. Ltd. in Sarnia, and **James M. King,** M.E.I.C., of Canadian General Electric Co. Ltd. in Peterborough, (chemical and metallurgical); **Gordon M. McHenry,** Western Region consumer service engineer for the Hydro-Electric Power Commission of Ontario in London, and **Harold R. Osborne,** chief engineer for Ferranti Electric Limited in Mount Dennis (electrical branch); **John H. Fox,** M.E.I.C., general sales manager of Minneapolis-Honeywell Regulator Co. Ltd. in Toronto, and **John H. Ross,** M.E.I.C., Toronto consulting engineer, (mechanical and industrial branch); **Duncan R. Derry,** chief geologist of Ventures Limited in Toronto, and **Reginald C. Mott,** manager of the mining and reduction division of Falconbridge Nickel Mines Ltd. at Falconbridge.

The executive director of the Association is **T. M. Medland;** the registrar is **J. Murray Muir,** and the field secretary is **Thomas C. Keefer,** M.E.I.C.

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**Charles Bentall,** M.E.I.C., president and general manager of Dominion Construction Co. Ltd., and president of New Building Finance Co. Ltd., in Vancouver, B.C., was recently elected president of the Association of Professional Engineers of British Columbia during the Association's two-day convention in Vancouver.

Newly elected council members of the Association of Professional Engineers of British Columbia are **F. R. Phillips,** M.E.I.C., of Pearson Phillips & Barrett, Vancouver; **J. D. McMynn, Col. G. M. Letson,** M.E.I.C., of Letson & Burpee Ltd., Vancouver, and **Jack L. Miller,** M.E.I.C., Vancouver consulting engineer.

The government of British Columbia has appointed four engineers to the council of the Association of Professional Engineers of British Columbia.

The new members are **E. C. Roper,** manager of Britannia Mining and Smelting Company; **Prof. W. O. Richmond,** M.E.I.C., of the Universtiy of British Columbia; and **William Hall,** chief engineer of the surveys division of the Department of Lands and Forests, and **J. H. Steele,** B.C. Electric Company.

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At a recent dinner in the Windsor Hotel in Montreal, long service awards were made by the Shawinigan Water and Power Company, Shawinigan Engineering Company Ltd., and Shawinigan Chemicals Ltd., to men with 25 years' service or more.

Among the men in the firms receiving awards were **C. R. Lindsey,** M.E.I.C., of Shawinigan Engineering, with 47 years; **R. E. Heartz,** M.E.I.C., president of Shawinigan Engineering, with 33 years; **R. J. Beaumont,** board chairman of Shawinigan Water and Power, with 43 years; **L. F. Lontrel,** president of Shawinigan Products Corporation, New York, with 33 years; **V. G. Bartram,** president of Shawinigan Chemicals, with 38 years; **J. A. McCrory,** M.E.I.C., former board chairman of Shawinigan Engineering, with 37 years; and **J. A. Fuller,** president of Shawinigan Water and Power.

**John B. Shallenberger,** M.E.I.C., president of the Connellsville Manufacturing and Mine Supply Company and chairman of the Board of Shallway Corporation, has been appointed assistant to the director of the Stanford Research Institute of Palo Alto, California.

**John B. Shallenberger, M.E.I.C.**

The Stanford Research Institute, created five years ago by a group of American business men and organized under the auspices of Stanford University, is a non-profit public service organization which assists industry in the United States, Canada and several

countries overseas in applied research fields of chemistry, physics, electronics, and economics. It is a separate corporation, employing 700 people, most of whom are industry-trained professionals.

Mr. Shallenberger was formerly assistant to the president of Canadair Limited, and spent two years gathering case material and lecturing at Aluminium Limited's School of international business administration, the Centre d'Etudes Industrielles in Geneva. He has been Washington representative for the Douglas Aircraft Company, and last year set up an executive development program as training manager for the international division of the Ford Motor Company.

He has lectured on a part-time basis at McGill University, Columbia University, New York University and Stanford University.

### Correction

In the January Journal, Personals Section, information about John F. Frisch, JR.E.I.C., was printed incorrectly. This was brought about by the confusion of his name with that of his father, John Frisch, M.E.I.C.

Correct information is as follows:

**John Frisch,** M.E.I.C., is a project engineer with Canadian International Paper Company in Hawkesbury, Ont.

Mr. Frisch was previously with Canadian International Paper Company at Temiskaming.

He is a graduate of the Technical Institute of Horton, Norway, Class of 1906.

**John F. Frisch,** JR.E.I.C., is the mechanical engineer in the Technical Section, Canadian Pulp and Paper Association in Montreal.

He is a graduate in mechanical engineering of McGill University, class of 1952.

David Cramer, M.E.I.C.

**David Cramer,** M.E.I.C., P.F.R.A. office engineer in Lethbridge, Alta., has been elected chairman of the Lethbridge Branch of the Engineering Institute.

Mr. Cramer was born at Sheho, Saskatchewan. He obtained his early education in Saskatoon, Saskatchewan. While attending the University of Saskatchewan, Mr. Cramer was employed during the summer months by the Department of Transport as chainman on airport construction; by P.F.R.A., as rodman for two summers on a survey party, and as instrumentman on a survey party.

After receiving his B.Sc. degree in civil engineering in 1944, Mr. Cramer joined P.F.R.A., Department of Agriculture, in Regina, Saskatchewan, as a design engineer. The following year he was transferred to Calgary, Alberta, to work on the St. Mary Irrigation Project as design engineer.

In 1946 Mr. Cramer was transferred to Lethbridge, Alberta, to take part in construction work on the St. Mary Project. Two years later he was appointed office engineer in Lethbridge.

Mr. Cramer was elected secretary-treasurer of the Lethbridge Branch of the Engineering Institute in 1948 and served in that capacity until 1951 when he was named vice-chairman of the Branch.

**John Zabinski,** M.E.I.C., has been appointed eastern district manager of chemical sales for Canadian Chemical Company. He will make his headquarters in Montreal and will be responsible for the sales district comprising the eastern part of Ontario, all Quebec and the Maritimes.

Mr. Zabinski graduated in chemical engineering from the University of British Columbia in 1943. Since that time he has concentrated on chemical sales and served with the industrial chemical sales department of Dow Chemical of Canada Ltd.

**R. E. P. Bowman,** M.B.E., M.E.I.C., has been appointed general manager of the Pacific Great Eastern Railway.

Mr. Bowman comes to the Pacific Great Eastern Railway from the Canadian Pacific Railway with which he had been serving as acting superintendent at Medicine Hat, Alberta.

A graduate of the University of Alberta, Mr. Bowman held the rank of major in the Royal Canadian Engineers with which he served from 1940 until 1945. During that time he formed and commanded the No. 2 Railway Company and later served as assistant director of transportation at the headquarters of the 21st Army Group and at the headquarters of the 1st Canadian Army. He was awarded the M.B.E. for his services.

Mr. Bowman first entered the Canadian Pacific Railway in 1926 and has very extensive railroad experience.

**Lt. Col. M. C. Sutherland-Brown,** M.E.I.C., senior highway engineer on the Alaska Highway for the Department of National Defence in Whitehorse, has been elected chairman of the Yukon Branch of the Engineering Institute.

Lt.-Col. Sutherland-Brown was born in London, England. He received his general education at University School, Victoria, British Columbia, and his engineering training at the Royal Military College and Queen's University, graduating from the latter with a B.Sc. degree in civil engineering in 1939.

During 1938 and 1939 he was employed on general construction as works officer with the Royal Canadian Engineers, and as assistant district engineer officer in Calgary, Alberta.

From 1939 until 1945 he served in various military engineering units overseas, during which time he rose from the rank of lieutenant to that of lieutenant-colonel.

For two years after the war, Lt.-Col. Sutherland-Brown was district engineer officer on general construction in Vancouver, B.C. Then, in 1947, he was posted to Army Headquarters as assistant director of works and accommodation. As such, he was responsible for general construction, including hospitals for the Department of Veterans Affairs, highway and general construction for the Defence Research Board, as well as town planning and development for new Army camps in isolated areas.

Lt.-Col. Sutherland-Brown has been in the Yukon since 1952.

Claude E. Howard, M.E.I.C.

**Claude E. Howard,** M.E.I.C., has been appointed staff manager of the government department of Canadian Johns-Manville Company, Ltd. In this capacity he will serve as liaison between the Company and all branches of government in Canada.

Prior to his joining Johns-Manville, Mr. Howard was an engineer with the Bell Telephone Company of Canada.

A native of Smiths Falls, he received his B.Sc. degree in mathematics and physics from St. Patrick's College, Ottawa, in 1939, and his B.Eng. degree in civil engineering from McGill University in 1950.

From 1943 until 1946 he served as flight lieutenant in the Royal Canadian Air Force.

**H. C. T. Boyd,** M.E.I.C., has been appointed assistant chief of research for the Canadian National Railways.

Born of Scottish parents on the Island of Penang off the Malay Coast, Mr. Boyd was educated at Charterhouse and the University of Cambridge, England. He graduated from Cambridge in 1927 with a Master of Arts degree in mechanical sciences.

After graduation he served as engineer on a hydro-electric development in Scotland. He came to Canada in 1929, and, after working in private business and with various engineering firms here, went to India to serve with the Military Engineering Services in 1936. He returned to Canada in 1939 and was engaged in the construction of defence projects until 1944. He then joined Canadian National Railways as assistant engineer in the research and development department.

Mr. Boyd is an associate member of the Institution of Civil Engineers in London, England.

**Alfreds Vikmanis,** M.E.I.C., is with the Foundation Company of Canada Limited in Montreal.

He was previously with this Company as designing engineer in Sault Ste. Marie, Ont.

Mr. Vikmanis graduated in civil engineering from the University of Latvia in 1938.

**J. G. McLellan,** M.E.I.C., wiring materials and marine equipment manager of the Northern Electric Company Limited's general sales department in Montreal, has been named manager of the Company's Fort William branch.

J. G. McLellan, M.E.I.C.

Mr. McLellan was born in Prince Rupert, B.C., and received his electrical engineering degree from the University of British Columbia in 1936.

He joined the Northern Electric Company in 1936 in Vancouver in the power apparatus and electronics sales department, and in 1942, was appointed power apparatus specialist in Calgary. Later in the same year he moved to Montreal as marine fittings supervisor in the general sales department. He became power apparatus engineer in 1945, and equipment engineer the following year. He was appointed wiring materials and marine equipment manager in 1947.

**James D. Murdoch,** M.E.I.C., former drilling engineer with British American Oil Co. Ltd. in Edmonton, Alta., has joined the Amurex Oil Development Company as senior petroleum engineer in Calgary, Alta.

He is a graduate in petroleum engineering of the University of Oklahoma, class of 1949.

**Donald D. Love,** M.E.I.C, has accepted the position of equipment engineer in the construction and maintenance department of the Marketing Division of Imperial Oil Limited in Toronto.

He was formerly plant engineer with Moore Business Forms Western Ltd. in Fort Garry, Man.

Mr. Love is a graduate in electrical engineering of McGill University, class of 1947.

**Eric A. Mackenzie,** M.E.I.C., is now chemist with Cables, Conduits and Fittings Limited in St. John, Que.

He was previously methods engineer for Northern Electric Limited in Lachine, Que.

**E. Armbruster,** M.E.I.C., has been transferred by the Fraser Brace Engineering Company, from Maitland, Ont., to Montreal, Que.

Mr. Armbruster is a 1941 civil engineering graduate of the University of Saskatchewan, class of 1941.

**George I. Loucks,** M.E.I.C., has opened a business under the name of Loucks Motors Limited at Ponoka, Alta.

He was formerly zone manager of the McColl-Frontenac Oil Company in Calgary, Alta.

Mr. Loucks is a graduate in mechanical engineering of the University of Saskatchewan, class of 1943.

**P. L. O'Shaughnessy,** M.E.I.C., is at present employed as construction manager of Commercial Leaseholds Limited in Hamilton, Ont.

Before joining this Company, Mr. O'Shaughnessy was associated as construction superintendent with Pilkey Noble Construction Co. Ltd. in Hamilton.



He is a graduate of McGill University in civil engineering, class of 1923.

**Major D. C. MacMillan,** M.E.I.C., formerly in the office of the Director of Works at Army Headquarters in Ottawa, has been promoted to the position of area engineer of Western Ontario in London, Ont.

Major MacMillan graduated in civil engineering from Queen's University in 1938.

**R. L. Morrison,** M.E.I.C., is now manager of Blairmore Iron Works at Blairmore, Alta.

He was formerly with Western Canadian Collieries in Blairmore, Alta.

Mr. Morrison is a B.A.Sc. graduate in electrical engineering of the University of British Columbia, class of 1929.

**Roland Webb,** M.E.I.C., has been appointed resident partner in Saint John, N.B., of Kearns & Bromley, associate consulting engineers, of Wolfville, N.S.

He was formerly consulting electrical engineer of The Webb Electrical Company in Saint John.

Mr. Webb graduated in electrical engineering from the University of New Brunswick in 1935.

**R. D. Rosser,** M.E.I.C., has been appointed sales engineer of the Brown Boveri (Canada) Ltd. Calgary Office.

A native of Calgary, Mr. Rosser graduated in electrical engineering from the University of Alberta in 1949, after serving as an electrical artificer in the Navy during the last war.

He was previously associated with Canadian Westinghouse Company Ltd. for four years.

R. D. Rosser, M.E.I.C.

**Z. Przygoda,** M.E.I.C., is now designer in the office of Kaplan and Sprachman, Toronto architects.

Mr. Przygoda received his engineering diploma from the University of Danzig in 1935 and his doctor of engineering degree from the University of Munich in 1947.

**John N. Franklin,** M.E.I.C., has recently rejoined Bowater's Central Research Laboratories in Gravesend, Kent, England.

He was previously technical director of Bowater's Newfoundland Pulp & Paper Mills Ltd. in Corner Brook, Nfld.

Mr. Franklin graduated in mechanical engineering from the University of Toronto in 1931.

**P. E. Goodwin,** M.E.I.C., was recently elected a member of the American Society of Mechanical Engineers.

Mr. Goodwin is executive engineer with Vectron Incorporated of Waltham, Mass.

**Richard Walsh,** M.E.I.C., of the Ontario Department of Highways in Kingston, Ont., has been transferred to Sharbot Lake, Ont.

Previous to joining the Department, Mr. Walsh was associated with Dominion Tar and Chemical Company Limited in Trenton, Ont.

Mr. Walsh is a 1948 civil engineering graduate of the National University of Ireland.

**Chas. R. Phillips,** M.E.I.C., previously with Northern Electric Co. Ltd. in Belleville, Ont., has joined Kelvinator Company of Canada, Ltd. in London, Ont.

Mr. Phillips is a graduate of the University of Toronto in mechanical engineering, class of 1939.

**Claud N. Rands,** M.E.I.C., general manager of Northern Exploration Service in Dawson Creek, B.C., has opened consulting offices under the name of Rands Exploration Company in Calgary, Alberta.

Formerly district geologist for Technical Oil Consultants Limited in British Columbia, Mr. Rands is a geology graduate of London University and has undertaken post-graduate research at the University of Chicago.

**Harold R. Young,** Jr.E.I.C., is now attending the Harvard Business School in Boston, Mass.

Mr. Young was previously employed by Margison, Babcock and Associates in Toronto, Ont.

He received his civil engineering degree from McGill University in 1943.

**Wm. B. Scott,** Jr.E.I.C., has joined the staff of Consolidated Paper Corporation Ltd. in Grand'Mere, Que.

He was formerly with the Cornwall Division of Howard Smith Paper Mills, Limited, and with the Quebec North Shore Paper Co. Ltd., at Baie Comeau, Que., and with the Canadian Paper Company in Windsor Mills, Que.

Mr. Scott graduated in civil engineering from McGill University in 1944.

**Edward A. Walker,** Jr.E.I.C., previously assistant works engineer with Canadian Industries Limited in Montreal, Que., has joined Technical Mine Consultants Limited in Toronto, Ont.

Mr. Walker is a 1946 graduate in civil engineering of Queen's University.

**F. C. Totino,** Jr.E.I.C., has accepted the position of construction engineer for the Cleve Construction Company in Lloydminster, Sask.

He was previously township engineer for McKim Township in the District of Sudbury, Ont.

Mr. Totino is a 1947 graduate in civil engineering of the University of Toronto.

**W. E. Van Steenburgh,** Jr.E.I.C., is now employed by the Ontario Hydro Electric Power Commission in Belleville, Ont.

Mr. Van Steenburgh was previously with the Canadian General Electric Company in Peterborough, Ont.

He graduated in electrical engineering from Queen's University in 1948.

**M. E. Thompson,** Jr.E.I.C., has been transferred by Sperry Gyroscope Co. of Canada Ltd. from the airport at North Bay, Ont., to St. Hubert, Que.

Mr. Thompson is a graduate of the University of Manitoba in electrical engineering, class of 1949.

**F/L E. A. MacNair,** R.C.A.F., Jr.E.I.C., who for the past year has been attending the Massachusetts Institute of Technology under the sponsorship of the Royal Canadian Air Force, and was awarded the degree of Master of Science in electrical engineering in September, 1953, is now on the telecommunications staff at Royal Canadian Air Force headquarters in Ottawa.

F/L MacNair received his B.Sc. degree in electrical engineering from the University of Manitoba in 1949.

**P. E. Kelly,** Jr.E.I.C., has joined Velto Exploration Co., Inc., in Jackson, Mississippi.

He was previously associated with Rock Wool Products, Ltd. in Exshaw, Alta.

Mr. Kelly is a graduate of the University of Alberta in chemical engineering, class of 1949.

**D. J. Kay,** Jr.E.I.C., formerly a designer with Dominion Engineering Co. Ltd. in Lachine, Que., has joined the staff of Ste. Anne Paper Co. Ltd. at Beaupre, Que.

Mr. Kay graduated in mechanical engineering in 1949 from the University of Saskatchewan.

**K. G. Lightwood,** Jr.E.I.C., until recently with Armco Drainage and Metal Products of Canada Limited, has joined Steel Building Sales and Supply Ltd. as district sales engineer in Toronto, Ont.

He is a 1949 graduate in civil engineering of the University of Toronto.

**F/L Robt. C. White,** R.C.A.F., Jr.E.I.C., is construction engineering officer at C.J.A.T.C. at Rivers, Man.

He was previously stationed at Lincoln Park, Alberta.

F/O White is a 1950 graduate in civil engineering of the University of Alberta.

**Capt. J. A. MacDonald,** R.C.E.M.E., Jr.E.I.C., has been posted to 205 Base Workshop at Camp Borden, Ont. He was previously stationed at the R.C.A.F. station in Fort Nelson, B.C.

Capt. MacDonald is a 1950 graduate in mechanical engineering of the Nova Scotia Technical College.

**Theodore Elidoros,** Jr.E.I.C., has joined the staff of the Timken Roller Bearing Company in Canton, Ohio.

He was previously junior research engineer with Canadian Pacific Railways in Montreal.

Mr. Elidoros is a graduate in mechanical engineering of the University of Toronto, class of 1950.

**John Waldman,** Jr.E.I.C., is a designer with Canadian Allis Chalmers Co. Ltd. in Lachine, Que.

Before joining the Company, he was on the staff of Dominion Engineering Works in Lachine, Que.

Mr. Waldman is a mechanical engineering graduate of the University of Budapest, class of 1950.

**Brian W. Cole,** Jr.E.I.C., has joined McMillan and Bloedel (Alberni) Limited as a mechanical engineer.

Mr. Cole is a 1950 graduate in mechanical engineering of the University of British Columbia.

**C. R. Nash,** Jr.E.I.C., is now laboratory engineer in the structures laboratory of Chrysler Corporation's Central Engineering Division in Detroit, Mich.

He was previously layout draughtsman with Harry Fergusion Inc. in Detroit, and with the Ford Motor Company in Windsor, Ont.

Mr. Nash is a 1950 mechanical engineering graduate of the University of Manitoba.

**D. W. Clark,** Jr.E.I.C., is an electrical engineer with Canadian Johns-Manville Company Limited in Asbestos, Que.

He was previously a graduate student in the Canadian Westinghouse test course in Hamilton, Ont.

Mr. Clark is a McGill University graduate in electrical engineering, class of 1950.

**Jas. K. Ross,** Jr.E.I.C., has joined Eastern Power Devices Ltd. in Toronto, Ont.

He was formerly assistant electrical engineer in maintenance at Shipshaw (Alcan) Power House.

Mr. Ross is a graduate in electrical engineering of the University of British Columbia, class of 1950.

**Geo. E. Bawden,** Jr.E.I.C., is now station foreman with Sun-Canadian Pipe Line Co. Ltd. in Burlington, Ont.

He was previously with Chas. Warnock & Co. Ltd. in London, Ont.

Mr. Bawden is a graduate in civil engineering of McGill University, class of 1950.

**Lieut. K. R. Gillespie,** R.C.E., Jr.E.I.C., has recently been posted from the Royal Canadian School of Military Engineers at Chilliwack, B.C., to the

School of Military Survey in Hermitage, England.

Lieut. Gillespie graduated in civil engineering from the Nova Scotia Technical College in 1950.

**A. J. Moffat**, Jr.E.I.C., is now employed as an electrical engineer with the Canadian Westinghouse Company in Hamilton, Ontario.

Mr. Moffat was previously in Rugby, England, completing Athlone Fellowship training.

He is a 1951 graduate in electrical engineering of the University of Manitoba.

**Walter M. Balke**, Jr.E.I.C., is on the staff of the University of Alberta as lecturer in the department of electrical engineering.

He was formerly in the technical department of the Canadian Industries Limited cellophane plant at Shawinigan Falls, Que.

Mr. Balke graduated in electrical engineering from the University of Alberta in 1949, and in commerce and business administration from the University of Toronto in 1951.

**F/O G. R. E. Dube**, R.C.A.F., Jr.E.I.C., has been transferred from the R.C.A.F. Station in North Bay, Ont., to the Royal Military College in St. Johns, Que.

He is a 1951 graduate in civil engineering of McGill University.

**Jean Roch Boisvert**, Jr.E.I.C., has been transferred from the engineering department of Canadian Industries Limited in Montreal to Maitland, Ont.

He is a 1951 graduate in civil engineering of McGill University.

**Lieut. B. J. Bennett**, R.C.E.M.E., Jr.E.I.C., is now stationed at the R.C.E.M.E. School at Kingston, Ont.

Lieut. Bennett graduated in electrical engineering from the Nova Scotia Technical College in 1951.

**F/O W. Henry**, R.C.A.F., Jr.E.I.C., has been posted to No. 3 F.W.H.G., Royal Canadian Air Force, in Zweibruecken Pfalz, Germany. He was previously stationed in Ottawa.

He is a 1951 graduate in civil engineering of the University of British Columbia.

**Jas. Ian McGibbon**, Jr.E.I.C., is presently attending the Graduate School of Business Administration of the University of Western Ontario.

Mr. McGibbon received his B.Eng. degree in mechanical engineering from McGill University in 1951.

**Howard E. MacIntyre**, Jr.E.I.C., has joined Dominion Iron and Steel Corporation in Sydney, N.S., as a mechanical engineer.

Mr. MacIntyre is a mechanical engineering graduate of the Nova Scotia Technical College, class of 1951.

**J. C. Wood**, Jr.E.I.C., is now with Canadian General Electric Company Limited in Toronto, Ont., after completing the Company's test course in Peterborough, Ont.

Mr. Wood graduated in electrical engineering from Queen's University in 1952.

**Jas. H. Stuart**, Jr.E.I.C., has joined the staff of Canadian Bridge Co. Ltd. in Walkerville, Ont.

He was formerly with the Canada Paper Company at Windsor Mills, Que.

Mr. Stuart is a 1952 graduate in mechanical engineering of the Nova Scotia Technical College.

**J. C. Wesch**, Jr.E.I.C., has joined Aluminum Company of Canada Limited in Arvida, Que.

Mr. Wesch received his B.A.Sc. degree in chemical engineering from the University of British Columbia in 1952.

**Colin B. Fairn**, Jr.E.I.C., has been transferred by T. C. Gorman (Nova Scotia) Limited to Port Hastings, Cape Breton, N.S., from N. Beaver Brook, N.S.

Mr. Fairn graduated in civil engineering from the Nova Scotia Technical College in 1952.

**George Suhanic**, Jr.E.I.C., has joined T. D. K. Rooney (Canada) Limited in Montreal, Que.

Mr. Suhanic is a 1952 graduate in civil engineering of the University of Toronto.

**R. de St. Croix**, Jr.E.I.C., is at present studying toward his master's degree in business administration at the University of Michigan.

Mr. de St. Croix was previously employed with Ford Motor Co. of Canada, Ltd. in Windsor, Ont.

He is a 1950 graduate in mechanical engineering of McGill University.

**R. E. Finch,** s.e.i.c., who has been employed as aerodynamicist by A. V. Roe (Canada) Ltd., has joined Consolidated Vultee Aircraft Corporation in Fort Worth, Texas, as aerophysics engineer.
Mr. Finch graduated in aero engineering from London University in 1950.

**H. L. J. Maisonneuve,** s.e.i.c., previously with Canadian General Electric Co. Ltd. at Quebec City, has joined the staff of Northern Electric Co. Ltd. in Montreal.
Mr. Maisonneuve is a 1952 graduate in applied science of Ecole Polytechnique.

**John G. Malus,** s.e.i.c., has been transferred by Canadian Pacific Railway from Vancouver to the Regina Division.
Mr. Malus is a 1952 graduate in civil engineering of the University of Manitoba.

**Robert M. Bell,** s.e.i.c., now a draughtsman in England, recently received an award from the American Society of Mechanical Engineers at their annual meeting.
A 1953 graduate of Queen's University, Mr. Bell was presented the undergraduate student award for a paper on a boring mill, written after summer employment with an engineering firm in Dundas, Ont., following his third year in college.

**J. R. Mutch,** s.e.i.c., has been transferred by the Socony-Vacuum Exploration Company to Regina, Sask., from Calgary, Alta.
Mr. Mutch is a 1953 graduate in petroleum engineering of the University of Alberta.

**Glen A. Jones,** s.e.i.c., is now architectural sales representative with Canadian Pittsburgh Industries in Edmonton, Alta.
Mr. Jones graduated in civil engineering from the University of Alberta in 1953.

**F/O P. Bussieres,** R.C.A.F., s.e.i.c., is now located at the R.C.A.F. station in Aylmer, Ont.
F/O Bussieres is a mechanical engineering graduate of McGill University, class of 1953.

**J. Sheinin,** s.e.i.c., a 1953 honours graduate in civil engineering of the University of Toronto, is studying toward his M.A.Sc. degree at the same university.

**J. P. Wolofsky,** s.e.i.c., is at present studying toward his master's degree at the University of Illinois.
Mr. Wolofsky graduated in 1953 in mechanical engineering from McGill University.

**Kenneth C. Scott,** s.e.i.c., is now on the staff of Central Mortgage and Housing Corporation as resident engineer at Shannon Park, Halifax, N.S.
Mr. Scott is an honours civil engineering graduate of the Nova Scotia Technical College, class of 1953.

**L. S. O'Connor,** s.e.i.c., has been transferred by Price Brothers & Co. Ltd. from Chicoutimi, Que., to Rimouski, Que.

**C. D. Wickes,** s.e.i.c., has joined the staff of the power plant section of Canadair Limited in Cartierville, Que.

**J. A. Marin,** s.e.i.c., previously with Dominion Tire Factory in Kitchener, Ont., has recently joined Canada Starch Co. Ltd. in Cardinal, Ont.

**David Inkster,** s.e.i.c., has joined the staff of H. K. Ferguson Co. Inc., New York, as an electrical draughtsman.

**Lieut. Richard Poulin,** s.e.i.c., recently received a scholarship presented by the Canadian Engineers' Memorial Fund. The scholarship, awarded annually to science students, was created in memory of engineering officers who died during the war. Brig. Frank Fleury, commander of Eastern Quebec area, made the presentation before Father Adrien Pouliot, dean of the science faculty of Laval University.

**K. R. Crean,** s.e.i.c., is now employed by Canadian Sirocco Company, Limited of Windsor, Ont., as sales engineer from the Hamilton office.
He is a graduate in mechanical engineering of the University of Toronto, class of 1953.

## Visitors to Headquarters

**P. E. Ellestad,** jr.e.i.c., Moose Jaw, Saskatchewan, January 7, 1954.
**A. H. Elliott,** m.e.i.c., Montreal, Quebec, January 11, 1954.
**H. F. McCorkney,** Montreal, Quebec, January 20, 1954.
**Gilbert H. Bancroft,** m.e.i.c., Vancouver, British Columbia, January 27, 1954.
**F. C. Mechin,** m.e.i.c., Toronto, Ontario, January 28, 1954.

# Obituaries

*The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.*

**James Gekke Campbell,** M.E.I.C., of the All Steel Company in Toronto, Ontario, died on November 28, 1953.

Mr. Campbell was born at Glasgow, Scotland, on July 24, 1882. After two years at the Glasgow and West of Scotland Technical College, he served five years' apprenticeship with Somervail & Company in Dalmuir, Scotland

In 1904 he joined the Cleveland Bridge Company in Yorkshire, England, and a year later came to Canada and entered the Montreal Locomotive & Machine Company where he was employed for two years.

Then, in 1907, he became draughtsman and checker in the Structural Steel Company in Montreal. The following year he was placed in charge of this Company's detailing on bridges, mill and office buildings, elevators and other works. In 1912 he was appointed assistant chief draughtsman, a position he held until 1917 when he became structural engineer with the Canadian Steel Corporation in Ojibway, Ontario.

Mr. Campbell joined Hamilton Bridge Works Company Limited in Hamilton, Ontario, in 1919 and remained with that Company until 1926 when he became associated with the Canadian Bridge Company as draughtsman and checker in Walkerville, Ontario.

More recently, Mr. Campbell had been connected with the All Steel Company in Toronto.

He joined the Engineering Institute of Canada as an Associate Member in 1919, transferring to Member in 1940. On January 1, 1953, he attained Life Membership in the Institute.

**James Norman Smith,** M.E.I.C., who retired seven years ago as supervising engineer of the City of Westmount power house, died at the Montreal General Hospital on December 16, 1953.

Mr. Smith was born at Toronto, Ontario, on September 17, 1868. He received his general education at the public school and Dr. Tassie's School, and then completed in 1886 an electrical course at the School of Science in Toronto.

The year following graduation he was appointed general superintendent and electrical engineer of The Ball Electric Light Company in Toronto. He remained in that position until 1895 when he joined the staff of the Canadian General Electric Company as assistant works engineer in Peterborough, Ontario. Two years later he was appointed chief engineer of the United Electric Company; and in 1901, general manager and engineer of Canadian Motors Limited.

From 1902 until 1913, Mr. Smith was associated with Messrs. Ross & Holgate in Toronto and with R. A. Ross and Company in Montreal.

When World War I broke out, Mr. Smith was appointed district inspector of fuses for Canada by the Imperial Ministry of Munitions. After the end of the war he became deputy power controller, representing Sir Henry Drayton at Niagara Falls, Ontario, during the power shortage.

In 1918 Mr. Smith joined the Toronto Power Company as research engineer on electrolytical production of oxygen, hydrogen and chlorine. He remained with this Company until it was absorbed by the Hydro-Electric Power Commission of Ontario. Mr. Smith then became associated for a brief time with the Toronto Railway Company.

In 1931 he returned to Montreal to join R. A. Ross and Company. Four years later he became supervising engineer of the power plant of the City of Westmount, a position he held until his retirement in 1947.

He was a member of the Association of Professional Engineers of Ontario, and a member of Westmount Council, Royal Arcanum.

Mr. Smith joined the Engineering Institute of Canada as a Member in 1921, and he attained Life Membership in 1951.

**The Honourable Michael Dwyer, M.B.E.,** M.E.I.C., one-time minister of mines, public works and labour in the Nova Scotia Government, and former president of the Nova Scotia Steel and Coal Company in Halifax, died in New Glasgow, Nova Scotia, on December 28, 1953.

Mr. Dwyer was born in Parkstown, Tipperary, Ireland, on February 4, 1877, and came to Nova Scotia as a child with his parents. He received his early schooling in New Glasgow and completed his high school education by means of night classes and correspondence courses.

He began his engineering career in 1895 as an office boy with the Nova Scotia Steel Company in New Glasgow. In 1902 he became chief draughtsman, and a year later, master mechanic. He continued in this position until 1913 when he was named assistant manager of colleries, coke ovens and wash plant. By 1915 he had become mechanical superintendent, and five years later assistant works superintendent.

In 1922 Mr. Dwyer resigned his position as works superintendent of the Company's steel mill at Sydney Mines to become president and general manager of the Indian Cove Coal Company there. He remained in that position for ten years.

Keenly interested in community affairs, Mr. Dwyer was elected mayor of Sydney Mines in 1926 by acclamation. He held this post for six successive years during which time he ran in only one election.

In 1926 and in 1930 he unsuccessfully contested Cape Breton North and Victoria federal constituency, but in 1933, he led the polls as a Cape Breton member of the legislature. He resigned from the Cabinet in 1938 and the following year he was appointed president of the Nova Scotia Steel and Coal Company in Halifax. In 1949 Mr. Dwyer was elected mayor of New Glasgow.

In 1936 he personally directed the rescue of two gold miners from the Moose River Mine. In directing the operation he was constantly on the job, his miner's helmet and clothing covered with mud.

Mr. Dwyer was closely associated with the early work of the Vocational Training Program in the mining industry in Nova Scotia.

He was a member of the Canadian Institute of Mining and Metallurgy and the Association of Professional Engineers of Nova Scotia, and served as president of the Nova Scotia Mining Society in 1931.

Mr. Dwyer joined the Engineering Institute of Canada as an Associate Member in 1925. Four years later he was elected chairman of the Cape Breton Branch. In 1940 he was transferred to Member of the Institute.

**Earle Meharg Baird,** M.E.I.C., Scarboro commissioner of works, died suddenly en route to the hospital after he had taken ill at a hockey game at Maple Leaf Gardens in Toronto on December 9, 1953.

Mr. Baird was born at Scarboro on February 18, 1901. After receiving his general education at the Scarboro Village school and Malvern Collegiate, he entered the University of Toronto in 1919 and graduated with a B.A.Sc. degree in engineering in 1923.

Immediately after graduation he became associated with the Township of Scarboro as an assistant engineer. Six years later he was appointed township engineer and continued in that position until 1953 when he was named commissioner of works.

Mr. Baird was a member of the Association of Professional Engineers of Ontario.

He joined the Engineering Institute of Canada as a Junior in 1925 and transferred to Member in 1948.

**Walter Bernard Maxwell,** JR.E.I.C., petroleum engineer of Imperial Oil Limited in Chatham, Ontario, died of poliomyelitis on September 23, 1953.

Mr. Maxwell was born at Anyox, British Columbia on August 4, 1928. He attended Upper Canada College in Toronto for five years before entering the University of Toronto where he obtained his B.A.Sc. degree in chemical engineering in 1950.

After graduation from the University of Toronto, he joined the staff of the Engineering and Development Division of Imperial Oil Limited in Sarnia, Ontario, as a process design engineer. He was transferred to Toronto in 1952, and a year later, to Chatham, Ontario, where he served as a petroleum engineer until the time of his death.

Mr. Maxwell joined the Engineering Institute of Canada as a Student in 1951, transferring to Junior Member in 1952.

# Employment Service

**THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.**

**NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.**

**REPLIES to advertisements should be addressed to File No. 000, Employment Service. The Engineering Institute of Canada, 2050 Mansfield Street.**

**INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.**

## Situations Vacant

### CHEMICAL

CHEMICAL ENGINEER with rubber experience to sell rubber chemicals and compounds for Canadian manufacturer in Eastern Ontario and Quebec. Salary and profit sharing. Opportunity for an aggressive sales minded man. File No. 4764-V.

### CIVIL

UTILITIES ENGINEER required salary $6,120 to $6,840 plus Fort Churchill allowance by Department of National Defence, Fort Churchill, Manitoba. Details and application forms at nearest Civil Service Commission office and National Employment Office. Quote No. 53-1205. File No. 4753-V.

CIVIL ENGINEER, graduate of a Canadian University and registered professional engineer with at least 10 years practical experience in a supervisory capacity specializing in design of structural steel and reinforced concrete building to supervise group of engineers and draughtsmen in consulting engineers office in Windsor, Ontario. Salary range $7,500 to $9,000 depending on qualifications. Please write giving full details including experience, age, references, etc. File No. 4769-V.

CIVIL ENGINEER wanted by private consultant located in Ontario. Requirements are at least 5 years experience in Canada or U.S.A. in the design and construction of storm and sanitary sewers, water mains and general municipal services. Preference will be given to applicant having commission as land surveyor. Salary $5,000. Please state age, education and experience to the fullest extent, and availability. File No. 4770-V.

### ELECTRICAL

FIELD ENGINEERS preferably with electrical background by oil well service company operating in Western Canada. Five months training period. Comprehensive employee benefits. Work is substantially in the field for initial years with irregular hours. Age limit of 28 preferred. Engineers will be based in active oil exploration area of Western Canada. Well established company active throughout world. Inquiries welcomed. File No. 4754-V.

ELECTRICAL ENGINEER required to fill position as Senior product engineer with long established and expanding company manufacturing rectifiers and distribution equipment for public utilities. Must have proven technical and administrative ability to assume responsibility for all design, development and product engineering and supervision of engineers, technicians and draughting staff. File No. 4756-V.

ASSISTANT PROFESSOR required in the department of electrical engineering of University located in Maritime Provinces. Preferably Canadian, under 35, and with at least two years experience. The course involves D.C. machinery A.C. circuits and introductory electronics. File No. 4760-V.

### MECHANICAL

PROCESS OR PRODUCTION ENGINEER required by locomotive firm. Excellent opportunity for progressive engineer who can initiate and follow through on cost reduction, machine and process improvement, and scrap reduction programs. Should have three or more years experience in modern machine shop and steel fabrication practice. This job offers splendid opportunity for advancement. Salary commensurate with ability and experience. File No. 4761-V.

INDUSTRIAL ENGINEER required by large organization. Applicants should be preferably graduate engineers in mechanical. The age range could be from 25 to 40 and the duties involved will be engineering studies of manufacturing operations for the purpose of improving operating methods, equipment material, handling, etc. Experience in time study for the establishment of production standards for large incentives, would be a decided advantage. Due to rapid expansion opportunities for advancement are excellent. Starting salaries range from $4,000 to $6,500 depending on qualifications and experience. File No. 4762-V.

MECHANICAL ENGINEER required by air conditioning and ventilating contractor in Montreal. Duties to include field supervision and estimating. Man must be familiar with sheet metal work and installation of air-conditioning equipment. Must be bilingual. File No. 4767-V.

MECHANICAL ENGINEER, graduate of a Canadian College and registered professional engineer with 15 years experience in design of pressure vessels, pressure piping, for work in Windsor, Ontario. Salary ranges between $8,000 and $10,000 depending on qualifications. Please write giving full details including experience, age, references, etc. An interview will be arranged. File No. 4769-V.

GRADUATE MECHANICAL ENGINEER, 23 to 28, interested in sales, to work as assistant in general engineering and sales department of growing engineering company. Company specializes in aircraft parts and industrial work. Location Montreal. Please write giving full details. File No. 4772-V.

### MISCELLANEOUS

SALES ENGINEER required in the Industrial division of large manufacturer of metal products for steel mills power plants and other industrial operations. Applicant should also be able to evaluate possible new business in the light of expanding manufacturing facilities, therefore a manufacturing background is essential. Good deal of travel is involved. Age range 35 years. Located in Montreal. Company has been serving Canada's railroads and industry for more than 50 years. File No. 4757-V.

GEOLOGISTS OR GEOLOGICAL engineers with a minimum of 5 years experience in geological exploration in Western Canada and/or Northwestern U.S. required by consulting firm. Must be qualified to assume complete responsibility of large exploration projects involving photogeological techniques. Occasional field work only. Top salary to qualified applicants. File No. 4758-V.

NATIONAL ORGANIZATION requires a sales engineer for the Province of Quebec. Applicants must be fluently bilingual. Engineering graduates. Those having a thorough knowledge through experience of road building and materials will receive preference. Age 30 or over. This is a well salaried position deserving consideration by qualified persons. Apply in writing. File No. 4759-V.

UNIVERSITY GRADUATE in electronics or applied physics required to act as assistant (technical) to the sales manager of a medium sized company engaged in the development and manufacture of advanced defence apparatus and systems. To draft specifications, prepare technical requests, edit instruction manuals, catalogues, price lists, etc. Work is concentrated in Montreal however, there is a possibility of frequent travel mainly in Quebec and Ontario. File No. 4763-V.

GRADUATE ENGINEER required immediately by the Department of Engineering at Carleton College, Ottawa. He will be required to teach in and direct the work of the present two-year engineering course and in addition to explore the possibilities of developing this into a degree course in general engineering. Qualifications a degree in engineering or its equivalent, together with some practice experience and proven ability to impart knowledge. Salary in accordance with the responsibilities of the position. File No. 4765-V.

YOUNG CIVIL OR mechanical engineer required by a pulp and paper company in Quebec. Applicant should have a minimum of three years experience in engineering and maintenance preferably in the pulp and paper industry. Applicant should be fluent in either French or English and should be able to get along in both. Replies should outline qualifications, experience, age and salary expected. File No. 4768-V.

SALES ENGINEER required by firm located in Montreal. Applicant should be acquainted with combustion lines, have sales experience, entries to architects, consulting engineers. This position could be either full or part time on a commission or drawing account basis or other arrangements could be made after discussion. File No. 4771-V.

*The following advertisements are reprinted from last month's Journal, not having yet been filled.*

### CHEMICAL

KEY POSITIONS in a new expanding, research lab. are open to competent scientists. Must have sound theoretical background, and at least five years practical experience in (a) natural and synthetic fibers—paper (b) high polymers—adhesives. Applicant should have M.Sc. or PhD. degree in chemical engineering or physical chemistry. Must be qualified to organize, plan and supervise the work of a group of men. In reply please submit personal resume education and experience which will be held confidential. Remuneration to be negotiated. File No. 4725-V.

CHEMIST OR CHEMICAL engineer with experience in the pulp and paper industry, to supervise control work in a section of the technical department. Applications will be held confidential. File No. 4729-V.

### CIVIL

CIVIL ENGINEER, age 35 to 40, for a position in the Steel work section of the Engineering Structural Division. Applicants should be either registered professional engineers in the Province of Ontario or capable of being so registered. They should have a wide experience in the design and fabrication of structural steel preferably for power developments and experience in tower design would be an additional qualification. They should be capable of writing reports and handling correspondence, and also capable of handling personnel. The salary will be dependent upon qualifications. Location Ontario. File No. 4715-V.

CIVIL GRADUATES, 1954, required by paving company in Province of Quebec. Applicants should be preferably bilingual. File No. 4726-V.

FULLY EXPERIENCED structural steel checker required in middle west organization. Applicant should have about fifteen years or more experience in structural steel and have previous checking experience. File No. 4727-V.

YOUNG GRADUATE ENGINEER PREFERABLY CIVIL or mining, required by manufacturer of drainage and all kinds of metal products. Applicant should not have more than two years experience and have a definite interest in sales work. Location Ontario. File No. 4733-V.

APPLICATIONS ARE INVITED and will be received by the undersigned for the position of a planning engineer. Applicants should have university graduation in civil engineering or architecture or related field preferably including or supplemented by courses in municipal planning. Considerable professional experience in municipal planning desirable, including some supervisory responsibility or an equivalent combination of training and experience. Applicants to state age, marital status, education qualifications and experience history. File No. 4736-V.

ASSISTANT TOWN ENGINEER required in Ontario. Graduate with 2 to 4 years experience and with some construction experience. Municipal experience is preferred but not essential. Work involved is supervision of surveys and the inspection and control of various municipal engineering projects. Salary open. File No. 4742-V.

CIVIL ENGINEER with good experience in field layout and draughting required by pulp and paper company in the Maritimes. File No. 4743-V.

RESIDENT ENGINEER, for the construction of a 10 million plant, near Quebec city, a professional engineer is wanted for one year and a half, from early part of 1954 or later. Minimum age 35 years. 5 years practice as independent resident engineer on large job absolutely necessary. Bilingual. Attractive salary. File No. 4746-V.

CIVIL ENGINEER University graduate and registered Professional Engineer required for sales promotion work by large company with Canada-wide interests. Applicants should have at least 5 years' experience in reinforced concrete structural design, should be in the twenty-five to thirty-five age group and should be prepared to do considerable travelling. Please apply giving full details of academic training and professional experience, references and salary required. File No. 4749-V.

APPLICATIONS WILL BE received for the position of Township Engineer and road superintendent for the Township of Sandwich West, population now 13,000. Applicants must be qualified civil engineers and should be prepared to handle all problems in connection with roads, water works, etc., in a growing municipality. We employ a work supervisor. Applicants should state age, qualifications, past experience, references and salary expected. File No. 4751-V.

### ELECTRICAL

RECENT ELECTRICAL ENGINEERING graduate required by large Canadian electrical manufacturer for sales and engineering work in Western Canada. Applicant should provide information in respect of educational qualifications and background in sales work, past experience, etc. File No. 4697-V.

ELECTRICAL ENGINEER required by large public utility in Brazil. Recent graduates having test course experience with large electrical manufacturer. Applicants must be single. Excellent pension plan. Apply in writing with complete details of past experience. File No. 4698-V.

ELECTRONIC ENGINEER required to take complete responsibility for the supervision of maintenance of extensive radar and communications installation. To provide technical liaison and able to work under adverse conditions. Must have Canadian or United States citizenship or a British subject. Salary commensurate with experience. Living expenses paid. Graduate electrical engineer or equivalent with minimum of 3 years experience. File No. 4704-V.

SALES ENGINEER required by the Canadian organization of a very prominent United States manufacturer of electric controls for heating, refrigeration, and air conditioning. Some experience with electric controls preferred. Would be located in Toronto area. Good opportunity to grow with a new Canadian company. Salary commensurate with ability. Not absolutely necessary that the applicant be a graduate engineer. File No. 4708-V.

ELECTRICAL ENGINEER required in junior capacity in utility located in Prairie City. Experience not necessarily required but desire to learn all aspects of civic electrical utility will be decided asset. State salary required and full details of qualifications and experience. File No. 4710-V.

ELECTRICAL ENGINEER registered professional engineer with five years experience in industrial design in Canada or U.S.A. Must be familiar with industrial power distribution, automatic controls, switch gear (high and low voltage), lighting. Must be able to make detailed designs and undertake supervision of draughtsmen. Required by firm of consulting engineers located in West Ontario. File No. 4718-V.

APPLICATIONS ARE INVITED for the position of assistant professor dept. of electrical engineering University of British Columbia, Vancouver, Canada. Candidates should have post-graduate training preferably at the Doctor's level in electronics and servo-mechanisms. Duties include teaching undergraduate courses in electrical engineering, post graduate studies in some phase of servo-mechanisms or electronics. Starting salary $4,500 to $5,000 per year. Date of appointment July 1, 1954. Further information may be obtained by writing to the head of the department. File No. 4720-V.

GRADUATE ENGINEER preferably electrical with one to four years experience and a desire for sales engineering is required by small nationally recognized electrical manufacturer. Six months to one year orientation at Toronto factory then sales engineering work in Montreal office on salary plus commission basis. File No. 4721-V.

ELECTRICAL ENGINEER for system planning division. Should have at least ten years' experience in the designing and operation of hydro and/or thermal generating plants and transmission systems, with particular qualifications as follows: Application of the method of symmetrical component to the solution of unbalanced conditions on A.C. systems, experience in the use of the A.C. net work analyser on load flow studies, relay problems and stability studies, both transient and steady state. Familiarity with problems associated with the operation of a power system, such as fluctuating loads, and methods used to mitigate the effect of some; also some knowledge of the operation problems associated with the inter-connection of two or more systems. Experience also desirable in A.C. system operation with particular regard to the maintenance of voltage levels, reactive and real power flow and speed covering problems. Address all applications giving full details of qualifiactions and experience and salary required. File No. 4723-V.

REPRESENTATIVE REQUIRED for Quebec and Ontario areas by electrical manufacturer to contact architects, consulting engineers and electrical contractors covering lighting equipment and wiring devices. Reply in handwriting stating qualifications and experience. File No. 472?-V.

ELECTRICAL ENGINEER required to design and develop rectifiers and communication equipment. Applicant should have better than two years experience in this field. Starting salary depends on qualifications. File No. 4728-V.

WANTED JUNIOR ENGINEER as estimator with large electrical manufacturing company. State full details technical and practical training and experience. Location Montreal. File No. 4730-V.

THREE GRADUATE ELECTRICAL engineers interested in design development, technical control or application engineering. The duties include: learning and preparing specifications for internal use of electrical conductors, the study of insulants and dielectric behaviour, the preparation of calculations and line design, assessment of the quality of raw materials, designing cables developing new products, and writing technical brochures and catalogue sections. Location Ontario. File No. 4738-V

YOUNG GRADUATE ELECTRICAL engineer bilingual required by manufacturer of vacuum tubes and fluorescent and incandescent lamps. The plant of this company is located at 60 miles from Montreal. The position offered would involve work in production engineering quality control, testing. Please state salary expected and full details of qualifications and experience. File No. 4740-V.

### MECHANICAL

JUNIOR MECHANICAL ENGINEER to work under the direction of a senior engineer in a research branch to develop test and modify remote control equipment, instruments and techniques. Recent graduate in mechanical engineering with some training in shop or instrument work. Should be fond of gadgeteering. Salary according to qualifications. State particulars including age, marital status, education and experience in 1st letter. File No. 4693-V.

GRADUATE MECHANICAL engineer preferably with sales experience to handle complete line of mechanical power transmission and materials handling equipment. Location Montreal. Age 35 to 45. Substantial income possible for qualified person. File No. 4699-V.

SALES ENGINEER, graduate mechanical, required by steel fabricating shop located in Montreal. Applicant should have 4 or 5 years shop experience. Salary open. File No. 4702-V.

MECHANICAL ENGINEER REQUIRED as assistant in the materials handling department of leading paper manufacturer in Eastern Canada. Applicant should have experience and the ability to take over the responsibility of entire department. Good salary to successful applicant. File No. 4712-V.

THREE GRADUATE MECHANICAL ENGINEERS TO ACT as sales engineers for large coal mining company with offices in Montreal and the Maritimes. One should be bilingual to cover Montreal and surrounding area, other to locate in Maritime office. File No. 4713-V.

LONG ESTABLISHED company located in Toronto area has interesting vacancies for sales engineers preferably experienced on pumps and compressors or would consider men with a good knowledge of heavy machinery or power plant equipment. All replies in strictest confidence. File No. 4714-V.

GRADUATE MECHANICAL ENGINEER wanted, experience in heater coil manufacture or design required. To assist also in technical sales. Salary commensurate with qualifications and experience. Location Montreal. File No. 4732-V.

SALES ENGINEER REQUIRED by large manufacturer of industrial equipment for sales and service of pulp and paper mills on west coast. Previous mill experience desirable. Excellent opportunity. File No. 4735-V.

GRADUATE MECHANICAL ENGINEER required to take over the preventative maintenance program of a fleet of transport vehicles operating interprovincially in Western Canada. Applicant should be prepared to spend some two to three months in the U.S.A. then put into operation a preventative maintenance program for this organization. File No. 4739-V.

APPLICATIONS ARE INVITED for the position of assistant professor, Department of Civil Engineering, University of British Columbia, Vancouver, Canada. Candidates should have had postgraduate training preferably at the Ph.D. level in fluid mechanics. Duties include teaching fluid mechanics and other courses in the under-graduate school and teaching one post-graduate course in some phase of fluid mechanics. Starting salary from $4,500 to $5,000 depending on experience, with the possibility of augmenting income with summer work on hydraulic models or other hydraulic projects. Date of appointment is July 1, 1954. File No. 4744-V.

POWER PLANT ENGINEER for large industrial concern near Montreal to take charge of high pressure steam plant turbo-generators and refrigeration. Only those having both practical experience and technical knowledge need apply. Young graduate engineer preferred. State age, experience and salary expected. File No. 4745-V.

PLANT LAYOUT AND material handling engineer required by automotive industry in Ontario. Applicants should have either specific experience in these particular fields or with plant or maintenance engineering experience, such as construction, piping, conveyors, etc. File No. 4747-V.

MECHANICAL ENGINEER with at least five years experience for expanding Canadian organization to supervise the design and marketing of a specialized line of construction equipment. This opening will interest you if you have a flair for design and business administration. Salary open. File No. 4750-V.

MOTOR DESIGN ENGINEER—Large U.S. manufacturer with factory in South America needs experienced induction motor design engineer with sound knowledge of manufacturing methods. Motor sizes to range from small fractional horsepower through 50 H.P. Please send complete resume covering education, experience and family, including recent photograph. File No. 4752-V.

### MISCELLANEOUS

ENGINEERING CO/ORDINATOR to supervise sales for organization in Montreal, representing leading American manufacturers in power plant process and industrial equipment field. File No. 4701-V.

EXPERIENCED CONTRACTING engineer to organize contracting department for old established firm specializing in brick floors, tank linings and tile setting. Headquarters in Montreal. Jobs throughout Eastern Canada. File No. 4703-V.

ELECTRICAL OR MECHANICAL project engineer required by electrical manufacturer in Ontario, a young graduate engineer to supervise the development of special prototypes through laboratory to production stage. This is a rapidly growing company and men with initiative should progress favourably. File No. 4709-V.

AN ASSISTANT CHIEF water resources division, at Ottawa. Salary $7,500 to $8,100. Details and application forms at your nearest Civil Service Commission Office, National Employment Office and Post Office. File No. 4716-V.

YOUNG MECHANICAL (or civil engineer), bilingual, with sales experience in-or good knowledge of diesel engines, road-building and municipal equipment required by important company for its Montreal sales staff. This position provides an ideal opportunity for an engineer seeking a future in the heavy equipment sales field. File No. 4717-V.

APPLICATIONS ARE INVITED for the following positions: 1. Research officer, to engage in theoretical and experimental studies relating to building acoustics. Duties may include supervision of standard acoustical testing, field measurements and laboratory research in acoustics. 2. Research officer, to engage in studies of soil vibrations and their effect on buildings. Duties may include theoretical and experimental studies of wave propagation in soils and design of suitable apparatus for vibration studies in both field and laboratory. General qualifications: University degree in physics or engineering and at least two years of post graduate training or pertinent industrial experience. File No. 4719-V.

STREET LIGHTING sales engineer required by a long established manufacturing company in the field of scientific illumination. Duties after a specific training program will involve the sale of light directors to municipalities and public utilities chiefly. Diligence, dependability, an agreeable personality, and determination to make a career in this field are of highest importance. File No. 4731-V.

AUTOMOTIVE INDUSTRY IN ONTARIO requires work standards men to be employed on time study and methods work. File No. 4734-V.

LAND SURVEYORS, salary $4,680 to $5,400 required by the Department of mines and technical surveys, Ottawa. Details and application forms at nearest civil service commission, and national employment office. Apply before February 26, 1954. File No. 4737-V.

POSITIONS BECOMING available at Winnipeg in air line for graduate engineers having comprehensive experience in aircraft structures, mechanical, electrical and radio systems. Also senior draughtsmen with experience in aircraft structural or mechanical engineering. File No. 4741-V.

TWO GRADUATE ENGINEERS required for large plant manufacturing various types of explosives, situated in P.Q. Duties required would be in maintenance department as project engineers and some design and alteration projects. Mechanical engineer required with from five to seven years experience. Other position requires chemical and mechanical engineer with two or three years experience. File No. 4748-V.

PLANT LAYOUT ENGINEER—Large U.S. manufacturer with plants located in Latin America requires capable Plant Layout Engineer for work in consulting office located in New York State. Must have experience in metal working industry in plant layout work with sound knowledge of building design and manufacturing methods. Please send complete resume covering education, experience and family, including recent photograph. File No. 4752-V.

## Situations Wanted

SANITARY ENGINEER, Civil engineer, B.Sc., Queen's 1948, M.A.Sc., U. of Toronto 1949, P.Eng., Jr.E.I.C., age 29, single. Four and a half years practical experience in municipal and sanitary engineering. Was chief municipal engineer for one and a half years responsible for design and development of waterworks and sewage projects. Also experienced in supervision of construction of various municipal projects, as well as in administration of a municipal engineering department. Recently employed as design engineer dealing with sewage treatment plants, water works projects, sewer designs, roads and pavements. Am seeking a responsible position, preferably with a firm of consulting engineers where individual initiative, hard work and proven ability will be recognized. Am a member of the Canadian Institute on Sewage and sanitation and the American Waterworks Association. File No. 250-W.

PIPING ENGINEER: nine years piping experience including gas and water. Presently completing $1½ million piping project including supervision of design, purchasing, construction. Canadian, aged 40, married. B.A.Sc., C.E., M.E.I.C., P.Eng. Present contract expires early 1954. Desires position as gas project engineer or superintendent anywhere in Canada. File No. 2466-W.

MECHANICAL ENGINEER, McGill 1944, single, age 34, with industrial eng. background. Wide experience in administration and supervision, production control, maintenance, plant eng., personnel work, wage incentives, time study, cost study, welding, fabrication. In welding industry, heavy equipment, production, printing, seeks opportunity to join progressive firm in engineering, production, or sales. Will relocate or travel. File No. 2920-W.

MECHANICAL ENGINEER, age 30, graduate. Experience in design and development, machinery, heat transfer, heating and ventilating, aircraft. Location immaterial. Available immediately. File No. 3012-W.

PHYSICO METALLURGIST, M.E.I.C., P.Eng., specialized in statistical elucidation of production data toward solution of workshop problems in metallurgy, specially in quality and process control in steel making-shaping-heat treating. As a statistical analyst experience second to none in sinchronisation of production factors so that optimum conditions for the lowest occurrence of pipe in steel ingot, of segregation in steel can be attained, and maintained for a predictable length of time. Also in sinchronisation of factors toward highest capacity of Bl.Fce. at lowest coke rate. File No. 3521-W.

GRADUATE ENGINEER, B.Sc., St. Francis Xavier University 1947, B.E. in Mechanical Engineering N.S.T.C., 1949, Jr.E.I.C. Age 29, married, one child. Two years as engineer in charge of machine and maintenance workshops for a research establishment. Two years as tool engineer and technical assistant to superintendent of a manufacturing division of a machinery manufacturing plant. Desires position with opportunities for advancement, where experience would be valuable. File No. 3547-W.

ADMINISTRATIVE EXECUTIVE post desired by civil engineer, B.Sc., M.E.I.C., with ten years of various consulting and construction experience. Experienced in design of steel, reinforced concrete, earthworks, the preparation of contract documents, specifications, and estimates; also in the site supervision of construction of an industrial plant, hydro-electric installations, bridges, roads and railways. File No. 3796-W.

MECHANICAL ENGINEER, Queen's 1944, M.E.I.C., P.Eng., married, age 34, eight years' experience as plant engineer, including planning, design, erection and maintenance on process steam, refrigeration, air conditioning systems, seeks employment in plant engineering, preferably, but not necessarily, in smaller city or town in Ontario or Western Canada, with growing company. Available on three months' notice. References include present employer. File No. 3935-W.

CIVIL ENGINEER (European) graduate from McGill and Master's degree from Toronto (52) wishes to work on design and construction of buildings. Possessor of professional engineer's certificate and experience on highway construction, surveys, soil borings and soil testing. Age 26, single, available in two weeks' notice. File No. 3988-W.

CIVIL ENGINEER N.S.T.C. 1952, age 28, married. Have had some highway construction experience. Presently employed in job requiring very little engineering training. Would like to obtain experience along any line of engineering. Present location Nova Scotia. File No. 4070-W.

SENIOR MECHANICAL ENGINEER (34) M.E.I.C., A.M.I., Mech.E. seeks responsible post in Vancouver or district. 10 years' experience in design and construction of medium and heavy machinery, rolling mills, chemical plant, hydraulic equipment. 3 years' experience research and development in noise and vibration science. Also administrative experience, personnel and purchasing. Good knowledge French and Italian. File No. 4091-W.

GRADUATE ENGINEER, B.Sc. Mining Engineer, University of Leeds, England 1951, Jr. E.I.C. Age 25, married, one child. 18 months' experience in municipal and general civil engineering, 8 months mechanical drafting. Desires change to position with a future. File No. 4207-W.

CIVIL ENGINEER, Jr. E.I.C., P. Eng., B.Sc. (Queen's 1948), veteran, age 32, married, one child, over five years' experience on layouts, steel and concrete design in a chemical plant. Ability to supervise projects and some knowledge of estimating and costs. Desires a responsible position where above experience would be an asset. Available on one month's notice. Preferable location southern Ontario. File No. 4238-W.

GRADUATE MECHANICAL ENGINEER, married, with family, requires employment. Diversified industrial experience. Purchasing, maintenance and machinery shop practice. Sound business training. Experience includes heating, sheet metal industries and general machinery equipment. Bilingual. Has good personality, enthusiastic, keen business acumen. Desires employment on production, sales or engineering administration. Location Montreal area. Available immediately. File No 4300-W.

MECHANICAL ENGINEER, Jr. E.I.C., B.Eng., McGill 1950, age 29, married. Completed Canadian General Electric test course after graduation and am presently employed as mill superintendent of a small textile mill. Would consider a position with a textile company. Would also consider production or service engineering in other fields. File No. 4309-V.

CIVIL ENGINEER, graduate 1950, Jr. E.I.C., married with one child, age 29 3½ years of experience with a structural steel fabricating firm estimating material and labor for structural steel and miscellaneous iron for buildings and also platework. Desires work with a firm with a future and opportunity for advancement. Available on one month's notice to present employer. File No. 4361-W.

MECHANICAL ENGINEER, Jr. E.I.C., P.Eng. (Ont.), B.Sc. (Eng.) Man. 1949, age 25, single. Experience in steel fabricating design, welding and estimating. Complete familiarity with ASME and APJ codes. Desires responsible position preferably with petroleum industry in Winnipeg or immediate vicinity. Presently employed in Ontario. File No. 4362-W.

ENGINEER DESIRES design, development, or research work requiring limited travel. Experience with Dominion Government, 4½ years on flood control, drainage, report writing; plus field experience, design and construction of small dams and sprinkler irrigation systems. B.S. degree in Agricultural engineering, 1949, University of Saskatchewan. Age 25. Married. File No. 4363-W.

CIVIL ENGINEER, S.E.I.C., P.Eng., Que., B.A.Sc., Toronto, age 28, married, presently employed. Seeks advancement, preferably in Southern Ontario. Have had limited experience in municipal surveys and planning, sewer design, construction and production. Also experienced in general plant engineering, structural steel and reinforced concrete design. Available on 30 days' notice. File No. 4364-W

CHEMICAL ENGINEER, M.E.I.C., M. of Sc. 1946 Denmark. Age 30. Canadian wife. Have worked in Canada since January 1952, presently employed. Experience in petroleum products, and in vegetable oils for paint and varnish. Desires position with opportunities in product development or research. File No. 4335-W.

PRODUCTION ENGINEER, M.E.I.C., age 35, 1938 graduate, with successful record in plant management field. Extensive experience at responsible level in labour negotiations and all details connected with the operation of an independent production unit employing over 350 men, with special emphasis on the development of new production methods and machines to maintain maximum plant effort. Interested in position where creative ability and imagination coupled with a sound engineering background are required. File No. 4366W.

ELECTRICAL ENGINEER, B.Sc. (Hons). 1941, St. Andrews University, Scotland, A.M.I.E.E., P.Eng., married. R.N. veteran. 3 years major oil company supervision maintenance and installation, 1½ years Canadian municipal utility in charge all electrical aspects. 2 years major electrical manufacturer in Ontario as applications engineer. Linguist, versatile, teaching experience, sound background electronics and instrumentation, experienced in all aspects distribution, system studies, etc. Seeks job with greater responsibility, location secondary, available reasonable notice. File No. 4371-W.

MECHANICAL ENGINEER, 1950 graduate Polish University College, London, age 31, married, two years experience in diesel engine design and development, one year in water-tube boilers, and one year in industrial furnaces design. Also two years general machine shop experience prior to university studies. Seeks employment in Toronto in any engineering field, which offers a good opportunity for advancement. File No. 4372-W.

CIVIL ENGINEER, Man. 1948, Jr.E.I.C., age 29, married, 2 children, veteran. One year surveying. For past 5½ years worked on large diversification of milling and refining equipment and building for mining and smelting company whose plant has undergone expansion. Experience in layout, design and detail of refining plants, small mines, shops, warehouses, townsite and other works required for isolated location; estimating and preparing specifications. Could supervise drafting office but would prefer position offering responsibility and advancement to intelligent and personable engineer. Will accept position anywhere in Canada. File No. 4373-W.

YOUNG ENGINEERING EXECUTIVE, mechanical engineering graduate, M.E. I.C., P.E. of Alberta, age 33. Engineering experience, tool designing, design of pressure vessels, plate weldments, processing vessels and equipment. General experience, shop and field inspection, purchasing and sales. Executive experience, director and general manager of small steel fabrication plant (70 employees) located in Western Canada. Desires position requiring initiative, organizing, and supervisory ability. Anything offering future advancement in responsible position. File No. 4374-W.

ELECTRICAL ENGINEER, Jr.E.I.C., 28 years old, married, B.A.Sc. (E.E.) 1951-U.B.C., 2½ years practical machine shop experience, 2 years radio and radar RCNVR, 8 months preparing specifications for telephone power equipment, 2 years steel mill experience—design and layout of conduit and cable for strip mill equipment including the devising of electrical control and interlock circuits—design of power distribution system including main substation and low voltage distribution transformer vaults Complete resume on request. Location no object. File No. 4377-W.

CHEMICAL ENGINEER, Jr.E.I.C., war veteran, 34, married. Experience includes two years supervision in a large chemical plant in Quebec. Desires employment on production or sales. Location preferred Southern Ontario. File No. 4383-W.

CHEMICAL ENGINEER, B.A.Sc., P.Eng. Graduated in 1950 from University of Toronto. Age 25, married with one child. Have excellent experience in time and motion study, methods study, cost control, and all phases of production. Presently employed as assistant plant superintendent in a small manufacturing concern in Ontario. Desires permanent responsible position with good prospects for the future. Location anywhere in Canada. Available on reasonable notice to present employer File No. 4384-W.

CHEMICAL ENGINEER, Jr.E.I.C., B.A.Sc., 1952, war veteran, 31, single. Experience in production and instrumentation. Desires new position in engineering, development or instrumentation. Location: Ontario, Quebec. File No. 4385-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.A.Sc. 1948. 6 years pulp and paper and heavy industrial equipment experience before graduation as project designer and 2 years after graduation. For several years engaged in the combustion engine field mainly diesel equipment. Desires position in either field with more responsibility. File No. 4386-W.

CIVIL ENGINEER, M.Sc., Technical University, Dansig 1935; D.Sc., Technical University, Munich 1947, M.E.I.C., age 40, bilingual. 17 years experience in Europe and Near East in architectural and structural design of residential, industrial, hospital buildings and in town-planning. One year Canadian experience in Toronto in residential, industrial, and theatre design. Seeks responsible position with firm of engineers or architects. File No. 4387-W.

MECHANICAL ENGINEER, D.I.C., G.I. M.E., 27, single, bilingual, three years experience in design office and manufacturing of fabricated steel and structural steel, 1½ years research experience, sound knowledge of shop procedure, electric and electronic bias, seeks permanent position in Montreal area but willing to travel. Presently employed below technical ability. Loyal, responsible and willing to start at junior level if opportunity for advancement is provided after ability has been shown. File No. 4388-W.

MECHANICAL ENGINEER and Chemist, B.A.Sc., 1952; B.Sc. (Chemistry and Physics), 1946; M.C.I.C., Junior A.S.M.E., age 28. Married, with two years experience in all phases of instrumentation in pulp and paper industry, also one and one half years work as junior chemist in the petroleum industry. Desires job with definite opportunity for advancement. Presently employed, but available on reasonable notice. File No. 4390-W.

CHEMICAL ENGINEER, P.Eng., B.A.Sc. (Toronto, '50), Jr.E.I.C., M.C.I.C., 32, married, one child, veteran 3½ years R.C.N., four years general office work, four years development control and supervisory experience in chemical process industry. Working knowledge of French, some German. Desire more responsible position in technical service, development or similar work, Canadian or foreign. All replies acknowledged. Resume on request. File No. 4391-W.

ELECTRICAL ENGINEER, Canadian, M.E I.C., B.Sc. (Alta., 1944), M.S. (Carnegie Institute of Technology, 1952), expecting Ph.D., Carnegie Tech. 1954. Married one child. 4½ years with large Canadian electrical manufacturer including test course and design experience; 3 years in electrical sales. Desirs teaching position in power field, or research and development in servomechanism and control field. Doctoral thesis being written on fundamental study of magnetic amplifiers. File No. 4392-W.

JR. E.I.C., graduate Polytechnique 1950, fully bilingual. Has been working for two years as estimator and construction engineer. Had one year experience in construction works in Europe. Position wanted in Montreal or surroundings, but would consider going anywhere in Canada. File No. 4398-W.

EXECUTIVE ENGINEER, M.E., M.E.I.C., P.Eng. (Ont.), twenty-three years varied design-manufacturing and management experience of which eleven years chief engineer with equipment manufacturing concern. Since 1946 practising privately and activities consisted mainly of larger engineering assignments including project development and execution, also extensive consulting with steel, pulp and paper industries as well as equipment manufacturers. Interested in an association with a really progressive organization offering appropriate opportunities preferably in connection with larger scale Canadian and/or foreign developments, or other responsible activities requiring engineering background, leadership qualities, a realistic approach to problem analysis, diplomacy, practical imagination and acknowledged design talent. Present income considerably above average but would consider reasonable compromise if proposition otherwise attractive. File No. 4399-W.

ELECTRICAL ENGINEER, B.E. (University College, Dublin), Associate Member, Institute of Civil Engineers of Ireland. Age 34, married, with children. Nine years experience with electricity supply organization. Experience mainly in electrical distribution design and construction overhead and underground networks. Arriving Canada, March or April. Seeking interviews for position as distribution engineer. Location unimportant. File No. 4400-W.

ELECTRICAL ENGINEER, B.Eng. (Hons.), M.A.Sc., M.E.I.C., P.Eng., age 35, married, and presently completing eighth year as Professor of Electrical Engineering. Has taught many different courses on senior and graduate level with emphasis in power. Broad general experience in construction, public utility work and as a naval officer. Has done considerable consulting work of general nature. Seeks appointment which should offer a broad challenge in keeping with background proffered. File No. 4402-W.

DIPLOMA ENGINEER, Mechanical, P. Eng., M.E.I.C., with comprehensive technical knowledge, creative ability and 18 years experience in design and manufacture of diversified machinery and devices such as power shovels, hydraulic presses, aircraft engines, pumps, machine tools, electric automatic controls, welded products, as well as experience in organizing and managing plants with up to 5,000 workers, economical minded with mature judgment, at present engaged in machine tool development, seeks a position with a progressive company where his past experience could be utilized best. File No. 4403-W.

PROFESSIONAL ENGINEER (Ont.), B.Sc. (E.E.) U. of Manitoba, veteran, age 28, married, two children, Canadian Westinghouse Training course. Nearing completion of Post-graduate work in Business Administration, consisting of evening classes leading to M.Com. Presently employed as project engineer responsible for co-ordination of all phases of manufacture of projects. Desires responsible position in administration or production. File No. 4404-W.

CIVIL ENGINEER, B.Sc., Jr.E.I.C., now employed with 3 years' foreign experience, construction and structural design (reinforced concrete) and one year Canadian experience in building construction and draughting (not in structural design) is seeking a junior position with prospects in structural design, preferably in Toronto. File No. 4407-W.

ELECTRICAL ENGINEER, Jr. E.I.C., U. of Alberta, 1949, veteran, age 33, married. 1½ years in industrial and commercial construction, 3 years design and development of power plants for large communication company. Experienced in electrical controls. Prefer Alberta or B.C., but willing to locate anywhere if work is interesting and has advancement possibilities. File No. 4411-W.

CHEMICAL ENGINEER, S.E.I.C., Jr. C.I.C., B.Sc. (Queen's 1952), single, age 22, desires position with responsibility in industry or technical sales. Three years summer employment in the paper industry. Have two years municipal engineering administrative experience working with senior executives and meeting the public. Location headquarters preferred in E. Ontario. File No. 4414-W.

SANITARY ENGINEER, M.A.Sc. University of Toronto as of April 1954. S.E.I.C., B.Sc. (C.E.) University of Manitoba 1952. One year's experience in building construction. Desires position offering experience in sanitary or Public Health Engineering. Location immaterial. Available beginning of May. File No. 4415-W.

OVERSEAS POSITION preferred by graduate chemical engineer, Jr.E.I.C., McGill 1949, war veteran. Considerable experience in mechanical work such as all phases of design fabrication and erection of heavy structural, plate and mechanical products. Also process plant experience and considerable customer contact experience. Presently employed in a supervisory capacity. File No. 4416-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950 graduate, Toronto, Veteran, 32, single, some research experience, over three years in chemical industry on project and design work, involving process and services equipment and piping, instrumentation and building construction, including some estimating, purchasing, expediting and inspection. Desires position of greater responsibility in similar work or in maintenance work of a general nature. File No. 4418-W.

CIVIL ENGINEER, B.Sc., C.E., U.N.B. 1950, Jr.E.I.C., age 30, married. 4 years experience as construction engineer on highways, including reinforced concrete bridges. 2 years in charge of building construction, including sewage disposal systems, water supply etc. One year as design engineer of municipal street layout, landscaping etc. Available on short notice anywhere in Canada. File No. 4419-W.

CIVIL ENGINEER, D.L.C. Hons. (civil engineering), M.E.I.C., grad. Inst. Struct. Eng. awaiting election to A.M.I.C.E. and P.Eng., Ont.), age 28, single, 6 years experience on construction of dry dock and deep-water quay, power station, airfields, bridges, roads and railways, survey, design of steel-piled cofferdams, track layout and construction schemes. Responsible for supervision of layout, construction, concrete inspection, pile-driving, underwater drilling, pressure grouting, test bore-holes, diving operations, measurement of quantities and cost reports. Presently employed as area engineer on construction of chemical plant. Desires position of responsibility suitable to past experience. Location—anywhere in Canada. File No. 4420-W.

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# SITUATION VACANT

**Chemical or mechanical engineer required for coal preparation research. Experience in coal cleaning, especially with Driessan cyclones and dense media, desirable but not essential. Starting salary will depend on training and experience and will be in a bracket of $4,000 - $5,000 per annum, plus cost of living bonus based on the consumer's index. The present bonus approximates $300 annually.**

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Activities of the Forty-seven Branches of the Institute
and
abstracts of papers presented at their meetings

## Belleville

C. H. Lusk, Jr.E.I.C.,
*Secretary-Treasurer*

**General Meeting**

The Belleville Branch of the Engineering Institute of Canada held its regular meeting at the Masonic Temple on December 14 with 24 members present.

A. O. Drysdale acted as chairman, in the absence of C. R. Whittemore. Mr. Drysdale advised that the next meeting of the Branch would be held on January 11. He also noted that Jack Both, mayor-elect of Belleville, is an affiliate of the Engineering Institute.

D. Pullan introduced the speaker for the evening, R. Worrall, of the British-American Oil Company Ltd. Mr. Worrall showed a film entitled "Via Pipe Line", which illustrated the construction of the pipe line from Montreal to Burlington by the Trans-Northern Pipe Line Company Ltd. Mr. Worrall also noted that this pipe line was constructed at a total cost of $42,000,000.00. One hundred and twenty-two million barrels of petroleum products are pumped through the line in one year. The normal rate of flow of the products is 4 m.p.h. which means that it would take approximately four days for the products to traverse the entire length of the line.

The appreciation of the Branch was extended by H. T. Floyd.

## Border Cities

R. J. Trinder, Jr.E.I.C.,
*Secretary-Treasurer*

H. C. Palmer, M.E.I.C.,
*Branch News Editor*

**October Meeting**

The first fall meeting of the E.I.C. was held at the Prince Edward Hotel in the latter part of October. An invitation was extended to the Association of Professional Engineers of Ontario and there was an excellent turnout to both the dinner and the meeting afterward. The guest speakers were, J. Herbert Smith and Col. Tom Medland. Mr. Smith, who is president of the A.P.E.O., gave an interesting talk covering the manner in which dues to the A.P.E.O. are spent and how efforts are made to obtain favorable legislation on behalf of the professional engineer.

**President's Visit**

The president visited the Branch on the 25th of November and the annual dinner and dance was held at the Beach Grove Golf Club. The president spoke on his trip to the Coronation for some minutes following the dinner gathering of engineers, their wives and girl friends.

**Annual Meeting**

The annual meeting of the Branch was held at the Prince Edward Hotel, December 16, 1953. A good attendance of the members was on hand for the dinner and following that there was a general meeting where officers of 1953's executive presented their annual reports. The officers for 1954 were elected by acclamation. The new executive is composed of: P. S. Dewar, chairman; W. G. Mitchell, vice chairman; J. C. Aitkens, past chairman; R. J. Trinder, secretary; J. G. Hoba, councillor; Morris Armstrong, papers committee; P. N. Brown, treasurer; D. Donnelly, branch news editor; E. Dykeman, membership committee.

Following the election of officers, a pin was presented to N. A. McDougall, a former member of the Border Cities Branch who has moved away and who had been a member of the executive for several years. After the business was cleared away two films were shown. The first one was on the Aluminum Company's Kemano Project in British Columbia, called "A Man With a Thousand Hands". It presented in technicolor one of the largest construction developments to be undertaken in Canada. At the completion of the picture a representative of the Aluminum Company of Canada answered a multitude of questions asked by the members. In the opinion of the writer this was one of the finest pictures of its kind he had seen and the other members were equally enthusiastic. The second film was on sports in the Rocky Mountains photographed by the C.N.R.

Following all this refreshments were served and everyone went home feeling that the last meeting of 1953 had been a very successful one.

## Central British Columbia

H. L. Topham, Jr.E.I.C.,
*Secretary-Treasurer*

**Annual Meeting**

The annual meeting was held at the Central Hotel in Kamloops on November 27, 1953. A total of 19 persons, including guests, was present.

Refreshments were made available from 6:30 to 7:00 p.m., at which time dinner was served. Following dinner the business of the meeting was introduced by the chairman, R. L. Bigg.

In his remarks to the meeting Mr Bigg expressed the hope that the whole of the membership would assist the incoming executive by attending the dinner meetings regularly and participating in student guidance work and other Branch activities. He expressed his sincere thanks for the assistance which he had received from the other members of the executive, and he wished the new chairman and executive every success in their endeavours.

The minutes of the previous meeting, held on September 18, 1953 were read and adopted. It was moved by Mr. Joplin and seconded by Mr. Hatfield that the increase in *Journal* dues of $2.00 per annum be added to the annual fees of our Branch Affiliates. This increase will raise their annual fees from $7.00 to $9.00.

Mimeographed copies of the Branch Annual Report were distributed by the secretary-treasurer to all Members and Juniors present at the meeting.

Following this, the Branch Councillor, M. L. Wade, suggested that our Branch members in each of the larger centres endeavour to meet informally with high school students who are interested in the engineering profession. He did not feel that it should be at a dinner meeting, as this might prove too expensive and would possibly not hold student interest as much as a more informal gathering.

The election of next year's executive then followed, and the results of the election by ballot are as follows: chairman, M. L. Zirul; vice-chairman, W. A. Ker; committeemen, H. D. DeBeck, A. F. Joplin and P. G. W. Walker.

Mr. Kanester and Mr. Owen were scrutineers for the election.

This brought the annual meeting to a close at 9:30 p.m., at which time the officers of the B.C. Engineering Society convened their Annual Meeting.

## Cornwall

L. H. Snelgrove, Jr.E.I.C.,
*Secretary-Treasurer*

John E. Pescod, Jr.E.I.C.,
*Branch News Editor*

**December Meeting**

The annual dinner meeting of the Cornwall Branch of the Engineering Institute of Canada was held at the Cornwall Golf and Country Club on the evening of December 14. R. L. Dobbin, the president of the Engineering Institute and Dr. Austin Wright, general secretary, paid their annual visit to the Branch on this occasion.

The committee chairmen of the 1953 executive read their reports of the activities of the past year. The nominating committee announced the election of J. Hawkes, H. Campbell, T. Webster, J. Morris, B. Stidwill, R. Blackett and D. McEwan to the 1954 executive, with J. Hawkes to serve a second term as chairman.

The president, R. L. Dobbin, in his address to the meeting, told of the magnitude of the development of Canada's natural resources that he had seen on his visits to twenty-four branches of the E.I.C. in Ontario, Quebec, the Maritimes and Newfoundland. He also related some of his impressions of the Coronation, which he attended as the official representative of the Engineering Institute of Canada. He was particularly impressed by the exceptional planning and co-ordination that made the ceremony so successful.

Dr. Wright also addressed the gathering. He dwelt at some length on the challenge to Canadian consulting engineers and contracting firms presented by foreign contractors and engineering firms who are entering the Canadian field and securing an ever-increasing amount of Canadian business.

Mr. Dobbin and Dr. Wright paid official visits to the Mayor of the City of Cornwall and the Reeve of the township of Cornwall on December 15.

## Edmonton

P. M. Butler, Jr.E.I.C.,
*Secretary-Treasurer*

K. Provost, M.E.I.C.,
*Branch News Editor*

***Panel on Engineers and Government***

On December 9 the Edmonton Branch of the Institute held its regular dinner meeting under the chairmanship of N. J. Allison.

The program for the evening consisted of a panel discussion on the topic "The Engineer and the Legislative Committees and Administrative Boards of Government". Keith Cumming, chairman of the program committee introduced the members of the panel who were, G. M. Blackstock, Q.C., former chairman of the Board of Public Utilities Commissioners; G. W. Govier, member, Petroleum and Natural Gas Conservation Board; J. E. Oberholtzer, deputy minister, Department of Industries and Labour, and F. A. Brownie, president, Canadian Western Natural Gas Company Limited, who although unable to attend personally, sent his views on the subject through Bruce F. Willson, management assistant for Northwestern Utilities, Limited.

Mr. Blackstock traced the development of boards throughout the years, and went on to illustrate the mental qualities required of board members. He pointed out that members of boards should be educated men, able to size up witnesses, weigh a mass of evidence and put aside preconceived ideas. This requires that a member have a "judicial mind", or be so mentally constituted as to be able in time to develop a "judicial mind". The "judicial mind", Mr. Blackstock observed is a monopoly of the law profession. Engineers were generally too rigid in their thinking, and they would have a place only in relation to, but not on boards, unless they could forget that they were engineers and had the mental capacity to develop a judicial mind.

Mr. Oberholtzer asserted that government administrators welcomed the assistance of boards and that engineers had an important place on these boards. As individuals, more or less removed from political influence, it was advantageous to have engineers as board members. Mr. Oberholtzer pointed out that boards should generally be representative of all levels of society, and that engineers, in representing the scientific level of society, tended to give glamour and stability to boards, and may even add some ideas!

A disadvantage of having engineers as members of boards could be the tendency to place too much weight on the facts provided by engineers, in instances where factors other than technical must also be considered.

Mr. Govier warned members against the danger of delegating too much authority to boards and advised that people, subject to the decisions of boards, should always insist on such minimum safeguards as boards consisting of members who are responsible thinking men and have access to the courts to prevent boards from going beyond their jurisdiction. As professional men trained in the "engineering method", that is, the ability to start from known facts and proceed step by step with an orderly dispassionate method of thinking to a final conclusion, engineers were valuable members of boards. Through the application of this "engineering method", the board could be helped to reach a sound decision with no room for prejudice or preconceived ideas.

Mr. Brownie in his message presented by B. F. Willson, to a degree, reaffirmed Mr. Blackstock's opinion. He pointed out that engineers, with their specific knowledge and training in the processes of gathering facts, analysing and drawing conclusions, were valuable in an advisory capacity to boards, but that training by itself was not enough. As a member of a board the engineer must, in addition, be judicial, articulate, intelligent, and, at times, even courageous.

H. LeM. Stevens-Guille thanked the panel on behalf of the members of the Institute.

## Halifax

W. A. Logan, M.E.I.C.,
*Secretary-Treasurer*

W. A. Deveraux,
*Branch News Editor*

***Annual Meeting, December 15***

O. N. Mann, administrator for the Nova Scotia Department of Trade and Industry, was elected as the new Chairman of the Branch at the annual meeting. He is a native of Sydney, Nova Scotia, and a graduate of the Nova Scotia Technical College. After spending several years in Quebec and Ontario doing engineering and management work, he returned to Nova Scotia to take his present position.

New members were elected for the Branch executive as follows: G. A. Cunningham, M. S. Hicks, and J. D. Fraser all of Halifax and for outside of Halifax, S. W. Kenney of Yarmouth and O. H. Manuel of Lunenburg.

The proposed program for the Committee on Professional Development Courses was outlined by G. D. Mader, chairman. Lectures this winter will cover Citizenship, Finance, and Management In Business. Prof. A. E. Flynn outlined the work of the Students' Guidance Committee and pointed out that eighty high school pupils were interested in this guidance and had been interviewed. This was almost double the number in the previous year.

An outline of the work of the Council of the Institute was given by A. R Harrington, who is one of the councillors for the Halifax area.

G. F. Bennett the retiring chairman reviewed the year's work and mentioned that one of the highlights was the holding of the annual meeting here last May. He thanked the committee which had handled arrangements in connection with this function under the chairmanship of R. F. McAlpine. He spoke of the new policy of having some out-of-town meetings for the Branch so that Institute members outside of the city might have a better opportunity to attend. A desire was voiced for more technical meetings in each year's activities. Upon retiring from his office, Mr. Bennett hopes to be of continuing service to the Branch.

A vote of thanks to Mr. Bennett was moved by G. J. Currie, president of the Association of Professional Engineers of Nova Scotia. Mr. Currie also congratulated the new chairman and the new members of the executive.

It was announced that the joint annual banquet with the Association of Professional Engineers of Nova Scotia would be held in Halifax on January 28.

## Hamilton

J. A. Reid, Jr.E.I.C.,
*Secretary-Treasurer*

F. S. Gue, Jr.E.I.C.,
*Branch News Editor*

***Annual Meeting***

The annual meeting of the Hamilton Branch was held in the Century Room, Fischer's Hotel, on Jan. 14, beginning with refreshments and dinner at 7:00 p.m.

Following greetings from W. A. Dawson, retiring chairman, J. A. Reid reviewed Branch business for 1953. Increases in membership, a successful and popular annual ball, a well supported Professional Development Program, and the arrangement of an excellent series of features for the regular meetings all contributed to a successful year.

The following slate of officers was elected: chairman, W. A. Wheten; vice-chairman, F. E. Milne; secretary-treasurer, N. A. Parry; executive committee, Ralph Adams, I. MacDonald, J. Kelly, D. Hains; councillor, N. Metcalf; councillor-elect, N. Eager; ex-officio, W. A. Dawson and J. A. Reid.

Thanks to the Canadian Westinghouse Company for frequent use of their attractive new Auditorium at the Longwood Road plant were tendered by D. J. Hains, and accepted on behalf of the Company by E. M. Coles, vice-president.

Mr. Coles also introduced the speaker of the evening, J. R. Montague, director of engineering, Hydro-Electric Power Commission of Ontario, whose topic was "Sir Adam Beck No. 2 and Associated Developments".

In his preamble, Mr. Montague brought out the following facts:

(a) Hydro has progressed from its founding 50 years ago to a serious consideration of atomically generated power today.

(b) H.E.P.C.'s present peak capacity is 4,800,000 h.p.—an 85 per cent increase over 1945.

(d) Canada's per capita installed horsepower is 60 per cent higher than anywhere else in the world.

Mr. Montague began the body of his talk, which was well illustrated with up to date colour pictures of the Queenston project, with a discussion of some of the geological conditions which have had to be met in the construction of electric sites at Niagara, and which have forced the adoption of many ingenious engineering expedients to get water to the turbines located far downstream from the lip of the Falls.

An idea of the magnitude of the forces under control in the project was

**New executive of Halifax Branch: Left to Right, W. A. Logan, G. A. Cunningham, O. N. Mann, J. D. Fraser, G. F. Bennett.**

given in the information that the water travelling through the intake tunnels has a momentum equivalent to that of a freight train 45 miles long travelling at 40 m.p.h. To bring this water to a halt requires a gate closure time of 1.5 hours.

The passing of huge volumes of water through areas which are now densely populated has involved full-scale mining undertakings. 14,000,000 yards of rock have been excavated—enough to fill a double line of 15-ton trucks lined up from Halifax to Vancouver. The resulting tunnels work as inverted siphons, carrying the water under the city. Finished diameter of each of the two tunnels is 45 feet. Originally, one tunnel was to be built, "with provision for a second if the load necessitated it." No sooner had the first been begun than the load necessitated the second, which was then driven simultaneously.

Millisecond blasting techniques have been extensively used in the open canals, with hydraulically smooth walls and greatly reduced cleanup time resulting.

Mr. Montague also discussed briefly the pump-storage scheme being developed to use off-peak power for storage of water above the cliff, using two of the turbines as pumps.

Many engineers in the employ of Westinghouse in Hamilton were particularly interested in details of the developments, since 600,000 hp. of the installed capacity of the new station will be built in Hamilton.

Mr. Montague was thanked by E. T. W. Bailey, past chairman of the Hamilton Branch.

Following the speaker's address, W. A. Dawson turned over the chairman's gavel to W. A. Wheten, the 1954 chairman.

## Kingston

D. R. Graham, Jr.E.I.C.,
*Secretary-Treasurer*

#### W. M. Hogg Is Speaker

The December meeting of the Kingston Branch was held Wednesday, December 16, and took the form of a dinner at the LaSalle Hotel. The guest speaker was W. M. Hogg, assistant field project engineer for the Ontario Hydro-Electric Power Commission at the Sir Adam Beck No. 2 development.

Mr. Hogg, making ample use of illustrated slides outlined the history of power development at Niagara and dwelt with great detail on the problems involved in the digging of the two giant tunnels, eight miles long, under the city of Niagara Falls. These tunnels are 51 feet in diameter, wider than a four lane highway. The latest estimates call for the job to cost $344,000,000.

Some idea of the magnitude of the task of boring the tunnels is the fact that 1,400 cu. yd. of concrete are poured in an 8 hour shift, and 125 railway cars of cement are required per week.

By the use of trucks costing $44,000 each and electric shovels, $300,000 each, the rock removal is being done cheaper than had ever been done before. As an illustration as to how costs have been scientifically computed and reduced, it was disclosed that at the start, without good roads, tire costs on the big trucks were running to 60 cents per tire per hour. This has since been reduced to 25 cents mainly by the improvement of roads on the project.

Mr. Hogg also mentioned problems relating to the limitations on the amount of water which can be diverted from the Falls, in order to maintain the scenic beauty and of the reservoir being constructed to overcome the problem.

The speaker was introduced by Dean D. S. Ellis of the Faculty of Applied Science at Queen's University and was thanked by Prof. W. Dolphin of the Royal Military College.

#### Dinner Meeting, January 13

The January meeting of the Kingston Branch took the form of a dinner at which members' wives were present.

The guest of honour was Ross L. Dobbin, president of the Engineering Institute of Canada who was making his annual visit to Kingston. As a topic for his address to the Branch Mr. Dobbin sketched, in an extremely humorous manner, his trip to the Coronation as representative of the Institute. Anecdotes were numerous and incidents hitherto unpublished were related.

On the serious side Mr. Dobbin said he was impressed with the extreme loyalty of the British people for their Queen. He also congratulated the British engineers for their part in the Coronation arrangements.

Mr. Dobbin was introduced by Professor H. Conn of Queen's University and thanked by Lt.-Col. C. W. Jones, R.C.E.M.E.

In addition to the dinner meeting, an executive meeting was held with the President in the afternoon at which the problem of amalgamation of the Institute and the Association of Professional Engineers was discussed in some detail.

During his visit to Kingston, Mr. Dobbin also addressed the cadets of the Royal Military College and engineering students at Queen's University.

## Lethbridge

R. D. Hall, Jr.E.I.C.,
*Secretary-Treasurer*

P. Harding, Jr.E.I.C.,
*Branch News Editor*

#### Ladies' Night

On December 19, 1953, the Lethbridge Branch held a "Ladies' Night" supper at the Marquis Hotel. Dinner music was provided by Mr. and Mrs. George Brown and the sing song was conducted by George S. Brown. Two solos were rendered by Miss Ella Findlay, "O Holy Night" and "White Christmas" and Mrs. Max Baines gave two very entertaining recitations. Art Hunt sang "Stout Hearted Men" and "Because".

R. Lawrence introduced the speaker, A. J. Cullen, who spoke on "Our Heritage". Mr. Cullen explained how the different degrees of engineering have changed our everyday lives in a manner that seemed sheer magic to the layman. It is interesting to notice how our heritage came into our hands. Since the 13th Century when Marco Polo toured through Asia, explorers and adventurers have conquered many deserts, jungles, mountains, rivers and plains. North America was found to be a very favourable country for the white race. Canada, the last great frontier, is rich in natural beauty and pioneer ruggedness. Men with work and vision began to reap the profits of Canada's resources. Trade was built on industry and industry on power.

Mr. Cullen pointed out that Canada has all the resources for power development, coal, hydro-electric, gas, oil and uranium. With the ingenuity of the engineers, Canada has progressed rapidly. The natural increase (without immigration) in four years was one million, while in the United States it is two and one-half million per year.

In addition to such resources and power, Mr. Cullen added another very important heritage, that of freedom brought from the mother country. This freedom should be exercised by voting and participating in civic affairs. We should protect and augment for future generations the work, vision, and freedom that our forefathers bore on their shoulders.

A vote of thanks was extended by N. H. Bradley.

## Montreal

R. J. Harvey, M.E.I.C.,
*Secretary-Treasurer*

S. T. Rudkin, M.E.I.C.,
*Publicity, Vice-President*

#### Panel Discussion on Lighting

"What Factor is Lighting in the Modern Electrical Load" was the subject of a panel discussion held before a group of some eighty interested engineers on November 30 and sponsored jointly by the Electrical Section of the E.I.C., the A.I.E.E. and the I.E.S. The panel of three consisted of a utility representative, Jean Lafontaine of Shawinigan Water & Power Co.; a consulting engineer, Don Heywood of McDougall & Friedman, and an illuminating engineer, E. Doray of Shortall Electric. R. K. Owen acted as meeting chairman and moderator. Considerable audience participation, in the form of written questions, was a feature of the meeting. R. D. Merritt was responsible for meeting arrangements.

#### Civil Section Meeting

On December 1, the Civil Section were sponsors of a meeting at which G. H. Kohl, a consulting engineer with considerable and varied experience in heavy construction, spoke on the subject of "Specifications". He demonstrated, by examples drawn from his own experience, how specifications should be drawn up in order to help and expedite the work on a project. Charles Miller was meeting chairman, with H. J. Racey in charge of meeting arrangements.

#### Trans-Atlantic Joint Meeting

On December 3, for the first time in Canada, a joint trans-Atlantic meeting by radio telephone was held between the auditorium of the Bell Telephone Company, where sat some 300 members of the E.I.C. and the Institute of Radio Engineers and guests, and the Government Post Office building in London, England, occupied by a similar number of members of the Institution of Electrical Engnieers. The meeting involved a discussion of the intricate preparations and equipment required for the televising and broadcasting by the BBC of the ceremonies last June for Queen Elizabeth's Coronation. As editorial mention is being made of this meeting, and the paper reproduced in the *Journal*, no further comment will be made in this column except a word of praise for the wonderful job of co-ordination carried out by D. Danylkiw, who was responsible for meeting arrangements.

##### *Management Section*

W. T. Wilson, assistant vice-president, and chairman of a C.N.R. committee set up to study the training of executive officers from junior staff members, was the speaker at a meeting sponsored by the Management Section on December 3. His subject was "Trends for Training for Management", and during the course of his talk, Mr. Wilson discussed the pitfalls and problems experienced by other organizations in management training, and outlined the structure of his company's staff training course, and its aims in conducting it. C. A. Peachey was meeting chairman, and D. A. J. McDonald was in charge of meeting arrangements.

##### *Aircraft Discussion*

"Rotary Wing Aircraft Development" was the subject of a very interesting talk given by Everett B. Schaefer, chief technical engineer with Canadair Limited on December 10. Based on the interest presently being displayed, he said, it did not appear rash to predict airline operation of helicopters in the next decade, but as an important supplement rather than any threat to the airline systems. Two or three basic types, with superior characteristics, would probably evolve from the diversified field in existence today. Already several years' experience has been gained in the carrying of air mail from airport to downtown central post offices in Los Angeles, Chicago and New York, and passenger shuttle services in New York between Idlewild, La Guardia and Newark airports indicate the steadily growing civil aviation side of the picture. Sabena Airlines of Belgium operate a helicopter service between Brussels and eight other cities within a range of 65 to 185 miles, and T.C.A. is seriously considering the potentialities of such a service. The first helicopter to be designed, built and flown in Canada, said Mr. Schaefer, was a three-phase single-rotor craft developed by Bernard Sznycer and Selma Gattlied in 1947. Sponsored by the Mechanical Section, the meeting was chaired by O. R. Brumell, and arranged by W. D. Kerr.

##### *R. J. Roberts Is Speaker*

On December 14, at a meeting sponsored jointly by the E.I.C. Electrical Section and the A.I.E.E., R. J. Roberts, assistant electrical engineer, equipment for the C.N.R., spoke on "Trends in Electrical Equipment for Railway Cars". Having been directly involved with the electrical systems for 300 ultra-modern passenger cars being delivered to the railway, Mr. Roberts was well qualified to discuss the lighting, air-conditioning, batteries and generating equipment of the modern railway car. Noll Wright acted as meeting chairman, and R. H. Tivy was responsible for meeting arrangements.

##### *Chemical Section Meeting*

The final meeting of the year 1953, sponsored by the Chemical Section, was held on December 15. Morris Katz, M.Sc., Ph.D., Chairman of the Canadian Section of the Technical Advisory Board on Air Pollution spoke on "Recent Developments in Atmospheric Pollution". Smog disasters, chemical reactions of atmospheric contaminents, and industrial pollution control were a few of the highlights present by Dr. Katz in his most interesting talk. J. B. Phillips, Ph.D., was meeting chairman; E. W. Coderre in charge of arrangements.

##### *Report on Symposium Held in November*

A symposium on student guidance for the French-speaking colleges was held November 26. The guest speaker was Dr. Huet Massue, P.Eng., in charge of the Department of Statistics and Economics of the Shawinigan Water and Power Company, who gave an "Exposé Général sur la Profession d'Ingénieur" The talk was extremely interesting and well illustrated by slides.

The students asked, in writing, a good number of questions which were answered during a period of nearly an hour by one or the other of the group of guest engineers. This group included Dean Gaudefroy, Professor Godin, Secretary, Professors Boucher, Brais, Maufette, and Professor Laurence, chairman of the Student Guidance Committee, all of the Ecole Polytechnique. Mr. Bournival, registrar of the Corporation of Professional Engineers of Quebec, was also present.

After the period of questions and answers, a short film entitled "L'art de l'Ingénieur" was shown. This film was lent free to us by the "Office Provincial de Publicité".

Altogether, twenty colleges were invited by a letter dated November 18, 1953. Only five colleges were represented by students and the total number of students present was twenty-five.

The most probable cause for this poor showing was the timing. It was concluded afterwards that a much greater number of students would have showed up if the meeting had been held in the afternoon of the same day. Unfortunately, this was not possible because of a meeting of the Faculty of the Ecole Polytechnique on that afternoon. Furthermore, it was not possible to hold the meeting later because many colleges would then be having their examination period, and also not possible to have meetings on other days of the week because these colleges have their holiday on Thursday afternoons.

It is concluded that the next symposium for the French-speaking colleges should be organized in the afternoon for a better chance of the success which should normally be expected.

## Northern New Brunswick

L. L. Marshall, Jr.E.I.C.,
*Secretary-Treasurer*

R. W. Rankine, Jr.E.I.C.,
*Branch News Editor*

**Review of 1953**

On December 19, 1952, a meeting was held in Bathurst, N.B., to discuss the possibility of forming a branch of the Engineering Institute of the northern part of the province.

It was decided that this meeting go on record as being in favour of forming a branch and that petitions be sent to Chatham, Newcastle, Bathurst, Dalhousie and Campbellton.

R. C. Eddy was appointed provisional chairman and L. L. Marshall provisional secretary-treasurer. A committee consisting of E. C. Bannerman, G. P. Milton and C. F. Taylor was asked to make a study of by-laws for the branch.

The inaugural meeting of the branch was held on March 12, 1953, beginning with a reception at the Canadian Legion Hall in Bathurst. Cocktails were served buffet style.

At 8.00 p.m. a turkey dinner was served to eighty-four members and guests at the Donald Eddy Memorial Hall. R. C. Eddy was chairman of the meeting and among those at the head table were: Dr. J. B. Stirling, Dr. L. Austin Wright, W. S. C. Stratton, chairman of the Moncton Branch; A. J. Fenwick, Deputy Mayor of Bathurst; J. G. Chalmers, administrative vice-president of Bathurst Power and Paper Company Limited and H. G. Rogers representing the Association of Professional Engineers of New Brunswick.

The toast to the new Branch was given by Mr. Stratton, who also presented the Branch with the Institute banner and a cheque for twenty-five dollars from the Moncton Branch.

Mr. Fenwick expressed the pleasure of the town council upon the formation of this new branch, a further step in the development of Northern New Brunswick.

Mr. Chalmers read a teletype message from R. L. Weldon, president of the Bathurst Power and Paper Company Limited and a member of the finance committee of the Engineering Institute of Canada, in which he expressed his good wishes for the Branch.

Mr. Rogers, speaking for the Association of Professional Engineers, stated that the Association was pleased to see a branch of the Engineering Institute of Canada formed in this section of the province.

Dr. Stirling, the main speaker of the evening, centred his talk around the engineers and this community. He stressed the fact that they should exert themselves to take part in municipal affairs and in local projects.

Dr. Wright followed by giving a brief talk on engineers in general and went on to give a picture of what was being planned for the annual meeting of the Institute to be held in Halifax on May 20, 21 and 22.

The meeting was then adjourned and the members and guests retired to the Legion Hall where a dance was held.

**General Meeting, September**

A general meeting was held in Bathurst on September 30. Guests were: the new president, R. L. Dobbin, and the general secretary, Dr. Austin Wright.

Twenty-four members of the Branch were in attendance and the meeting began with a very enjoyable supper. R. C. Eddy was the chairman.

During the following business meeting the report of the scrutineers on the recent election was received. They reported that the following officers were elected: vice-chairman, G. A. Robb, Dalhousie, N.B.; executive members, Restigouche County, D. MacCallum, D.

A. Stack; executive members, Gloucester County, G. P. Milton, C. F. Taylor. The following officers had been elected previously by acclamation: chairman, R. C. Eddy, Bathurst, N.B.; secretary-treasurer, L. L. Marshall, Bathurst, N.B.; executive members, Northumberland County, Martin Cyr; Tracy Gould.

The chairman called upon Dr. Wright to introduce the president of the Institute. President Dobbin gave a short, but informative talk on his trip to the Coronation as representative of the Institute. He then presented the meeting with two topics for discussion. First, the admission of science graduates to the Institute as members without examination; and second the feeling of the Branch if in the future it was found impossible for the president to visit all branches in one year.

These topics brought forward a lively discussion with a large number of views put forth. The president's intention is to present the views of the various Branches to the Council for discussion.

**November Meeting**

The next meeting of the Branch took place at the R.C.A.F. Station, Chatham, N.B. on November 6.

Previous to the business meeting twenty-four engineers were conducted on a very interesting tour of the base by F/Lt. Martin. The group visited in particular the sewage disposal plant and a reinforced concrete hangar.

Following supper, served in the Officer's Mess, the business meeting was called to order. The special speaker for the evening was F. W. Purdy, sales manager for Maritime Cement Company Limited.

Mr. Purdy gave a fine talk on portland cement, tracing the history of the product and giving a resume of the present day uses and went on to look at the future. To augment his talk Mr. Purdy used a film showing the methods of manufacturing portland cement.

The meeting was adjourned to an oyster smoker and refreshments.

## Quebec

Roger Desjardins, M.E.I.C.,
*Secretary-Treasurer*

Guy Babineau, Jr.E.I.C.,
*Branch News Editor*

**December Meeting**

A joint meeting of the E.I.C. Quebec Branch and the "Association des Diplômés de Polytechnique—Section de Québec" was held on December 3, at the "Faculté des Sciences" building of Laval University. This meeting consisted in the presentation of four films the showing of which was made possible following an agreement between "La Société des Ingénieurs Civils de France", "Le Directeur des Laboratoires de Bâtiments et Travaux Publics", Paris, France and Messrs. Georges Demers, P.Eng., M.E.I.C., and P. A. Dupuis, P.Eng., M.E.I.C., who visited France early in 1953.

The first film shown, "Reconstruction of Block V-4 at Le Hâvre, France", described the process used in reconstructing part of the city apartment houses destroyed during World War II. This method consists of prefabricating *in situ* all reinforced concrete structural and decorative elements of the building. The method of fabricating and assembling these various elements was well covered.

The second film described the construction of a steel pipe-line in Maroc where new techniques were being used for laying the pipe across natural obstacles as well as for lining the conduit with a special protective coating.

The next picture was devoted to the building of a 12 kilometer tunnel for diverting water from the Rhue River in France "Massif Central" region. A scientific method of blasting was used in this instance as well as a new technique for the concrete lining of the tunnel walls whereby concrete is forced by means of compressed air in between the walls and reusable forms moving on rails.

A new and most daring technique of constructing an aircraft hangar in the vicinity of the city of Marseille was the subject of the last film. Due to the particular weather conditions prevailing in this region, the thin-shell concrete roof structure had to be erected on the ground and then raised into its final position at some 60 feet above ground.

A considerable number of engineers and architects were present at this meeting which was under the chairmanship of Georges Demers; the thanks were expressed on behalf of the Branch by its chairman, A. E. Paré.

#### President's Visit

The president of the Institute, R. L. Dobbin, paid his annual visit to the Quebec Branch on December 9. After devoting the greater part of the afternoon to a Branch executive meeting, President Dobbin, General Secretary Austin Wright and members of the Branch executive met the engineering students of Laval University; the Institute prize for the best academic record was awarded upon this occasion to Bernard Michel, fifth year student in civil engineering.

A large section of the Branch membership met afterwards with the president at a dinner held at the "Cercle Universitaire". Mr. Dobbin's remarks were confined mostly to describing the important role played by British engineers in providing all necessary lighting, public address, broadcasting and television facilities for the coronation of Queen Elizabeth II of Great Britain. The fact that for the first time Institute representatives were officially invited to attend the ceremony in Westminster Abbey, the president added, is to be regarded as a tribute of recognition to the engineering profession.

General Secretary Austin Wright briefly reviewed the Institute activities pointing out how fast they had been growing in the last few years. "The financial situation of the Institute is good", added the secretary. He also warned existing Canadian consulting and contracting firms to get ready to meet a much stiffer competition following what he termed the ever increasing invasion of foreign firms now incorporating in Canada. The Institute has always been happy to provide its full help and support when required so that contracts may be awarded to existing domestic firms, and it will continue to do so, stated Mr. Wright. But it belongs to them now more than ever to go out and sell their services and facilities through proper advertising and aggressive salesmanship, he said.

The dinner was under the chairmanship of the Quebec Branch president A. E. Paré, who introduced Mr. Dobbin; thanks and good wishes were expressed to the visiting president in behalf of the local Branch by a member of its executive, B. O. Baker.

## Saguenay

C. C. Louttit, Jr.E.I.C.,
*Secretary-Treasurer*

#### President Dobbin Visits the Branch

A meeting of the Saguenay Branch of the Engineering Institute of Canada was held on December 10, 1953 in the Assembly Room of the Saguenay Inn, Arvida. Guests for the evening were President R. L. Dobbin, and Assistant General Secretary Col. Thompson.

G. K. Clement, branch chairman, introduced the president to the members. President Dobbin outlined his visit to the Coronation ceremony in England and his visits to various engineering societies, schools and factories. He reported that the Canadian engineer is held in high esteem by their British counterparts and every courtesy was shown to him in his office as president. Mr. Dobbin outlined his visits to the Branches so far, having covered all of Eastern Canada with the exception of a few Branches in western Ontario. During his trip he had remarked how few of the Branches asked mayors, councillors and other municipal and government members as speakers, thereby missing opportunities for good publicity and the furtherance of good public relations. Other opportunities for enhancing the reputation of the E.I.C. are found by serving in an advisory capacity in disputes and making general recommendations for the guidance of city councils, etc.

Mr. Clement asked Col. Thompson if he would say a few words. Col. Thompson outlined the activities of headquarters staff, showing how these had increased during the past year. Speaking of the *Journal*, the editorial staff had been able to advance the date of publication by two weeks, even though the *Journal* had increased in size by about 30 per cent. It was anticipated that the new membership directory would be mailed by December 1. However, this was not possible but it will be mailed before December 25. To cover the cost of issuing the list advertising space has been sold. Had this not been done, the cost to the Institute would have been about $1.50 per copy. Col. Thompson also outlined the E.I.C.'s part in the student's exchange this past summer, when 30 European engineering students paid their passage to and from Canada and worked during the summer for various Canadian companies. No Canadian students made the trip to Europe. It has been requested that a representative of the E.I.C. be present at a meeting in Stockholm in January to discuss plans for the coming summer.

A lively discussion period followed the talks. President Dobbin was asked to give Headquarters' views on the admission of science graduates. Stemming from this, Col. Thompson told the meeting that in only one case was the E.I.C. compelled to accept, by agreement, a member of the professional body as a member of the E.I.C. This was in the Province of Alberta, whose Professional Association presently admitted geologists and scientists who would not normally be admitted as members. In all other provinces, the Institute accepted a man's educational qualifications as satisfactory if he were a member of the Professional Association and only passed on his engineering experience before granting membership. The rest of the evening was taken up by discussion of an explanatory nature on points raised during the talks by the president and assistant general secretary.

The meeting was adjourned at 10.30 p.m. and discussion continued over coffee and sandwiches.

## Saint John

John A. B. Brenan,
*Secretary-Treasurer*

#### Annual Meeting

The annual meeting of the Saint John Branch was held December 8 with Chairman A. G. Watt presiding.

Reports of the year's activities, the treasurer's report and a report on the professional development courses were read and after the counting of ballots the following slate of officers was declared elected for 1954. Chairman, R. M. Richardson, vice-chairman, W. M. Brenan, secretary-treasurer, J. A. B. Brenan. Members of the executive are J. J. Donahue and F. L. Doty.

Two members of the 1953 executive, T. C. Higginson and C. G. Clark still have one year to serve. H. S. McCleave was appointed representative to the E.I.C. Nominating Committee for 1954.

Mr. Watt welcomed the new chairman and presented him with the E.I.C. charter, and Lorne Cass, on behalf of the members, thanked Mr. Watt for his work as chairman during the past year.

The matter of city engineers for Saint John and Lancaster was discussed at some length. It was decided to forward a resolution to the Saint John Common Council and the Lancaster City Council protesting the fact that no qualified engineer is at present employed by either city. The cooperation of the Association of Professional Engineers of the Province of New Brunswick is to be sought in this matter.

Three films were shown before the meeting was brought to a close.

## Sudbury

George Fleming, M.E.I.C.,
*Secretary-Treasurer*

T. C. Robertson, M.E.I.C.,
*Branch News Editor*

#### Pipe Line Construction Illustrated

On October 16, 1953 the first oil from Alberta reached Vancouver by way of pipe line. The laying of this oil pipe line was the topic presented at the January dinner meeting of the Sudbury Branch of the Institute held at the Sudbury Granite Club. The speaker, Bill Skully, was introduced by J. Quance. Mr. Skully was born in Montreal but spent many of his younger years in New York. He served in the Canadian Navy aboard H.M.C.S. *Huron* with the rank of lieutenant. He now lives at Jordan Station where he is within commuting distance of Toronto or St. Catharines as manager of public relations for the Canadian Comstock Co.

In introducing the coloured sound film "Man Against Mountain", Mr. Skully stated that the construction of such pipe line over the scenic mountains, across great marsh lands, under roads and under rivers presented one of the most unpredictable problems which modern engineers have been called upon to conquer. As a result of the inherent uncertainties no Canadian company felt able

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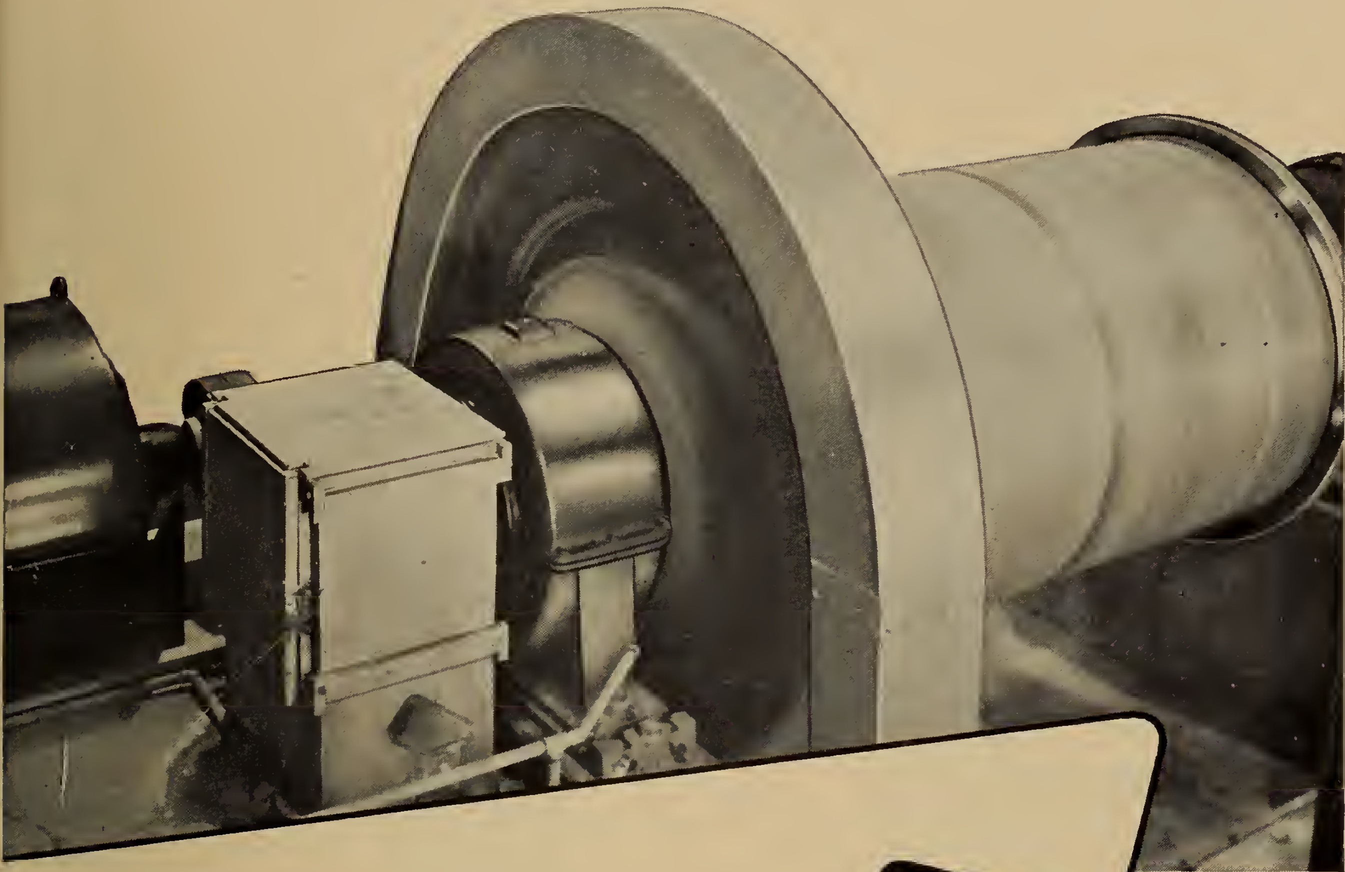

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to take the risk involved so a company "Comstock Mid Western" was formed. This was a combination of Canadian Comstock and Mid Western of. Tulsa, Oklahoma. It was interesting to note that at the outset the engineering staff was 75 per cent American but for the last 2 years of construction this percentage had been changed to 80 per cent Canadian. The picture was taken near Jasper, Alberta about one year ago on one of the spreads. In the construction of the 425 mile section of the pipe line there were three such spreads. Each spread required over a million dollars worth of capital equipment.

The film "Man Against Mountain" depicted Alberta as a country of wheat, cattle, Chinook winds etc. There were the bituminous sands at Fort McMurray. Oil was discovered in the Turner Valley in 1912 but not until 1950 did the oil developments become fantastic making a pipe line the answer to the marketing problems. The 780 mile survey required 2 years to complete with all its detours around lakes, creek crossings and mountainous climbs. However, this great tourist country crowned with 100 square miles of ice presented engineering problems even more rugged than its rugged beauty. In the building of this billion seven hundred and eighty million dollar pipe line the men were housed in trailer camps near the location and all the equipment serviced on the job. The 50 foot right of way had to be cleared and grubbed by heavy bulldozers in some places, in others the rock had to be blasted ready for the big cats to take over, and in still others timbers had to be laid to support the machinery which followed. All this and much more in preparation for the 3 ft. wide and 5 ft. deep trench which was to be the resting place for the new pipe line.

The 24 in. diameter and ¼ in. thick pipe was transported on 5,000 railway cars, each length weighing one ton. After the pipes were cleaned and buffed the cats with side beams aligned the pipes on blocks beside the trench. They were then held in place by a line-up clamp ready for welding. The welding was done in three operations. The stringer bead of weld was followed by another which must be free of pin holes of any kind and then came the finish pass which had to be smooth and regular. After the completion of the welding a special gamma ray machine was inserted in the pipe and photographic film placed on the outside of the pipe gave a record of any flaw which may have been present in the weld. The pipes were then covered with a primer paint and when dry a wrapping of asbestos and fibre glass saturated with asphalt or coal tar was applied. In crossing rivers or marshes the pipes had to be weighted with concrete blocks which were poured on the site and then fastened to the pipe. In these cases the pipe was welded in long sections and then moved into place. The piping used in these locations was ½ in. in thickness in order to withstand the extra strain to which it might be subjected.

After the piping was completed in one continuous length the cats lowered the pipe into place and covered it to a depth of 3 ft. except in the river or road crossings where the covering was increased to 6 ft. All that then remained to be done was to level off the right of way and the line was ready to begin its work of transporting 150,000 barrels of crude oil per day from the wells to the refineries at the Pacific coast.

At the end of the film Mr. Skully answered many pertinent questions regarding this enormous undertaking. Al Cameron, on behalf of the Branch, expressed the appreciation of the gathering and extended a most hearty thanks to the speaker for such an interesting evening.

#### Meeting At North Bay

The Sudbury Branch of the Institute journeyed to North Bay for the December meeting on Saturday December 5, where they were conducted through the diesel locomotive servicing and repair shop of the Ontario Northland Railway. Jack Cooper, the assistant chief engineer met the party and had members of his staff on hand to conduct the tour. After the trip through the shops Mr. Cooper entertained the members of the branch at his home prior to the dinner at the St. Regis Hotel in North Bay.

Officially opened in October the million dollar shop contains the newest equipment available for the speedy and efficient servicing of modern diesel locomotives. One of the most important pieces of equipment is the "drop table" which consists of an electrically operated elevator for changing locomotive trucks. The engine is positioned so that the damaged truck is over the elevator which is at track level. The body of the locomotive is then supported by two beams and the truck uncoupled. The elevator lowers the truck to a depressed track where it is moved from under the locomotive on a transfer track to the repair area where it is again raised to track level. This procedure reduces the time required to change trucks from one and one half days to two hours.

The exhaust ventilating system is the first of its kind in Canada. A continuous duct is suspended over each of the two service tracks and runs the full length of the building. All gases are discharged into this duct and are carried off by motor driven exhaust fans. These fans are automatically started and stopped so that the maximum amount of heat is conserved in the winter months.

The main shop is 104 feet long and consists of two sections each of which is 52 feet wide. The one section is for servicing and has platforms on both sides and between the two service tracks, as well as a depressed floor between the tracks. All necessary servicing equipment is readily available, in production line order, so that a minimum of time is consumed before the train is back in service again. The other section is the repair area and has two short tracks on either side of the drop table. One of these tracks is used for truck repairs and the other for electric motor servicing.

In an adjoining section of the building are many auxiliary rooms such as lunch room, lecture room, apprentice class room, wash room, fan room, oil room, offices and several special servicing rooms.

The wheel conditioning room houses two of the most up-to-date lathes available. The wheel turning lathe is capable of increasing the number of axles turned out in an eight hour shift from nine by the old method to twenty-four by the new method.

All in all the engineers of the O.N.R. are to be congratulated on having assembled the most modern equipment and incorporated speedy servicing techniques so that now the O.N.R. is prepared to continue in their program of complete dieselization.

After the dinner a short business meeting was held and it was announced that the first meeting of the educational and professional development section would be held December 7 and would be addressed by J. Berger, chief constable for Sudbury, who would speak on traffic problems as they affect the city.

## Vancouver Island

P. F. Fairfull, M.E.I.C.,
*Secretary-Treasurer*

***Annual Dinner Meeting***

The annual dinner meeting of the Vancouver Island Branch was held at the Oak Bay Beach Hotel on Friday, December 11, 1953, when 33 members attended.

R. E. Haskins of the B.C. Cement Company introduced the speaker of the evening, Les Willoughby, who spoke on the design and control of concrete. By courtesy of the Portland Cement Association the very instructive film on the same subject was shown and at the conclusion Mr. Willoughby answered innumerable questions. The speaker was thanked for his enlightening talk by A. S. G. Musgrave, past chairman of the Branch.

## Hamilton

N. A. Perry, Jr.E.I.C.,
*Secretary-Treasurer*

***Hamilton Engineers' Wives Association Report of 1953 Activities***

At the close of 1953 the membership was 67 with an average attendance of 42.

The program for the year consisted of three business meetings, three parties, a dinner and a penny bake sale. Speakers at sessions following the business meetings were J. D. Witmer, interior decorator, Mrs. Marjory Freeman Campbell, author, and a demonstrator of Elizabeth Arden products.

In addition to the monthly meetings there were four interest groups—craft, service, music appreciation and bridge. The craft group made hats, aluminum trays, brass jewelry and Christmas candles and poinsettias. In addition to regular meetings the music appreciation group attended the Toronto Symphony concerts. The service group did work for the Red Cross and Mountain Sanitorium. These groups' meetings were very interesting and well attended.

***Executive for 1954***

Executive of Hamilton Engineers' Wives Association for 1954 is as follows: honorary president, Mrs. W. Wheten; past president, Mrs. F. J. Veale; president, Mrs. J. A. Tyerman, vice president, Mrs. J. J. Dravis; recording and corresponding secretaries, Mrs. P. J. McNally, Mrs. H. K. Craibbe; treasurer, Mrs. J. M. Skinner; program and social convenors, Mrs. R. J. Northrup, Mrs. V. J. A. Derraugh, and membership secretary, Mrs. D. Friesen.

# LIBRARY NOTES

## Additions to the Institute Library

Reviews — Book Notes — Abstracts

## BOOK REVIEW

**Lost trail: The story of Klondike gold and the man who fought for control.** Francis Cunynghame. London, Faber, Toronto, British Book Service, 1953. 213 pp., illus., $4.00.

"On the 2nd January, off I went aboard the old 'Etruria' bound for New York, and reached Dawson City in early June, 1898."

Such is the brief record which Arthur Newton Christian Treadgold, commonly known as "Treader" made of the start of his fabulous history-making adventure in the Klondike gold field.

Descended from Sir Isaac Newton, and proud of that lineage, Treader had a will of his own, an independent spirit, and an iron constitution. He went to a good public school, and then took his Mus. Bac. degree at Cambridge. For a few years he schoolmastered at Bath, but soon his adventurous spirit got the better of him.

In eighteen hundred and ninety-seven, he met Grace Henderson, a Canadian student from Toronto, and less than a year later he was on his way to the Klondike, excited by letters from Miss Henderson's sister, then married to a Mountie stationed in the gold area.

An excellent overall description of the early miners is given in the author's own words:

> There was only one drawback, one great worry in all this get-rich-quick population. There was a great scarcity of provisions. Flour was twelve to sixteen dollars a hundredweight, bacon fifty cents a pound, blankets twenty-five dollars; heavy prices in those days. At times it was impossible to buy anything at all. In Dawson City hungry millionaires paraded the streets and tried to forget their unappeased appetites by improving their shacks or going to the saloons and dance-halls. There was no real poverty, but no one knew where he was going to get his next meal. They just had to sit with empty stomachs and wait patiently for a steamer to come up with food. There was plenty of salmon in the rivers and plenty of moose on the hills. Were they too lazy or too glutted with gold to fish or hunt?
>
> Vanity of vanities! It was truly an amazing world.

During the first summer, Treadgold examined the workings by open cut, by drifts, and by prospecting shafts in the several valleys being actively worked. His conclusion, which he set out to report back to England, was that an adequate supply of water and electric power was the prime need for the area. Camped on Bonanza Creek, he met the now well known geologists, R. G. McConnell and J. B. Tyrrell. These two specialists were reporting these same needs, namely, water and electric power.

Names that are familiar, and even legendary, live through the pages of the book: F. H. Chrysler, Major Cunynghame, Colonel Feilding, Sir John Latta, D. M. McCarthy, William Trask, J. B. Watson, and Raleigh Smallman, Big Alec Macdonald, Andy Hunker and Joe Boyle.

Treader's speculative borrowing, and indiscriminate buying and transferring of shares, are all brought out in the trial in nineteen hundred and thirty-two and nineteen hundred and thirty-three.

The latter part of his life, when he returned to his old digs at Oxford, the final judgment of nineteen hundred and thirty-three, and a most interesting summing up of his activities and character, conclude this quite refreshing and different book. And the reader will find the index a great convenience. E.K.

## BOOK NOTES

**Prepared by the Library**
**The Engineering Institute of Canada**

* Review provided through the courtesy of the Engineering Societies Library in New York.

**Catalogue of ferrous alloy specifications (Commercial and service): American-British-Canadian armies standardization program.** Canada, Department of National Defence, 1949. 932 pp.

This publication, which came into effect in January, 1950, "correlates the standard and service ferrous alloy specifications currently in use in the United States, the United Kingdom, Canada, and Australia, in use as of 1 January 1949. The purpose

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of this standard is to facilitate production in one country when using production data referencing ferrous metal specifications of another country, by providing the characteristics, nomenclature and related information in this form."

"This Standard is promulgated by authority of the Technical Procedures Committee established in Washington, D.C., in accordance with the standardization agreement between the United States, the United Kingdom, and Canada."

It "was developed as Project No. 9.6.1.1, assigned to the Canadian Army as the monitoring country, and developed by the Canadian Arsenals Limited, Ottawa, Canada, as monitoring agency."

The volume is divided into two main sections: Table I, which designates chemically equivalent specifications, and Table II, which gives chemical compositions and mechanical properties.

The classification of ferrous alloys is based on the numbering system for steels of the American iron and steel institute and the Society of automotive engineers, except in the tables for Cast iron and steel, Ferro alloys, Nitriding steels, Nickel base steels, and Special steels.

The tables are so arranged that it can be seen at a glance the corresponding numbers for each specification in the different countries.

The index to this volume lists alloys under the product for which they are to be used — Bars, billets, forgings, etc. — and according to their A.I.S.I.-S.A.E. series number, but alongside the series number is also listed the type of alloy which this number represents.

Although intended primarily for use by the manufacturers of service equipment, the tables should prove useful to all those interested in ferrous alloys as not only are the specifications of the four countries concerned linked together, but the chemical composition of the alloys, and their mechanical properties are also given.

**Direct current machines for control systems.** A. Tustin. London, Spon, Toronto, British book service, 1952. 306 pp., $10.00.

One of the most remarkable recent developments in engineering is the application of automatic precision controls in industry, transport, and the defence services, and it is the object of this book to describe some of the different types of direct current machines and machine combinations which are suitable for use in this connection. In this book, the term automatic control has been used to include all kinds of automatic regulating, control, and positioning devices.

The author describes various different types of machine, such as Normal shunt, series and compound wound generators and motors, and Ward-Leonard control, the Rosenberg generator, the Amplidyne, and the Magnavolt. These machines are used in control systems, both separately and combinations, as when one machine is used to excite a larger one. Although the various types seem quite different, Mr. Tustin states that they conform to a common pattern, that of a sequence of stages of power amplification, and, as far as possible, he has treated the machines in common, pointing out the similarities and differences between the various types.

The choice of electric machines for control purposes depends partly upon their "static" characteristics, but even more upon their dynamic or "response" characteristics, that is, the way in which the output (current or voltage) responds to the variations of the input (the exciting current or voltage). For this reason, the author has given enough of the theory of control systems to make clear the part played by the dynamic characteristics in determining its suitability for use in such systems.

The book has been written for engineers connected with the manufacture of electrical equipment, industrial engineers and research workers. It should also be useful for students of electrical engineering as an additional text on d-c machines.

**The editorial directory: business, industrial, professional, farm, consumer publications, 1953.** New York, Galub publishing company, 1953. 232 pp., $27.00.

Readers who already know this publication need only be told that this edition has been increased to include Farm and Consumer publications, and additional new editorial data, such as complete matphotocut information, type and page size and column width, payment policies for material purchased and charge policies for handling publicity, description of readership, circulation affiliation, and subscription rates.

Contributing magazines are indexed alphabetically in the front, and reference is to their section number rather than the page, listings being alphabetical under each section; there is also a numerical group number index.

It seems slightly puzzling as to why Canadian publications are listed separately, and we also wonder why the Consumer and Farm publications were not incorporated into the general alphabetical index.

Information provided, when available, includes, name of magazine, address, publisher, telephone number, news and feature deadlines, editors both general and local, size, type, use of photographs, etc., and a general description of material published and type of readers, as well as new information mentioned above.

The use of the volume will be limited in Canada, as the Canadian listings are so few. But it will be of special value to library reference shelves all across the country who deal with many questions on editorial or publication information matters.

**Electrical installation rules and tables,** 5th ed. W. S. Ibbetson, ed. P. A. Rowland. London, Spon, Toronto, British Book Service, 1953. 210 pp., $1.50.

First published in nineteen hundred and twenty-one, and now in its fifth edition, 1953, this is a handy compendium for practical wiremen, electricians, engineers, contractors and architects. It is also prepared to be of value to students studying for the City and Guilds examination in electrical installation work.

Conversion data on work and energy units, British and metric equivalents, electrical symbols, graphical symbols for numerical values, the Greek alphabet and mensuration, along with general definition and electrical regulations are extremely useful additions to the volume.

The book itself is a thoroughly practical handbook for on the spot installation information, or for practical study purposes. It is well indexed, as well as being logically arranged, and should be a boon particularly to our younger electrical members.

***Foams; theory and industrial application.** J. J. Bikerman. New York, Reinhold publishing corp., 1953. 347 pp., $10.00.

This first complete treatise on foams reviews the literature and practice in the field and discusses the physical chemistry and industrial uses of foams. The first part of the book deals with the fundamental knowledge of the subject, and the second with applications in fire-fighting, froth flotation and in other miscellaneous applications such as building materials, plastics, etc. The last chapter is on chemical antifoaming agents. Extensive lists of references are included.

**Gas turbines.** Harry Sorensen. New York, Ronald press, 1951. 460 pp., illus., $6.50.

This volume received normal new book publicity by direct mail advertising in October, nineteen fifty-three, although the author completed his work on it in October, nineteen fifty.

It is just another example of what a number of technical publishers have been doing for some time, and which is most confusing to book dealers, librarians, and technical readers alike. When sales lag and stocks are still high, brochures come out which lead people to believe that a new edition of an old title has been published.

Although the author's references and acknowledgments throughout the volume seem copious, we fail to find, for instance, any reference to the very obvious assistance of Mr. D. G. Shepherd. One engineer very aptly described it, "it is a good collection of other peoples' work", useful in its way, in that it collects scattered data into one place, but this fact is also the obvious reason for its needing shot-in-the-arm publicity by the publishers at so late a date.

***Introduction to aeronautical dynamics.** M. Rauscher. New York, Wiley, 1953. 664 pp., $12.00.

Intended as a two-semester course for undergraduates, this text provides a thorough coverage of particle dynamics, fluid dynamics, airfoil theory, rigid dynamics, and vibration analysis.

The detailed analytical treatment is kept within the range of the student's mathematical background, the main object being to lay a solid foundation, along with the applied courses, for the subsequent study of aircraft stability.

**Manual of traffic engineering studies,** 2nd ed. Association of casualty surety companies. New York, The association, 1953. 278 pp., illus., $3.75 (U.S.)

Specially designed to meet the needs of communities with populations ranging from twenty-five thousand to five hundred thousand, this volume is now in its second edition, which is ample evidence of its value.

And this value is no doubt due to the very practical arrangement and presentation of its material.

The introductory chapter contains a general discussion of the importance and need of traffic studies, types of studies, basic transportation planning, traffic safety and parking surveys and their financing, and general survey planning.

The general text presents twenty-eight separate studies, ranging from all types of traffic rule observation, motor vehicle occupancy, rates of speed, parking, traffic trends, pedestrian volume, and staggered hours.

Appendices include an analysis of traffic trends, statistical treatment of traffic data, comparisons of studies and drawing up of questionnaires, the preparation of reports, and a seventeen item bibliography of selected traffic references.

Practically every page carries reproductions and graphs, charts, maps and forms for data collected, and no effort seems to have been spared to make this a most practical, as well as interesting and useful manual to all our members interested in traffic engineering or town planning of any type.

***Mechanical vibrations.** W. T. Thomson. New York, Prentice, 2nd ed., 1953. 252 pp., figs., $6.00 (U.S.)

Intended for a first course in the subject this text presents the fundamentals of vibration theory and provides a general background for advanced study in the field. The last two chapters deal with the vibration of elastic bodies and with electromechanical systems and analogics. Numerous problems are presented throughout to illustrate the method of analysis.

**Modern wiring practice.** W. E. Steward. London, Newnes, Toronto, British Book Service, 1953. 228 pp., illus., 1952. $4.00.

Wiring both for light and for power, on industrial and domestic premises, is covered in this volume, with numerous and detailed illustrations and pictorial diagrams.

Modern wiring systems and methods, and the use of steel, copper, aluminium, flexible metallic and non-metallic conduits, is thoroughly explained and illustrated.

The permissible deviations from standard practice are set out for temporary wiring for garden parties, etc., and the special techniques required for dealing with mineral insulated metal-shathed cables and paper-insulated metal-sheathed cables are dealt with in detail, along with earthing and installation-testing.

The volume is indexed, and appears to be number one in the Newnes Practical Electrical Engineering Series.

***Principles of transistor circuits.** R. F. Shea, ed. New York, Wiley, 1953. 535 pp., figs., $11.00.

This first comprehensive treatment of the subject divides roughly into three main parts covering essentially low-frequency, and large-signal non-linear applications. Each part includes the presentation and analysis of equivalent circuits, analysis of the mathematical relationship, and development of the applicable circuits. Basic semi-conductor principles are discussed, and the treatment throughout enables the engineer with vacuum-tube experience to utilize the material effectively.

***Protective atmospheres.** A. G. Hotchkiss and H. M. Webber. New York, Wiley, 1953. 341 pp., illus., $7.00.

The practical aspects of the subject are emphasized with the intent of providing an operating manual for process engineers and metallurgists. The first chapter gives a tabulated summary of data on compositions and costs of typical protective gases, processes for which they are used, and recommended gases for particular applications. Succeeding chapters develop the subject, with separate chapters on types of atmospheres, instruments, storage and handling, applications, and practical remedies for operating difficulties.

**The spirit of philosophy.** Marcus Long. Toronto, University press, 1953. 306 pp., $3.00.

The basis of this volume was a series of introductory lectures in philosophy, over a period of several years on the University of Toronto campus. Simple demand on the part of hearers resulted in the author presenting the information in book form.

The spirit of the enquirer, of the searcher for truth, rather than that of the teacher, permeates the volume, and the chapter headings give a good idea of the clarity and well thought out presentation of the subject on the part of the author.

They are, The meaning of philosophy, Things, Quality, Quantity, Space and time, Causality, Mechanism, Teleology, God, Value, Truth, Reason and Skepticism.

Classic, mediaeval, and modern philosophers and philosophies are all discussed under their appropriate headings, and a reading of this book should be a welcome relief to some of our members, in contrast to the usual technical publications listed in these pages.

**Standard RLM specifications for industrial lighting units,** 3rd rev. ed. Chicago, Reflectors and lighting equipment manufacturers standards institute, 1953. 52 pp., gratis.

These specifications for industrial lighting have been prepared by the Reflector and lighting equipment manufacturers standards institute as a standard which must be attained by manufacturers before the RLM label can be attached to their products. The Institute, therefore, provides a nationally recognized standard similar to those issued by the American standards association, the American society for testing materials, and other official bodies.

The specifications cover different types of porcelain enamel reflectors and fluorescent lamp units of varying lengths, from 48" to 96", and containing two or three lamps. In this edition, new specifications are included covering fifteen variations of semi-direct fluorescent units which direct twenty to thirty per cent of their light upwards. Revisions have also been made in existing RLM specifications.

**Standard specifications for highway bridges,** 6th ed. Washington, American association of state highway officials, 1953. 328 pp., $4.00 (U.S.)

These specifications are intended to serve as a guide in the preparation of State specifications for highway bridges, and also as references for bridge engineers. They apply to ordinary highway bridges with maximum span of 400 feet, and set forth minimum requirements which may be modified according to local conditions. Reference is made to relevant specifications of the American society for testing materials, the American welding society, the American wood preservers' association, and the American association of state highway officials.

The book is arranged in four divisions: General provisions, Construction, Design, and Materials. The first section covers general matters, such as award of contract, control of work, legal responsibility to the public, and payment for work. The second deals with all phases of construction, including excavation and fill, piles, different types of structure (concrete, brick, steel, and timber) painting, flooring, and railing. All aspects of design are covered in the section devoted to that topic, and there are many examples and tables. The last section covers materials used in construction, and gives required standards for each; here too frequent reference is made to the standards of the organizations listed above. Formulas for steel columns, and loading, constitute the appendices, and the standards are all

alphabetically listed in the back with reference to page and article number.

Even though intended primarily for use in the United States, this volume should prove useful to our members in Canada interested in bridge construction, as the application of the standards is general.

**The structural analysis of the dome of discovery.** T. O. Lazarides. London, Crosby Lockwood, 1952. 64 pp., illus., 25/.

The main framework of the Dome of Discovery roof consists of a triangulated system of rigidly connected aluminium alloy arch ribs, forming part of a sphere. Approximately equilateral spherical triangles are formed by these ribs, some lying exactly, and some approximately, on the circles of the sphere.

By taking full advantage of symmetry of structure and modern methods of analysis, work on the dome was reduced to manageable proportions.

The book is packed throughout with detail of statistical properties, limits of accuracy, influence co-efficient, conversion tables, operational tables, loads, stresses and support reactions, besides eighteen folded tables at the back of the book.

But in spite of all this detailed information, the chief value of the book lies in its general application of modern analysis methods, as the method devised by the author is applicable to any highly redundant space frames. For this reason it will be a welcome addition to the analysis field for both theory and practice.

**Theory and practice of structural design applied to reinforced concrete.** B. Eriksen. London, Concrete publications, 1953. 401 pp., figs.

"Due to the monolithic nature of reinforced concrete structures they are more often than not statically indeterminate, that is they cannot be analysed by means of the statical conditions of equilibrium. Although reinforced concrete structures may not be truly elastic they are considered to be so for the purposes of analysis, and the theory of elasticity is adopted as a means of obtaining additional data to enable the bending moments and forces to be determined."

Ordinary building frames can be provided with codes, by-laws, and approximate formulae for bending moments. For larger members, no one but the professional engineer can safely introduce simplifications.

The purpose of this volume is to enable students to apply the principles of statics and theory of elasticity to the design of structures for which formulae are not available.

Part one deals with elementary principles of statics, deformation, and strain.

Part two states the fundamental principles of the theory of elasticity, their adaptation to special types of structures and their translation to special methods, as related to statically indeterminate structures.

In cases where calculus is used to demonstrate principles and formulae, the meaning of integrals is explained in terms of simple mechanics and geometry.

The book carries a brief index, but a detailed table of contents.

**Welding practice.** E. Fuchs and H. Bradley, eds. Toronto, Butterworth, 1951-52. 3 v., illus., $8.50. v. 1, **Welding methods and tests,** 130 pp., $2.75; v. 2, **Welding of ferrous metals.** 198 pp., $3.50; v. 3, **Welding of non-ferrous metals.** 183 pp., $3.50.

Divided into three volumes, the aspects common to all applications of welding are collected in volume one. The other two volumes deal with the specific problems arising in the welding of the ferrous and non-ferrous metals groups respectively, making the first volume complementary to the other two.

The primary object of welding practice is to meet the needs of designers, draughtsmen, works and research engineers, engineering inspectors, and foremen in charge of welders, and in its original form it was a series of pamphlets prepared by members of the staff of Imperial Chemical Industries.

The glossary is the same in all three volumes, but the indices are separate and individual to each volume, and are in good detail.

The editor makes no claims to have included bibliographies, but publications listed with the chapters are those considered specially important and of practical use.

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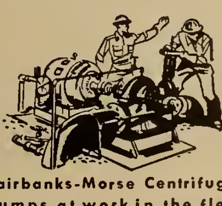

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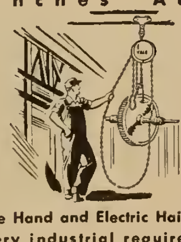

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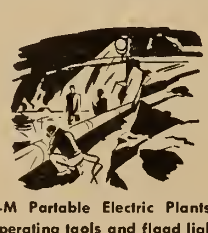

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**British Standards, British standards institution, 24-28 Victoria Street, Westminster, London, S.W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.**

**B.S. 1133: Section 4:1953—Packaging code for mechanical aids in package handling.** 6/–.

Packers are often discouraged by the evidence of poor handling of containers in transit and there is little doubt that much of the damage sustained by packages is due to inefficient handling. There is little that the packer can do to control the treatment given to his goods after they leave his factory. There is, however, a great deal that can be done to improve the handling of packaging materials and filled containers during movement from one part of the factory to another or during the loading on to vans or wagons for the first stage of their journey. Manual handling, however experienced the operator, is expensive in time and labour and the use of an efficient system of mechanical handling generally results in a reduction of accidents with a consequent greater safety to the operatives and less damage to the goods.

With this in mind B.S.I. has prepared this section of the Packaging Code dealing with mechanical aids in package handling. It describes the many types of equipment available and gives notice to assist users in selecting equipment and using it to the best advantage. This section contains about 80 illustrations of typical pieces of equipment likely to be of use to packers.

**B.S. 1728: Part 5:1953—Methods for the analysis of aluminium and aluminium alloys. Copper (absorptiometric method).** 2/–.

The British Standards Institution has just published Part 5 of B.S. 1728 'Methods for the analysis of aluminium and aluminium alloys'.

This British Standard method for the absorptiometric determination of copper is intended for use with alloys containing smaller percentages of copper than those covered in B.S. 1728, Part 1 (of the order of 0.01 — 0.3 per cent.)

The method specifies the reagents used, recommended methods of sampling and test procedure. An indication of the reproducibility expected is given and is derived from experiments carried out by a number of independent analysts.

**B.S. 2032: 1953 — Aluminium bronze rods, sections and forgings for general engineering purposes.** 2/6.

**B.S. 2033: 1953 — Aluminium nickel iron bronze rods and forgings for general engineering purposes.** 2/6.

These standards have been prepared to reduce the number of alloys in this field, the two compositions chosen being those which have characteristics and mechanical properties which cover as far as possible all known applications.

In B.S. 2032 the composition is a compromise between those of two Ministry of Supply material specifications D.T.D. 160, 'Aluminium bronze for valve seats, and D.T.D. 174 'Aluminium bronze sand or die castings', while in B.S. 2033 it approximates to that of D.T.D. 197 'Aluminium nickel iron bronze bars, forgings and stampings'. It is hoped that these two British Standards will be used wherever aluminium bronze is required for general engineering purposes.

**B.S. 2039: 1953 — Enamelled round copper wire (Enamel with vinyl acetal base) (Metric units).** 4/–.

The British Standards Institution has now published as B.S. 2039: 1953, a metric edition of B.S. 1844 which has the same title. This has been prepared primarily from the point of view of exports and it differs from the 1952 edition of B.S. 1844 only in that all qualities are expressed in metric units, and the range of diameters covered is 0.050 mm. to 4.00 mm.

For normal purposes in the United

Kingdom, B.S: 1844 is still the appropriate standard to be used. The technical details contained in the new specification are taken entirely from B.S. 1844, with the addition of an appendix giving constants for converting resistances of annealed high-conductivity copper at various temperatures to the standard temperature of 20°C. It gives details of diameters, resistances and thickness of enamel (including tolerances) together with tests on the enamel insulation. These tests relate to hardness, flexibility and adhesion, heat shock, heat ageing and electric strength.

**Canadian standards, Canadian standards association, National research building, Ottawa, Canada.**

**C.S.A. B89.3-1953—Automobile fire fighting equipment.** $1.75.

This specification on Automobile fire fighting apparatus covers types of apparatus which are believed to fit the needs of the average town or city. It covers the minimum requirements and performance of the following types of apparatus: Pumper (Triple Combination); Ladder Truck (Aerial); Ladder Truck and Pumper (Quadruple Combination).

The rating of pumpers, the capacity of pumps, and the standard which they should reach are all discussed. In addition to the material dealing with the actual pump, the standard lists requirements for the automobile or truck to which the pump is connected. Here are included such topics as ignition, wiring, clutch, tires, lights, etc. It also deals with the question of hose and ladders.

Additional sections list the equipment, both "basic" and "extra", which is carried on fire fighting apparatus.

This second edition has been drafted with two objectives. First, to bring the technical and performance requirements into closer harmony with the equipment normally available on the Canadian market, without depreciating the Standard, and second, to establish a specification consistent with the testing and listing requirements of the Dominion Board of Insurance Underwriters.

**C.S.A. C22.2 No. 90-1953—Construction and test of mechanisms and motors for sound recording and reproducing equipment.** 75 cents.

This specification applies to mechanisms for record players, recording mechanisms and motors for these mechanisms intended as components for approved phonographs, radio-phonographs, record players, or recording apparatus, and designed to be used on supply circuits operating at not more than 150 volts to ground, employed in accordance with the rules of Part I of this Code." It covers both domestic and commercial use, and includes record changers, wire or tape recorders, or any other form of recording in addition to standard disc recording.

The topics under the heading Construction include motors, switches, conductors, bushings, wiring, insulation, and spacings. Where applicable, the specifications of the C.S.A. to which individual parts should comply are listed.

The final sections of the specification enumerate the approval tests for the equipment.

**C.S.A. C22.2 No. 106-1953 — Construction and test of HRC fuses (Low-voltage power fuses).** $1.00.

HRC (High-Rupturing Capacity) fuses are used for the protection of electrical circuits and equipment and in particular where the fuses covered by the latest issue of CSA Specification C22.2 No. 59. 'Fuses (Both plug and cartridge-enclosed types)' are unsuitable or inadequate because of insufficient rupturing capacity. This Specification applied to HRC non-renewable cartridge fuses to be employed in accordance with the rules of Part I of this Code, and for the following voltage and current ratings:

(a) At 600 volts a-c, for current-ratings up to and including 600 amperes;
(b) At 250 volts a-c, for current-ratings up to and including 600 amperes;
(c) At 600 volts d-c, for current-ratings up to and including 600 amperes;
(d) At 250 volts d-c, for current-ratings up to and including 600 amperes.

Included in the Specification are information on general requirements, construction and marking, and temperature and overload tests, and rupturing-capacity tests.

**C.S.A. C22.3 No. 1 (D)-1953. Rules, requirements and specifications for the joint use of poles to support supply and communication circuits.** $1.00.

The recent expansion in construction of power and communication lines has emphasized the need for a specification providing guidance for the solution of problems arising out of this construction. The specification is intended to apply to steel and concrete poles, as well as to wood poles, although the requirements may be subject to modification for the former. The standard lists general requirements for pole steps, vertical runs, communication suspension strands, climbing space, insulators, etc. Sections 2 and 3 deal with clearances and separations and strength requirements, whilst the Appendices and plates cover such topics as timber strength separation between line conductors, street lamp installation, clearance of communication cables from luminaire bracket, and a typical crossover attachment.

**C.S.A. Z102.12T-1953. Temporary specification for corrugated fibreboard boxes and products for use by defence services.** 75 cents.

This specification is intended to provide appropriate requirements for the purchasing of containers of this type, by the Defence Services, and also to specify the details of suitable containers for shipments of products required on government contracts. It is not intended to apply in cases where authorities having jurisdiction specify the details for containers for special products, such as explosives, which are to be transported by rail or motor vehicle.

Pending the rendering of a decision by the Canadian Freight Association, in the matter of Revision of Rule 1 of the Freight Classification, this Specification is published as "Tentative".

The standards listed all apply to corrugated fibreboard, and cover 3 types of boxes; cutout wrappers; liners; cells; pads; sheets and rolls.

**American Standards, American standards association, 70 East 45th Street, New York 17, N.Y.**

**A21.2-1953 — Cast iron pit cast pipe for water or other liquids.** 45 cents.

**A21.3-1953 — Cast iron pit cast pipe for gas.** 25 cents.

**A21.4-1953 — Cement mortar lining for cast iron pipe and fittings.** 35 cents.

**A21.6-1953 — Cast iron pipe centrifugally cast in metal molds, for water or other liquids.** 40 cents.

**A21.7-1953 — Cast iron pipe centrifugally cast in metal molds, for gas.** 25 cents.

**A21.8-1953 — Cast iron pipe centrifugally cast in sand-lined molds, for water or other liquids.** 45 cents.

**A21.9-1953 — Cast iron pipe centrifugally cast in sand-lined molds, for gas.** 25 cents.

**A21.11-1953 — A mechanical joint for cast-iron pressure pipe and fittings.** 35 cents.

These eight standards, together with A21.10-1952 — Short body cast-iron fittings, 3 inch to 12 inch, for 250-p.s.i. water pressure plus water hammer — provide uniformity in methods of determining the thickness and length of cast iron pipe, depending upon the pipe's diameter and the pressure it must withstand. These specifications, dealing with both spun pipe and cast or molded pipe, also include data on reasons for failure of cast iron pipe and methods for preventing corrosion.

The standards were developed under ASA Committee A21, which was formed in 1926 to undertake this project. Committee chairman since that time has been Thomas H. Wiggin, consulting engineer. Mr. Wiggin represents the American Water Works Association in the project.

Mr. Wiggin stated: "Our committee has one important task remaining. That is to recommend dimensions, thicknesses, and pressure ratings for fittings over twelve inches in diameter. This is the committee's present undertaking."

The committee, organized under the auspices of ASA, is made up of 35 producers, users and other groups interested in standardization of cast-ron pipe. Administrative leadership of the project was furnished by the American Gas Association, American Society for Testing Materials, American Water Works Association, and New England Water Works Association, acting as sponsors.

## BOOKS RECEIVED

**British standards 1953 year book.** London, British standards institution, 1953. 488 pp., $2.25.

**Ceiling unlimited.** Lloyd Morris and Kendall Smith. Toronto, Macmillan, 1953. 417 pp., illus., $7.25.

**Central building research institute, Roorkee** — Issued on the occasion of the opening of the Institute, April 12, 1953. New Delhi, Council of scientific and industrial research, 1953.

**Communication theory.** Willis Jackson, ed. Toronto, Butterworth, 1953. 532 pp., $11.00.

**Defense and the dollar.** A. G. Hart. New York, Twentieth Century Fund, 1953. 203 pp., $2.00 (U.S.)

**Design for decision.** I. D. J. Bross. Toronto, Macmillan, 1953. 276 pp., $4.75.

**Design in structural steel.** J. E. Lothers. New York, Prentice-Hall, 1953. 454 pp., figs., $10.00 (U.S.)

**Economic controls and defense.** D. W. Wallace. New York, Twentieth Century Fund, 1953. 260 pp., $2.00 (U.S.)

**Elements of radio, 3rd ed.** Abraham Marcus and William Marcus. New York, Prentice-Hall, 1953. 771 pp., diagrs., $6.00 (U.S.)

**Engineering thermodynamics.** B. E. Short and others. New York, Harper, 1953. 467 pp., figs., $6.00 (U.S.)

**Essentials of engineering thermodynamics.** H. J. Stoever. New York, Wiley, 1953. 279 pp., figs., $4.50.

**FBI register of British manufacturers-1954, 26th ed.** Federation of British Industries. London, Kelly's Directories & Iliffe, 1953. 952 pp., $8.00.

**Highway research board, proceedings of the thirty-second annual meeting, January 1953.** United States. National research council. Highway research board. Washington, The board, 1953. 616 pp., (Publication No. 271).

**How to troubleshoot a TV receiver.** J. R. Johnson. New York, Rider, 1953. 128 pp., illus., $1.80 (U.S.)

**The international yearbook and Statesmen's who's who, 1953.** London, Burke's peerage, 1953. 447 pp., £8.8.0.

**Irrigation engineering.** K. R. Sharma. Jullundur, India, India Printers, 1953. 3 v., illus., $17.00 (U.S.)

**Manual on rock blasting.** K. H. Fraenkel, ed. Stockholm, Aktiebolaget Atlas Diesel, Montreal, Canadian Cop-Co, 1953. 498 pp. (irreg. paging) fold. tables, loose leaf, $15.00.

**Materials for product development, 1953. Proceedings of the Basic materials conference held in conjunction with the First Basic materials exposition, New York, June 1953.** New York, Clapp and Poliak, 1953. 265 pp., illus., $7.50 (U.S.)

**Metal machining.** L. E. Doyle. New York, Prentice-Hall, 1953. 511 pp., illus., $10.00 (U.S.)

**Modern electroplating.** A. G. Gray, ed. New York, Wiley, 1953. 563 pp., illus., $8.50.

**National directory of the Canadian pulp and paper industries, 1953.** Gardenvale, Que., National Business Publications, 1953. 478 pp., $4.50.

**National research council of Canada review, 1953.** Ottawa, Queen's Printer, 1953. 244 pp., 75 cents.

**Normblatt-Verzeichnis 1953.** Berlin, Deutsche Normenausschuss, 1953. 344 pp., 9,60 DM.

**Our neighbour worlds.** V. A. Firsoff. New York, Philosophical Library, 1953. 336 pp., illus., $6.00 (U.S.)

**Pensions and profit sharing.** G. B. Buck and others. Washington, D.C., Bureau of National Affairs, 1953. 272 pp., $5.50 (U.S.)

**The physical chemistry of melts: a symposium on the nature of molten slags and salts held . . . 20th February, 1952.** London, Institution of mining and metallurgy, 1953. 106 pp., figs., 15/–.

**Pressure vessel manual, 4th ed.** K. O. Siemon. Ann Arbor, Mich., Edwards, 1953. 284 pp., diagrs., $3.85 (U.S.)

**Procedures in experimental metallurgy.** A. U. Seybolt and J. E. Burke. New York, Wiley, 1953. 340 pp., diagrs., $7.00.

**Proceedings of symposium on prestressed concrete statically indeterminate structures.** London, Cement and concrete association, 1953. 180 pp., diagrs., 25/–.

**Proceedings of the general discussion on heat transfer, 11th to 13th September 1951.** London, Institution of mechanical engineers, New York, American society of mechanical engineers, 1953. 496 pp., illus., $7.50.

**Research and building construction in India.** Kurt Billig. New Delhi, Council of scientific and industrial research, 1953. (Central building research institute, Bulletin, v. 1, No. 1.)

**Recent developments in mineral dressing.** London, Institution of mining and metallurgy, 1953. 766 pp., illus., $9.00.

**Spending for industrial research, 1951-1952.** DeW. C. Dearborn and others. Boston, Harvard business school, 1953. 103 pp., $2.50 (U.S.)

**State traffic safety: its organization, administration and programming.** Maxwell Halsey. Saugatuck, Conn., Eno Foundation for highway traffic control, 1953. 280 pp.

**Steelwork in building.** W. B. Scott. London, Spon, Toronto, British Book Service, 1952. 203 pp., figs., $5.00.

**Table of natural logarithms for arguments between zero and five to sixteen decimal places.** United States. National bureau of standards. Washington, D.C., G.P.O., 1953. 501 pp., $3.25 (U.S.) (Applied mathematics series No. 31).

**Television tube location guide, v. 4.** Indianapolis, Sams, 1953. 189 pp., illus., $2.00 (U.S.)

**Temperature measurement in engineering, v. 1.** H. D. Baker and others. New York, Wiley, 1953. 179 pp., figs., $3.75.

# TECHNICAL BULLETINS AND PAMPHLETS RECEIVED

**Bell telephone system. Monographs:**
No. 2084 — Computers — past, present and future, by W. H. MacWilliams. No. 2085 — Solderless wrapped connection, by J. W. McRae (and others). No. 2090 — The L3 coaxial system.

**British electrical and allied industries research association. Technical reports:**
No. G/T272 — Restriking voltage characteristics· self capacitances of H.V. transformers, reactors and busbars, by J. S. Vosper. No. L/T273 — The dielectric properties of phenol formaldehyde resin, by E. Rushton. No. L/T274 — Thermal decomposition of organic insulating materials in relation to the mechanism of tracking, by V. E. Yarsley, W. J. Grant and G. C. Ives. No. Q/T138 — The self-excitation of capacitor-compensated induction motors, by J. A. Nicholson. No. Y/T15 Characteristics of a small heat pump installation, by M. V. Griffith and H. J. Eighteen. No. Y/T20 — The Shinfield heat pump. Interim report, by M. V. Griffith and H. J. Eighteen.

**British electricity authority. Annual reports:**
Fifth report and accounts, 1952-3.

**Canada. Geological survey. Bulletin:**
No. 26 — Bedrock geology of the seaboard of Labrador between Domino Run and Hopedale, Newfoundland, by E. H. Krank.

**Construction in Canada, 1951-1953.** Canada, Queen's Printer, 1953.

**Engineering and pure science,** by W. F. G. Swann. Washington, Smithsonian Institution, 1953. (Publication No. 4114).

**Illinois. University. Engineering experiment station. Bulletins:**
No. 411 — The dielectric constant and dissipation factor of soda-potassia-silica glasses at room temperatures and at frequencies of 1 to 300 kilocycles, by G. F. Stockdale. No. 412 — Heat emission characteristics of warm-air perimeter heating ducts, by J. R. Jamieson (and others). No. 413 — Transport of momentum, mass, and heat in turbulent jets, by L. G. Alexander (and others). No. 414 — Frequency analysis of hydrologic data with special application to rainfall intensities, by Ven Te Chow.

**...Reprint series:**
No. 51 — Progress reports of investigation of railroad rails and joint bars, by R. E. Cramer and R. S. Jensen.

**Modern plastics encyclopedia, and engineer's handbook, 1953.** 943 pp., illus. Available with a subscription to Modern Plastics.

**Montreal. Civil service commission:**
8th annual report, 1952-1953.

**Ontario. Hydro-electric power commission:**
45th annual report, 1952.

**Philips' Gloeilampenfabrieken, Laboratoria. Separaat:**
2107 — Condition for vanishing spontaneous magnetization below the Curie temperature, by K. F. Niessen. 2116 — General considerations regarding the dosimetry of roentgen and gamma radiation, by W. J. Oosterkamp. 2119 — Low-hydrogen welding rods, by J. D. Fast. 2121 — Quantitative spectrochemical analysis by means of the constant temperature D.C. carbon arc, by N.W.H. Addink.

**A review of materials handling in British manufacturing industries.** London, Institution of Production Engineers, 1953.

**Royal Institute of Technology, Sweden. Transactions:**
V.71, 1953 — Flow problems with respect to intakes and tunnels of Swedish hydro-electric power plants, by Lennart Rahm.

**Smithsonian Institution. Annual report of the Board of Regents:**
The operations, expenditures, and condition of the Institution for the year ended June 30, 1952. $2.75.

**United States. Highway research board. Bulletin:**
No. 74 — Traffic-accident studies. (Publication no. 265).

# Business & Industrial Briefs

## *A Digest of Information received by* The Editor

## Appointments and Transfers

**Shawinigan Chemicals Limited.** — Hugh D. Ross, senior superintendent of the plants of Shawinigan Chemicals Limited at Shawinigan Falls, and superintendent of the carbide division, has been appointed assistant vice-president of the Company at the head offices in Montreal, it is announced by V. G. Bartram, president.

Mr. Ross is being succeeded as superintendent of the carbide division by A. Clifford Holm, formerly manager of the research department of the parent Shawinigan Water and Power Company.

Three new appointments among staff of Shawinigan Chemicals Limited were also announced.

D. C. Downing, until now stationed in the research laboratories at Shawinigan Falls, has been transferred to the Montreal office as assistant director of the development department. Conrad Monfet, a member of the same department, has been appointed economic analyst, and John F. Goudey has been named development engineer in the Montreal Office.

G. E. Hill, Q.C.

**B. F. Goodrich.**—V. O. Griffin, manager of belting and hose of B. F. Goodrich in Canada, joined the International Division of the company in Akron in January, 1954. The international promotion was announced by H. P. Hawkins, general manager of the Industrial Products Division.

M. E. Bailey has been promoted to manager of the Belting and Hose Sales.

**Toronto Brick Co. Limited.** — The Company wishes to advise that on and after January 11, 1954 their head office and showroom will be located in new quarters at 425 Bayview Avenue, Toronto.

**Peacock Brothers Limited.**—Effective January 1, T. P. Wall, formerly in charge of the company's sales to the pulp and paper industry, has moved from Montreal to become manager of the Toronto office. He succeeds W. S. Mills, who is forming a new industry sales division known as the waterworks and sewerage department, with headquarters in Toronto. At the same time, H. N. Hill has taken over the management of the pulp and paper department.

**Trane Company of Canada Limited.**—Grant E. Cole, executive vice-president and general manager of Trane, announced that at a recent meeting of the Board of Directors, E. C. Phillips and G. E. Hill, Q.C., were elected directors of the company.

Mr. Phillips is vice-president and assistant general manager. Mr. Hill is a partner in the law firm of Holmstead, Sutton, Hill and Kemp and a director of other companies.

At the same meeting Wayne J. Hood was appointed treasurer and L. V. Sutton, Q.C., secretary.

**Dahl Brothers.**—Dahl Brothers (Canada) Limited announces the appointment of Ross Watson and H. Willy Kennals as sales representatives to the plumbing and heating trade in the Province of Ontario.

**John Fisher.** — John Fisher, internationally-known Canadian, has been appointed to the board of directors, BLM Automatic Clutch Corp., it was announced by N. Bruce Wilson, president and chairman of the board.

(*Continued on page 225*))

E. C. Phillips

(*Continued from page 221*)

**Chrysler Corporation of Canada, Limited.**—W. E. McGraw became a member of the company's management staff after serving for 24 years as chief engineer. J. P. Cummings will succeed him as chief engineer.

●

**Letourneau-Westinghouse Company.**—W. E. Hendricks, who has served as assistant to the general sales manager for Letourneau-Westinghouse Company since last June, has been named domestic sales manager, company officials announce.

Also announced is the appointment of Lloyd Rager as sales promotion manager.

●

**Union Carbide Canada Limited.** — William B. Humes has been named manager of operations for Union Carbide Canada Limited, it was announced by Ewart Greig, president.

**William B. Humes**

●

**B. F. Sturtevant Company.**—K. W. Kraser, general manager of the B. F. Sturtevant Company of Canada Limited has announced the appointment of K. J. Dewhirst to the post of manager of sales for Canada.

Douglas G. Forster will assume managership of the B. F. Sturtevant Company Toronto district office, succeeding K. J. Dewhirst.

●

**Taylor Instrument.** — Taylor Instrument Companies of Canada Limited have recently completed a move to expanded facilities in Montreal.

Taylor's new address is 190 Rockland Road—at Graham Boulevard traffic circle, in the Town of Mount Royal. Telephone numbers are REgent 3-8246-7.

The Montreal staff has been augmented by the appointment of R. H. Shand to sales.

●

**New Office Location.** — Mickelson & Fraser, Engineers and Architects, announce the removal of their offices from the Cuthbertson Block Fort William, Ontario to Mills Building, 16th Avenue at Memorial Avenue, Intercity.

●

# New Equipment and Developments

**Advanced Welding Course.** — The Canadian Welding Bureau, division of the Canadian Standards Association, Ottawa, announces that details are now available concerning the major options of an advanced welding course.

Written by university professors in conjunction with the Bureau's staff of welding engineers, the course has been sanctioned by the Bureau's Board of Directors as a result of requests from engineers and others for a course more advanced and complete than that originally sponsored by the Bureau and entitled "Welding Fundamental Principles and Practices."

Consisting of a number of options, the advanced course will be made available over the next two or three years. These will include: The Elements of Structural Steel Design (An Introductory Course), Structural Design, Mechanical Design, Metallurgy, Resistance Welding, Submerged Melt and Inert Gas Welding, Inspection, and Welding Physics.

Details of each of these options with date of commencement and duration, together with fees and instalment payment plan may be obtained from the Canadian Welding Bureau, 1393 Yonge Street, Toronto.

●

**Welding Goggle "Defroster".**—A new ventilation principle has been developed by Dominion Oxygen Company, Ltd., to provide welding goggles that won't steam up or fog even in hot damp weather. The Oxweld No. 24 coverall goggles depend upon a steady stream of air to prevent steaming and moisture condensation. Sixteen vents, located behind the lens retaining rings, permit continuous circulation of fresh air across the inside surface of the lens.

●

**Monsanto Canada Limited.**—Start-up operations of Monsanto Canada Limited's new $400,000 petroleum additive plant at Montreal began recently with production of the first run of crankcase additives entirely manufactured in Canada.

Scheduled for initial production are several types of detergents and inhibitor additives, both essential components in modern high-performance engine oils. Certain special compounds for gear lubricants will also be manufactured.

●

**German Industries Fair Hannover.**— The German Industries Fair will take place next year, not in two parts as in the past few years, but in one gigantic display on the Hannover Trade Fair Grounds which will cover both consumer and industrial goods, and will be open from April 25 to May 4, 1954.

●

**New Machinery Quarters.**—Plans have been completed and a contract awarded for the erection of a modern building on Kempt Road for the construction machinery division of William Stairs, Son and Morrow Limited, A. D. Stairs, president of the old Halifax firm announced recently.

Cameron Contracting Limited has been awarded the contract for the building, which was designed by J. Philip Dumaresq and Associates.

●

**New Office and Warehouse.**—Canadian General Electric Company's new office and warehouse building at 5000 Namur Street, at Decarie Boulevard, in suburban Montreal, opened for business on January 1. The building, which serves the Province of Quebec generally —with the exception of the Ottawa trading area—will be occupied by the Montreal staffs of the company's Wholesale and Industrial Products Divisions.

●

**Refractories and Plastics.** — J. L. Spence, president of Refractories Engineering & Supplies Limited, announces the opening of the Company's new plant at Bronte, Ontario. This new plant will manufacture, under license, internationally known refractory specialties: plastics, castables and cements.

●

**Carboloy Tools.**—According to Canadian General Electric Company's Carboloy Sales the surface finish on a carbide tool tip has little effect on tool life for average machining on steel. During roughing operations, it points out, carbide tools perform satisfactorily whether they are ground on a diamond or silicon carbide grinding wheel — or even if left with the surface in as-sintered condition.

These are the surface finishes which can be obtained on cemented carbides by various methods of grinding or lapping.

As-sintered carbide tools provide a tool surface finish of 30 plus micro inches. Those ground on silicon carbide grinding wheels provide 15 plus micro inches. Eight to fifteen micro inches are obtained with diamond grinding wheels, and lapping and super finishing reduce surface finish to 0.5 to 5 micro inches.

Tests conducted indicate that a lapped or superfinished tool fails more rapidly in making roughing cuts than one ground on a diamond wheel. This is because the lapped surface over which the chip slides offers more area contact, increasing both the rate of heat transfer from chip to tool tip and friction due to sliding. A slightly rougher tool offers less surface contact and operates at lower temperatures.

Tools employed for finishing and precision finishing aluminum, magnesium, etc., must have a good surface finish. Lapping of the top face and cutting edges is a must for good tool life.

For a precision finishing operation involving steel, it is necessary to finish grind the tool cutting edges with a diamond wheel. Long-run jobs, using quick-change tool holders, require the use of a duplicating type grinder to control uniformity of the cutting tool shape. These duplicating grinders often use a 400 grit resinoid bonded diamond wheel. But in this operation, very little stock is removed since it is more of a truing up operation.

Rough grinding of precision finishing tools may be done by off-hand grinding with a 100-grit silicon carbide or diamond wheel.

●

**Cast Iron Segments.**—A delegation of engineers of the Port of New York Authority visited the Bethlehem Steel Company plant to watch the manufacture of segments for the Lincoln Tunnel between Manhattan and New Jersey.

They began their tour at the iron foundry where 50 of the 3,400 pound segments are being poured daily. The hot metal is brought to the mold by ladle from a cupola with an hourly capacity of 25 to 30 tons. The segments are made individually, the metal being poured into a long row of molds on the foundry floor.

●

**Diesel Locomotives.** — An increase in horsepower, up to 17% is one of the major features of the improvements in a new line of six types of railroad locomotives announced by General Motors Diesel Limited, at London, Ontario.

Most of the increases in ratings or in service life stem from the introduction of a new General Motors diesel engine, the 567 C series, upon which General Motors engineers have been working for five years; and from a new traction motor which has been so greatly improved that it has "made possible the elimination of arbitrary short-time ratings for all models and all gear ratios."

Deliveries of the six types of new locomotives began January, 1954.

●

**New Testing Station.** — Underwriters' Laboratories of Canada marked the formal start of construction of their 10,000 square foot office and laboratory at a simple ceremony held recently at the new Scarborough, Ont., site.

The office and laboratory will provide the nucleus for an extensive long range building program designed to provide up-to-date and complete facilities for the Laboratories.

●

**Blasting Agent.**—A blasting agent, powerful, yet not subject to accidental detonation by blasting caps, flame, friction, or impact, including that of a rifle bullet, is now being produced in Canada for use in mine and open-quarry blasting.

Know as "Nitrone" it is manufactured in Canada by Canadian Industries Limited in a plant recently constructed at C-I-L's commercial explosives works at Beloeil, Que.

Nitrone has no liquid content and is packaged for use in sealed metal cans. In addition to its safety feature, it is not affected by water as long as the can is not punctured or by any outdoor temperature experienced in Canada.

Nitrone was first introduced in the United States in 1935, and has found widespread use in that country for many surface blasting operations.

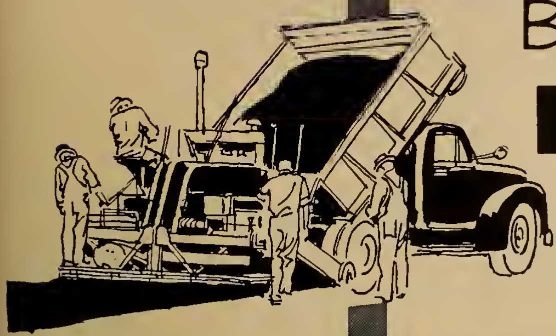
●

**Employee Participation.** — Canadian Westinghouse employees were in line for a $40,000 windfall after the company asked for their help in an all-out drive to meet competition.

In announcing that the firm will double suggestion awards, vice-president W. A. Campbell said, "The decision is part of a determined effort to maintain a competitive position and improve job security. Many of the best ideas on quality improvement, waste reduction and better manufacturing methods come from people who build or service our products."

A pioneer in the use of suggestion plans, Westinghouse receives 2,500 ideas

*(Continued on page 230)*



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**ESSO AND ESSO EXTRA** Gasolines that give a better combination of power, acceleration, and mileage on hauling and road-building operations.

**MARVELUBE CHASSIS LUBRICANTS** High-quality lubricants that lower maintenance costs by helping to reduce wear under all conditons of service.

**IMPERIAL ESSOLUBE HD** A detergent-type, heavy-duty motor oil that helps keep engine upkeep to a minimum, stands up to tough working conditions.

**MARVELUBE GEAR OILS**
Give reliable lubrication when you need it under all types of heavy service and gruelling wear.

## IMPERIAL OIL LIMITED

IMPERIAL ESSO PRODUCTS

(*Continued from page 226*)

annually for reducing costs or improving products and services.

**Power Contract.** — Prime Minister Duplessis announced a contract by which the Quebec Hydro-Electric Commission will sell the Shawinigan Water and Power Co., 400,000 horsepower of electrical energy from the Commission's giant development on the Bersimis River.

The Bersimis hydro electric development, now under construction on the Bersimis River about 90 miles above its confluence with the St. Lawrence, and about 200 miles northeast of Quebec, will have a capacity, eventually, of nearly 2,000,000 horsepower. The first generators are expected to be in operation late in 1956.

**Production Cut.** — The Consolidated Mining and Smelting Company announced that owing to unfavourable market conditions it has become necessary to curtail certain of its zinc operations. The zinc oxide plant and one slag fuming furnace was shut down at the year end. In excess of 200 men are normally employed in the operation and maintenance of these plants. The cut in production will amount to 130 tons of slab zinc per day or about 25 per cent of the Company's present output. Cominco officials, in expressing their regrets at this unavoidable curtailment, said that employees hired since early 1951 would probably be affected.

**New Passenger Cars.**—C.P.R. recently announced a 38 million dollar order of stainless steel streamlined passenger cars. The most outstanding of the many new features of the equipment will be the "Scenic Dome" cars, which the Canadian Pacific will introduce for the first time on any railroad in Canada. The new cars will be placed in service as received.

**Pallet Rack.**—A new economical and sturdy pallet rack which can be instantly erected or dismantled is now available. It is an all welded construction, fabricated from heavy gauge steel tubing which combines great stability with economy. The "L" sections hook into the "H" sections without use of nuts and bolts or wrenches.

Sections are set in place as they are unloaded from the transport or railway car. Literature on request from Service Steel & Engineering Ltd., 232 King Street East, Hamilton, Ontario.

**Plant-Office Addition.**—The diversity of its own lines is to be seen in the new plant-office addition to the Toronto division of Westeel Products Ltd.

In addition to the steel roof deck and newly developed windows, hollow metal doors, door frames, skylights, office and toilet partitions, lockers, counters, cabinets and shelving are products of the company's own plants.

The new addition has also made it possible to increase production facilities for the wide variety of sheet metal products now being fabricated by the Toronto division.

**Engineering and Manufacturing Alliance.** — Riverside Iron and Engineering Works, Ltd., of Calgary, Alberta, manufacturers of coal preparation equipment have formed an engineering and manufacturing alliance with the McNally Pittsburgh Corporation of Pittsburgh, Kansas, it was announced by Mr. Thomas Bishop, manager of the Riverside Iron and Engineering Works, Ltd.

Under the arrangement all McNally Pittsburgh engineering services, patents, drawings, etc., will be placed at the disposal of the Riverside Iron and Engineering Works, Ltd.

**Basic Materials Exposition.**—A group of 14 leading industrialists will serve as a board of sponsors for the second Basic Materials Exposition, the product development show, which will be held at the International Amphitheatre, Chicago, May 17-20, it was announced by Clapp & Poliak, Inc., New York, producers of the event. Don G. Mitchell, chairman of the board, Sylvania Electric Products, Inc., New York is chairman of the sponsoring board.

**Metal Detector.** — A general-purpose metal detector which can be installed around conveyor systems without cutting the belt and can be adapted to special applications, is available from Canadian General Electric Company's Apparatus Division.

The new device can be used in manufacturing processes involving the inspection of non-magnetic and non-conductive materials. Belt speeds can range from 90 to 500 ft. per minute.

In operation, the device detects metals by perceiving the effect of the metal particles on the characteristics of an inductance bridge circuit. The coils which make up the inspection unit are elements of this bridge circuit, and a metal particle coming into the inspection aperture causes the bridge to become unbalanced electrically. The output (or unbalance signal) of the bridge is then amplified and used to operate an appropriate alarm or control.

**Transducer System.**—After three years' research and development work in collaboration with the Research Laboratories of The General Electric Co. Ltd. of England, a new system for measuring pressures, temperatures and mechanical movements electrically and indicating the results at a distance has been introduced by The British General Electric Co. (Canadian) Ltd. This new system is a development of the original electro-mechanical converter system and introduces a smaller transducer with a wide range of applications. These include the direct measurement of mechanical movements of 0-20, 0-50 and 0-100 thousandths of an inch by a spring-loaded stylus, the measurement of pressures, utilizing a diaphragm or other pressure mechanical conversion device, and the measurement of any quantity which can be converted into a mechanical movement.

The instrument, which is of similar construction to the standard moving coil switchboard instrument with a 100° scale, may be located at any distance from the transducer, provided the resistance of any one conductor does not exceed 25 ohms. To prevent errors due to stray a-c. pick-up, all three conductors should run within the same cable or conduit. With the standard type of 3-core cable, the maximum distance between the transducer and the instrument is 1,000 yards, but greater distances are permissible.

If desired, certain types of a-c. potentiometric recorder may be used in place of the instrument, whilst it is possible to switch the output of up to ten transducers on to one instrument.

# Publications

**For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.**

**Please mention *The Engineering Journal* when writing.**

**Outdoor Bushings.**—A manual of Outdoor Bushings, Technical Data H-33-156, is available from Westinghouse District offices.

A general description, electrical characteristics and operating power factor curves are given in the introduction.

Also included are, dimension tables, bushing outline and detail assembly drawings, and handling, installation and maintenance instructions.

**Thermocouple Protection Tube.**—Publication of a new bulletin describing a metal-ceramic thermo-couple well, just put on the market, has been announced by the Bristol Company of Canada Limited, 71-79 Duchess Street, Toronto. The bulletin outlines all properties and specifications of the new protection tube, which combines the thermal conductivity and shock resistance of metal with the corrosion and deformation resistance of ceramics. The wall of the tube has the same thermal conductivity as cast iron, and although it is only 1/8 inch thick, only single wall construction is needed.

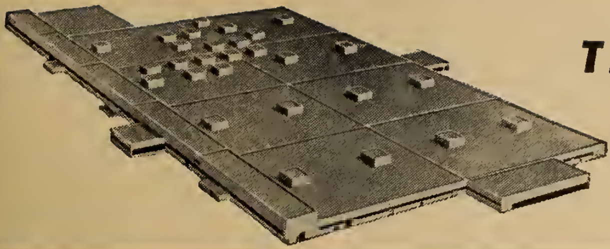
The bulletin is available from the company.

**High Slip Motor.** — A new four-page bulletin describing the company's totally-enclosed, fan-cooled, high-slip induction motor for punch press service has been announced as available from the Canadian General Electric Company, 212 King Street West, Toronto.

Designated as GEA-5968, the four-colour publication discusses the design of the Type KRX motor and explains how an extended bar rotor helps reduce the problem of rotor heat. Cutaway drawings illustrate the ventilation and construction features of the motor which is specifically designed for heavy-duty high-inertia applications on drawing and forging presses in the automotive and metal working industries. Also included are rating and frame sizes, a speed-torque curve, and detailed dimension information.

**Hypochlorite Specification.**—Tentative specifications for calcium and sodium

(*Continued on page 234*)



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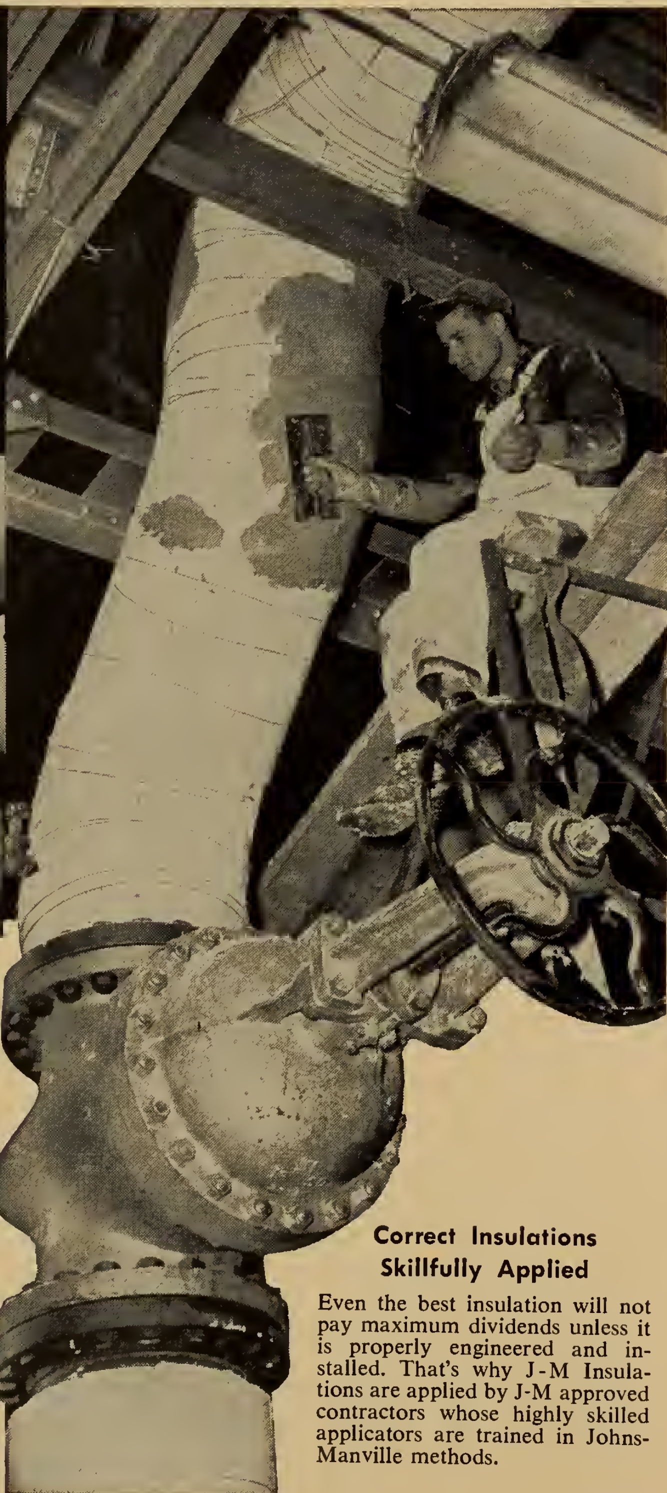

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MATERIALS • ENGINEERING • APPLICATION

*(Continued from page 230)*

hypochlorites for water treatment have been published by the American Water Works Association, 521 Fifth Avenue, New York 17, New York, and may be obtained upon advance remittance of 20c. The 7-page standard, known as AWWA B300, includes material specifications and standards for sampling, inspection, packing, marking and testing.

●

**Underwriters' Products List.**—Distribution has commenced on the latest list of inspected appliances, equipment, and materials, published annually by Underwriters' Laboratories of Canada. The list is dated September, 1953, and supersedes the 1952 edition with the March, 1953, Supplement thereto.

The present list, which has 172 pages compared to 152 in 1952, contains 537 listings (467 in 1952) of products which have been examined and tested as to their life, fire, and casualty hazards, and crime prevention.

Requests for copies should be addressed to the Head Office at 340 Richmond St. West, Toronto 2B, Ontario.

●

**Fire Protection.**—A number of colorful bulletins have been issued by the Automatic Sprinkler Company of Canada, Limited, 7000 Jeanne Mance Street, Montreal.

"The ABC of Fire Protection" and "Design and Application of Automatic Fire-Fog" are included.

Complete information may be had from the company.

●

**Electric Plants in Africa.**—The story of four Onan electric plants, and how they performed their rugged duties in the heart of darkest Africa is told in a beautifully illustrated, 28-page booklet written by Commander Attilio Gatti and published by D. W. Onan & Sons Inc.

Gatti describes his life "on location" in the heart of Zululand and the many problems involved in taking moving pictures of wild game in the jungle. Photographs taken by the expedition illustrate the booklet which is available, free from D. W. Onan & Sons Inc., Minneapolis 14, Minn., upon request.

Ask for the booklet "Onan on Safari."

●

**Flooring Materials.**—Following numerous requests, a revised and more comprehensive edition of Webster & Sons Limited book on flooring materials has been prepared. Copies available from Webster & Sons Limited; 724 Canada Cement Building, Montreal 2, Quebec.

●

**Pumps.**—Catalogues showing the line of Aurora turbine-type and centrifugal pumps are available from the Air Conditioning Engineering Company (Canada) Limited, 636 St. Paul Street W., Montreal. Each catalogue consists of eleven pages, and includes three separate sheets of table to help in the rapid selection of pumps for hot water heating and for cold water circulation or for cooling towers.

List prices are also available from the company, with the necessary horse power data for the motor required to drive the pumps at different loads.

●

**Plastic Pipe.**—A new booklet describing Uscolite plastic pipe, fittings, and valves has been issued by Mechanical Goods Division, Dominion Rubber Company Limited.

The booklet lists both the physical and chemical properties of Uscolite, and includes complete directions for handling and installing in use. Dimensions of pipe, fittings, and valves, and recommended working pressures, are also given.

Copies of the folder are available from any Dominion Rubber Company branch.

●

**Announcement of New Publication.**—Tables of Coefficients for the Numerical Calculation of Laplace Transforms, National Bureau of Standards Applied Mathematics Series 30, 36 pages, 25 cents.

The tables presented served to facilitate the numerical evaluation of infinite integrals expressible in the form of Laplace transforms, such as arise in the theory of heat condition and in various branches of electrical engineering. Applications and illustrations of the various uses of the volume are given, and a schedule of the explicit expressions of the Lagrange interpolation coefficients is provided. In addition to the tables of the Laplace transforms of the Lagrange coefficients for the two-point through the eleven-point formula, there is also included a short table of $n!/p^{n-1}$. Order from the Government Printing Office, Washington 25, D.C.

●

**Temperature Control Systems.** — Bulletin F6149 on temperature control systems is now available to everyone interested in industrial process temperature control.

An informative section will help in the selection of sensing elements and their correct use for the most satisfactory results. Instrument industry control terminology is given in this bulletin as well as rules to follow in selecting the proper method of temperature control for process characteristics or reaction.

Write to the Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill.

●

**Corrosion.**—A folder which describes in detail the services offered industrial and commercial establishments in which chemical and corrosion conditions exist has been issued by Canadian Stebbins Engineering and Mfg. Co. Ltd., Castle Building, Montreal, Que.

●

**Gage Pressure Potentiometer.** — A 4-page brochure No. 3553 describes a new miniature gauge pressure potentiometer in standard ranges from 0-100 to 0-5000 psi. Photographs illustrate the method of accurately transmitting the movements of the bourdon tube to the sliding contact of the wire-wound potentiometer. Diagrams, curves, charts and outline drawings provide additional technical information.

Write Dept. NL, Bourns Laboratories, 6135 Magnolia Ave., Riverside, California.

●

**Poweractor Positioner.** — Bulletin 473, just issued, describes the Poweractor, a force-balance type of positioner for cylinder operated devices. The unit will position equipment requiring high power and long stroke, such as large size control valves, large dampers and variable speed drives, through pneumatic cylinder (or springless diaphragm) operating mechanisms. It is designed especially for use with the Foxboro stabiload cylinder.

Copies of the bulletin will be sent on request from Peacock Brothers Ltd., Ville LaSalle, P.Q., agents for the Foxboro Co. in Canada.

●

**Pyrometer Calibration Data.** — The Bristol Company of Canada Limited has announced the publication of their new issue of "Pyrometer Thermocouple Calibration Data". These tables are based on data recently released by the National Bureau of Standards. Adopted by the Scientific Apparatus Makers Association and the Instrument Society of America, the tables are corrected to the absolute volt and to the International Temperature scale of 1948. The iron-constantan table has also been corrected to a new curve which has been adopted by SAMA.

Copies of the new tables are available from the Company at 71-79 Duchess St., Toronto, Ont. Ask for bulletin P1259.

●

**Conveyor Systems.** — Link-Belt News, published by the Link-Belt Company, 307 N. Michigan Ave., Chicago, Ill., devoted to the application of materials handling and power transmitting machinery for solving the problems of modern industry is available to anyone requesting it on business letterhead.

Featured in the Nov.-Dec. issue is the mining operation of a potash mine at Carlsbad, New Mexico.

●

**Roll Crushers.** — Double roll crushers, manufactured in Canada by Jeffrey Manufacturing Company Ltd., are completely described in their recent bulletin No. 848.

Four types of crushers are listed: Junior-Standard-Heavy Duty and Special Heavy Duty. Tables of capacities, overall dimensions, a general description of each type with illustrations explain the use of this type of crusher.

The bulletin may be had by writing to Jeffrey Manufacturing Company Limited, P.O. Box 428, Montreal, Que.

●

**Air Heater.**—Peabody Engineering Corporation, has released a six page air heater bulletin.

Printed in seven colours, the bulletin describes in both print and detailed flow diagrams the operation and application of the air heater.

Bulletins available from Peabody Engineering Corporation, 580 Fifth Ave., New York 36, N.Y.

●

**Non-Metallic Pinions.** — The Hamilton Gear and Machine Company, 950 Dupont St., Toronto, Ont., have issued a technical data sheet and information required to supply or quote on non-metallic pinions. The sheet describes the properties of the materials used in silent pinions and includes information on design and operation.

Copies are available from the company at the above address.

●

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**OF THIS ISSUE**

**PRINTED**

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# CONTENTS



*Indexed in The Engineering Index*

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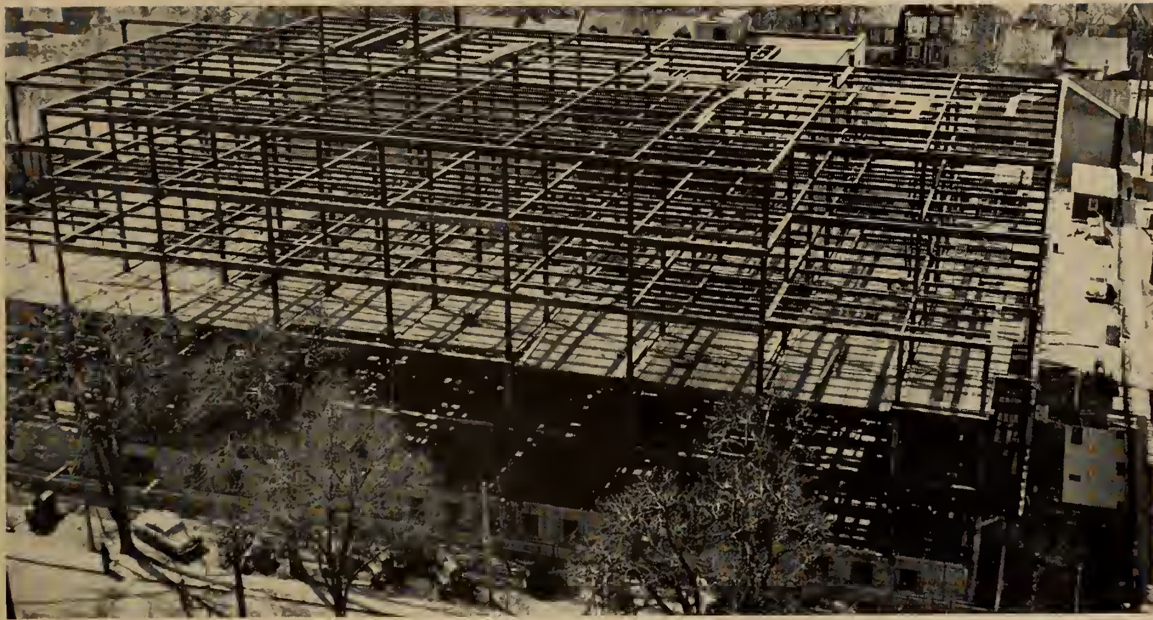

# Ontario Hydro's All Welded Multistorey Building

*by*

**M. McMurray, M.E.I.C.**
*Welding Engineer*
*Dominion Bridge Company, Limited*
*Ontario Division*

*and*

**T. H. Ivory, Jr.E.I.C.**
*Project and Resident Engineer*
*Hydro-Electric Power Commission of Ontario*
*Toronto, Ontario*

The Hydro-Electric Power Commission of Ontario is now erecting the first multistorey all welded building in Canada of rigid frame and continuous beam design. The Commission is a large employer of professional engineers and the completion of this building will bring a number of widely scattered engineering units under one roof.

Located in Toronto on the west side of Murray Street to the rear of the present Administration Building on University Avenue, the new building has a steel frame, clad with Queenston limestone. It is 230 feet long, 115 feet wide, and consists of a basement, five storeys and a two-storey penthouse over the elevator shafts.

The building was originally designed as a flat slab frame in reinforced concrete with a basement and three storeys, but it became necessary to add two more storeys because of staff expansion. The load of the two additional floors proved excessive for the existing soil conditions. The design was therefore changed to steel construction, with cellular precast concrete floor slabs to reduce the dead weight of the structure.

On the west side, this engineering building is connected to an existing three-storey, flat slab reinforced concrete office building. It was essential that the floor to floor height, (13 feet) and the window head elevations be the same for the two buildings. Steel construction presented a major problem when consideration was given to the restricted clearance for air conditioning and electrical installations.

Methods of designing rigid frames and continuous beams have been well known for many years, but it is only since we learned how to make acceptable welded joints that these methods could be satisfactorily and economically applied to actual structures. The building described in this article is a good example of such a welded structure and is noteworthy as it is the first of its kind in Canada.

The Commission's engineers had watched with interest the growth of welded structures in the United States and decided to see if welding would solve their problem. After

The above illustration is a view of the structural framework prior to erection of penthouse steel.

considerable study it was decided to make the building of rigid frame steel construction, thus keeping the depth of the beams to a minimum. The close proximity of hospitals and office buildings also made welding attractive, as it would reduce erection noise.

The method followed in designing the building was to consider the bents in the east-west direction (short dimension) as rigid frames and the beams running north and south (long dimension) as continuous. The columns are set with the webs running east and west and the girders span the same direction. The column spacing of the building is 23 feet; to carry the precast floor slabs the beams running north and south are spaced at 7 ft. 8 in. centres. The spandrels are also designed as continuous beams making all connections suitable for welding.

By taking advantage of continuity in design the required section moduli became 20 to 25 per cent less than for comparable simply supported members. The depth of the girders is kept to a maximum of 14 inches, and the floor beams to 10 and 12 inches for spans of 23 feet.

The original design in 1948 made full use of American wide flange sections. Unfortunately, before any work was done the steel control program was instituted and these sections could not be procured. The Commission, however, was able to secure most of the required steel in Great Britain. By the time it arrived here, the Canadian government had banned all office building construction.

Analysis showed that the British sections were not as desirable as the American because of a more limited selection. The total weight of American beams, excluding built-up sections, was 677 tons compared to 750 tons of British beams. Also, the British steel was largely standard I-beam shapes with tapered flanges. This section does not serve nearly as well for butt welds as the American wide flange section. Butt welds from beam to column were used wherever possible, but generally a plate connection was required (Figure 1). This increased the cost of these connections by approximately 25 per cent. The advantage of continuity was therefore reduced; this fact should be borne in mind when comparing the relative economics of this welded frame and conventional rivetted structures.

Because steel was in short supply before the ban on the construction of office buildings, the Commission awarded the contract for the steel superstructure at the earliest possible date, January 12, 1951. Anticipating that this ban would be lifted early in 1953, the contract for the substructure was awarded on June 23, 1952. Thus the detailing, but not the fabrication, of the steel was going on while the substructure was being constructed. The final contract for the completion of the superstructure was awarded on January 15, 1953, only fifteen days after the ban was lifted.

**Fig. 1. Typical girder and beam connections to column before welding.**

There were several architectural details which presented difficulties. By a proper balance of good design and compromise on the part of the engineers and the fabricators, these were overcome. One of the difficulties was that a precast floor system which had interior cells for service conduits was used. Close tolerances were necessary for the thickness of the top flange plate connections to meet the floor requirements. This requirement was met by using special channel slabs over the girders where slabs with cells were not required.

Tolerances in steel work were:

Outside columns—Permissible slope, 1:1000, but not outwards.

Inside columns—Permissible slope, 1:500 in any direction.

Spandrel beams—vertical plane, one-eighth inch outwards or one-quarter inch inwards. Horizontal plane one-eighth inch above or below.

The close tolerances required on the spandrels were difficult to meet. When the construction of the building was changed from reinforced concrete to steel, its exterior was not altered. With reinforced concrete construction, it is a simple matter to mould the spandrel beams to suit the stonework, but with steel the problem is different. As the stone must be supported at a maximum distance of 1¼ inches back from its face, the outside perimeter of the steel beams must parallel the face of the building. To meet this requirement, built-up sections of steel plate varying in thickness from ⅜ inch to 1 inch were used.

In detailing the steel use was made of "Arc Welded Steel Structures", by Lamotte Grover, and of standards established by the fabricators on other welded frame buildings. Wherever possible joints were designed for the use of downhand welding and over-head welds were kept to a minimum. In the preparation of standard sheets (Figure 2) the field welding was indicated by the use of heavier lines and these standards were keyed to an erection floor plan on which all the joints were indicated. This was a new departure and proved useful in the field, as the foreman welder was able to distribute these sketches for the guidance of the individual welder.

Canadian shops in general are laid out for the production of rivetted structures and do not lend themselves to the economical production of welded work. The advantages of structural welding will increase as shops are rearranged and new ones built more suitable for welding production. From experience gained on this job and elsewhere it would appear that welding is competitive, but to make it so co-operation in design must exist among architect, engineer and fabricator.

With the exception of the built-up spandrel beams, which had an unusual eccentric shape, shop fabrication presented no problems. On the spandrels the original idea was to use automatic welds on the fillets, but this proved awkward and so they were manually welded. The welds were intermittent, but the heat input on this odd shape still caused distortion. The top plate was given a slight camber, which took care of most of the out-of-tolerance conditions. However, many had to be straightened by bumping them in a straightening press (fiddle). Incidentally, sometimes it is easier to straighten members in a press, if the necessary welding control to achieve the same purpose becomes too cumbersome. These beams were assembled and tack-welded together in a jig, and then welded by two welders working opposite each other, the sequence of welding being from the centre towards the ends.

Field erection is the showy part of any structural job and also provides the major headaches. When it comes to a welded frame, a careful erection sequence must be worked out in advance or one is left with locked-up stresses, or distortion, or both. In any welding program a compromise must be arrived at between these two factors. On this job it was decided to minimize the distortion effects without allowing the locked-up stresses to become excessive.

The fabricator consulted at length with the Commission's engineers on a suitable erection procedure. The erection could not be accomplished from the perimeter of the site, because of the existing building and the busy city streets bounding the property. The original intention was to erect the whole five storeys by means of a crawler crane, working in the interior of the building site and backing out at one end. It was decided to hold up

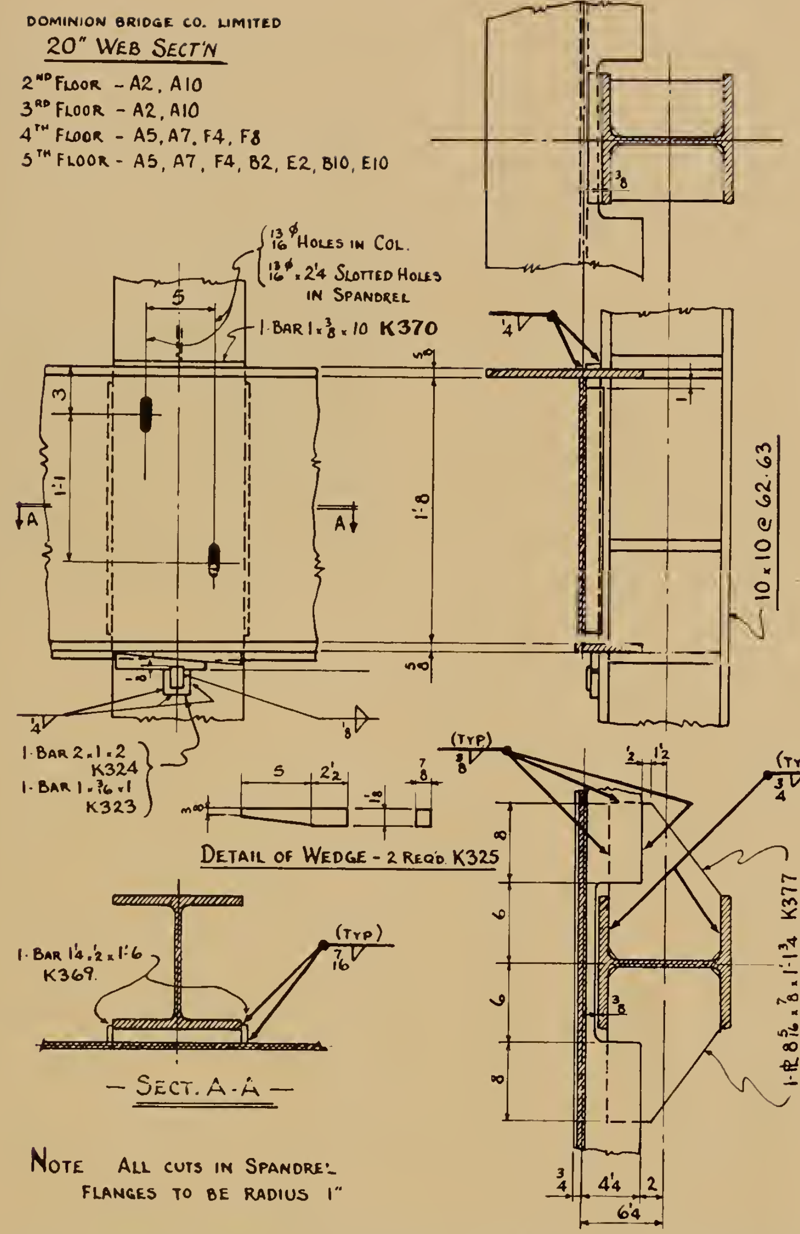


**Fig. 2. Standard sheet for a typical spandrel beam to column connection.**

Notice slotted holes and provision for shims to adjust elevation of spandrel. Shear connection also allows for movement in relation to face of column.

welding until at least half the building was erected, and then start in the centre, radiate from the centre to the outside walls and do the final adjusting on the wall joints.

This scheme was practicable, but it meant that the general contractor would be unable to work efficiently until the structural steel was virtually completed. This situation did not suit the time schedules, and the fabricator was asked to reconsider. The next idea was to treat the structure as two separate buildings, making a division at half length. This meant making a final adjustment on the centre line, if required. This scheme was finally adopted, with some variation, and proved satisfactory.

The building was fabricated with columns three floors high, making two tiers of steel. The north half, lower tier was welded first, starting from the centre bay and working outward radially in all directions. In the meantime, the upper tier was erected and there were some gaps in the south half, lower tier. After completion of the lower tier welding, the welders moved to the upper tier. When the south half erection was completed, a similar welding procedure was followed, and final closure was made at the centre line.

Upon completion of the lower tier of the north half of the building, the shrinkage in the east-west direction was thought to be excessive and was taken up by the use of fills on the outside columns. On the remainder of the building care was taken to distribute the shrinkage effect by individual joint adjustment as the work progressed.

Welders worked in teams of two and four teams welded around the column points of a bay at once. They worked on opposite sides of the columns in order to balance the heat input. Definite sequences for welding were followed. This provided for maximum control and yet allowed for some flexibility, so that the operator did not have to change his machine setting too often.

The beams were first field-bolted in position and then welded. The use of erection clips was considered, but these were not used, because of the tapered flanges on the beams and also because the columns were three floors high.

The fabricator started work in the field on February 1, and began with a maximum crew of 12 welders in order to complete the job in 21 weeks. The crew was increased to 20 welders and, by working on several Saturdays, the job was completed in 15 weeks, so that the general contractor could proceed with the stonework and have the building enclosed before severe winter weather.

At times, the large crew proved to be unwieldy, because continuous care had to be taken that no areas were locked out of the sequence program. It was necessary to adhere closely to welding sequences to facilitate keeping the building plumb. If changes had been made, it would have been difficult to trace the causes of discrepancies.

The spandrels were the last items on each floor adjusted and welded, to ensure that they would meet the required tolerances. Adjustments by wedges were provided, both vertically and horizontally. Two field engineers were kept busy throughout the whole job, plumbing and aligning, to secure accuracy. This supervision is felt to be excessive, but was necessitated by the spandrel design. The care was worth while, however, as the masons have had very little trouble in setting the stone.

Canadian winters are not ideal for outdoor welding. In spite of the relatively mild winter, there were many days in February and March when special precautions were necessary. When the temperature fell below 32°F., the joints were preheated with oxygen and acetylene torches. The welders and the working area were protected from the wind by tarpaulin houses.

**Fig. 3. The building nearing completion.**

Most of the work was done from hanging bracket-type scaffolds. These were light angle frames which clamped over the top flanges of the beams. They were used in pairs and planks were used as a floor. These scaffolds could support two men and were easy to erect and to move.

All welders employed were tested and approved by the Canadian Welding Bureau. The main inspection on the job was by the Commission. It was visual only, the capability of the individual welder being judged by the steadiness of his arc and the appearance of the weld. Welds were inspected upon completion of the operation for penetration, undercutting and size, and a day later for shrinkage cracks. This inspection was rigid, but fair, and good co-operation existed between the Commission staff and fabricator.

The following information is of general interest.

(1) A synopsis of the cost of the steel frame of this building is as follows:—

| | |
|---|---|
| 750 tons of English sections, f.o.b. Toronto, . . . . | $62,860.76 |
| 178 tons of plate and 47 tons of Canadian I-beams, plus fabrication and erection of all steel . . . . | 221,912.56 |
| Total tonnage, 975. Total Cost— | $284,773.32 |

Cost per ton, $292.00

(2) Gross area of the building, 146,000 sq. ft. Steel per square foot, 13.4 lb. Cost per square foot, $1.97.

(3) Average rate of erecting steel, excluding welding, 106 tons per week.

(4) Total weight of welding rod 13,850 lb. or 14 lb. per ton.

(5) Time to complete erection and welding of the steel frame, 15 weeks.

(6) Burn-off rate of welding rod, 1.6 pounds per hour per welder. This includes downtime for changing of scaffolding and machine adjustment, relief, etc.

(7) On this job standard steel erection tolerances were used, but it is suggested that on future jobs the fittings be snug because of shrinkage.

(8) The material and work conformed to the following specifications:
British steel—B.S.S. No. 15.
Canadian steel—C.S.A. No. G40—1935.
Connections and welding—C.S.A. No. W59—1950.
Fabricators—Approved by Canadian Welding Bureau to C.S.A. No. W47—1947.

E. P. Muntz, M.E.I.C., and Prof. M. W. Huggins, M.E.I.C., acted as consulting engineers and A. M. Lount, M.E.I.C., was structural engineer, T. H. Ivory, JR.E.I.C., project and resident engineer, and W. D. Walcott, Welding engineer, for the Commission.

The Carter Construction Co., Ltd., was contractor for the foundations and substructure and the Foundation Co. of Ontario, Ltd., held the general contract. The steel was fabricated and erected by the Ontario Division of the Dominion Bridge Co., Ltd., under the direction of E. R. Graydon, M.E.I.C., chief engineer, M. McMurray, M.E.I.C., welding engineer, W. Wells, erection superintendent, and R. Boyd, resident engineer. √

# MANAGEMENT

## Its Responsibility for Equalizing Development

of

## Technical and Social Sciences

*A panel discussion held at the Sixty-seventh Annual General and Professional Meeting of the Engineering Institute of Canada at Halifax, May 22nd, 1953.*


*Chairman*

**S. M. Finlayson**

*President — Canadian Marconi Company, Limited, Montreal.*

PANEL

**P. J. Nicholson, President of St. Francis Xavier University, Antigonish; F. C. Toombs, University of Toronto, Institute of Business Administration, Toronto; N. T. Smith, General Manager, Nova Scotia Light and Power Company Limited, Halifax; J. W. Simpson, Management Consultant, Leetham Simpson Limited, Montreal.**


The following text has been compiled from miscellaneous notes supplied by the speakers. The verbatim report being unusable, the discussion from the floor was not available for publication.

*Mr. Finlayson*—Ladies and Gentlemen, this afternoon we are to discuss the subject "Management — Its Responsibilities for Equalizing Development of Technical and Social Sciences". This is a very broad subject and probably carries a different meaning to each of you, it certainly has to each of your panel. With such a broad subject we can't do much more than poke around the edges a little and certainly we cannot reach any decisions in the short space of an hour and a half. We hope that a discussion of this subject, or certain phases of it, will promote thought which may someday help to improve the understanding, by management personnel, of the social problems that affect their day to day job.

To obtain diverse opinions on this subject, your panel has been selected from top level administrators in education, industry and management consulting.

#### Introduction of the Panel

I would like to introduce the panel to you — On my left is Dr. P. J. Nicholson, President of St. Francis Xavier University at Antigonish. St. Francis Xavier has long been noted for its work in the social sciences. Next on my left is Mr. Norman T. Smith, General Manager of the Nova Scotia Light and Power Company. Mr. Smith will discuss this subject from the industrial viewpoint flavoured by his experience in Great Britain. On my right is Mr. F. C. Toombs of the University of Toronto Institute of Business Administration. Since he was involved in the now famous Hawthorne experiment, he can approach this subject from a different angle than Dr. Nicholson. Next to Mr. Toombs is Mr. J. W. Simpson of the Management Consulting Firm, Leetham Simpson Limited of Montreal. In this work, Mr. Simpson comes in contact with a great many managers and consequently will have a broader viewpoint than any of us who see management problems in our one location.

Since our time is limited, I will call on Dr. Nicholson to lead off.

*Dr. Nicholson* — The topic proposed for discussion seems to me to call attention to the vast difference existing between the sciences that deal with human beings and those that deal with machines. The training of engineers produces experts in dealing with machines; nevertheless, in the practice of their profession engineers must usually be dealing with human beings as well as with machines, and the human sciences have been almost crowded out of the engineering curriculum. The prestige of the engineer as a citizen is very great; his influence should therefore be really felt in the operation of democracy, national and international. Perhaps the fact that human sciences have been receiving relatively less attention has something to do with the fact that although natural science has built a new order in the subjection of the physical world to the human mind, our generation has been cursed with two world wars and one world-wide depression. And the problems involved in human relations are becoming progressively more complicated even than the problems of natural and applied science. At the same time, more and more attention is being given to the natural sciences; less and less to the studies that deal with human nature. It took World

War I to awaken Canadians to the necessity of organizing the National Research Council and to the system of fellowships, scholarships and bursaries that it administers. Nearly forty years later we are beginning to discuss the setting up of a Humanities Council. Any university student who has a good record in natural science is sought out and positions are offered him during his vacations before he has completed his training; the humanities student very often has to search for employment and possibly in the end be happy to earn part of his next year's expenses as a common labourer.

The situation is being viewed with alarm by many of the leading thinkers of the day. As eminent a physicist as the Nobel Prize Winner Harold Urey has declared, "I am a frightened man. All the scientists I know are frightened — frightened for their lives — and frightened for your life". Another eminent scholar, Professor Elton Mayo of the Harvard School of Business Administration speaks of the "successful sciences — chemistry, physics, physiology, and the unsuccessful sciences — sociology, psychology, political science". He shares a common opinion that if social skills had been developed as rapidly as technical skills, the Second World War could have been averted. This conclusion presents a great challenge to those who are prominent in technological fields.

That internationally famous scholar Alexis Carrel in "Man, the Unknown" has suggested that the complexity of modern problems may require the recruiting of a community of geniuses who will sacrifice all their talent and training and time to the task of counselling the race regarding its problems. Such a solution is hardly feasible; but certainly it is necessary that more attention be given to questions of human welfare other than technical ones. And it is fair that industry which has been doing so much to raise the efficiency of machines should also concern itself with all that concerns the welfare of the people who operate the machines.

We of this panel have been urged to be provocative, and this encourages me to make three suggestions.

1. Quite a considerable number of scholarships are sponsored by industry for young men to enable them to pursue higher studies in technology. Each one of these should be matched by a scholarship for those who wish to pursue higher studies in the "unsuccessful sciences".

2. A considerable number of scholarships should be established for engineering students of superior talent who have already qualified for the degree of Bachelor of Arts.

3. Industry should sponsor programs of Adult Education that include humanistic studies and the "unpopular sciences" along with programs in Applied Science.

*Mr. Finlayson* — Thank you, Dr. Nicholson. I am sure you have left food for thought and have stirred up questions. I might add that if anyone in the room has questions, please feel free to interrupt the speaker. We want to keep the meeting as informal as possible.

Mr. McDonald tells me that he has passed paper out to you on which you may write your questions if you wish. These questions will be collected and we will endeavour to discuss them, if not answer them, after the panel members have finished speaking.

Mr. Smith will now give us his views on this problem.

#### The Broadening of Staff Education

*Mr. N. T. Smith* — In considering the title of the management panel discussion I have found difficulty in interpreting the meaning of social sciences. As one engaged in industry, my interpretation of the expression may differ considerably from the academic understanding of the subject. My contribution to this discussion deals with the broadening of the education of staff beyond the pure technical science into the study of human relations. I feel that the primary responsibility of the equalizing development must remain with the university or technical college as they receive human material at a young age and are responsible for their primary moulding. This early training must instill into the mind of the student the urgent necessity of broadening his mind and outlook, beyond the pure technical science upon which he has decided to devote his life, and the colleges should provide the facilities for the student to engage upon a course leading to this objective. I fully concur that industry must also play its part in this equalizing development in the student's post graduate days, but I would like to be very emphatic that the student himself must also play his part and not assume that university and industry are going to coddle him from the cradle to the grave. I have had the unfortunate experience with students who, having obtained a degree, discard their technical and other studies and have decided that the time has come to cash in immediately on leaving the university. I have experienced, as many of you will similarly experience, the student who interviews industry rather than is interviewed by industry.

When the student enters industry, he naturally finds himself in a new world and somewhat at a loss to understand his future career and promotion through that industry. This is where I feel management responsibility commences in the guidance of the student to his proper niche in the line of business that he has chosen. The Monteith report of Engineers Council for Professional Development is in many ways a good outline that might be followed. It is management's desire in every industry today to encourage a harmonious and happy spirit throughout the organization and my own experience has been shown that such desire is not too difficult if a proper approach is made to the subject with every phase of development of the employee.

There are two separate fields, one internal to the company and the other external.

I am a firm believer of the principle of pressing responsibility down through the organization as far as possible and I have rarely found that if responsibility is given to the more junior people that they have not lived up to the confidence placed in them. At the same time their outlook generally of the company's affairs have been broadened, and their enthusiasm in the company considerably fanned.

Dealing with internal affairs, I am a firm believer in holding:

1. Senior staff meetings where all major items are discussed between management and senior staff with free discussion.

2. Executive staff departmental meetings for explaining and understanding company policy as determined at the senior meeting.

3. Regular annual or even biannual meetings of foremen and supervisory staff with senior management. This latter group might well be called a team of management where papers are given by senior staff explaining the work of individual departments and also by the men in the field explaining their viewpoints.

4. Local meetings of foremen with the rank and file at sub-department level where papers can be given at the request of the rank and file to enable them to understand the workings of the company outside their normal orbit.

5. Meetings with labor union

representatives to explain changes in policy and conditions. This should not be confused with the management committees advocated by some unions.

In addition, monthly technical meetings should be held when other phases of the industry's technical and operation departments can be ironed out by free discussion.

External to the company's affairs, selected members of the staff should be encouraged to enter community and institutional activities in the area, with the object of making themselves and the company they serve, good citizens. Industry should assist in every way possible, universities and vocational schools to broaden the scope of the employee associated with their profession or divergent from their jobs. In this connection, the university can further assist in the equalizing development by the provision of evening classes covering a variety of subjects desirable in the particular community. Management should at all times encourage the art of free expression and public speaking, even to the extent of providing prizes for such activities. Such courses should not be made available to the student under compulsion or entirely free of cost to the student, with the thought that full appreciation and advantage is dependent upon some personal effort and sacrifice, but finance should not be a deterrent to the adoption of such training.

*Mr. Finlayson* — Thank you, Mr. Smith. You will notice Mr. Smith has lived close to this problem throughout his career.

Now Mr. Toombs will give us a slightly different slant.

### Spiritual Enhancement and Human Love

*Mr. Toombs* — The following brief story that has come into circulation recently interests me, and I would like to share it with you. I am not pushing a particular moral. You may take from it as you choose. At any event, I hope that you will find it amusing.

This story concerns a report purported to have been made by experts from the British Treasury's Office of Organization and Methods, following attendance at a program being performed in the Royal Festival Hall, London, England. The report reads as follows:

For considerable periods the four oboe players had nothing to do. The numbers should be reduced, and the work spread more evenly over the whole of the concert, thus eliminating peaks of activity.

All the twelve first violins were playing identical notes. This seems unnecessary duplication. The staff of this section should be drastically cut; if a large volume of sound is required, it could be obtained by means of electronic amplifier apparatus.

Much effort was absorbed in the playing of demi-semi-quavers. This seems an excessive refinement. It is recommended that all notes should be rounded up to the nearest semiquaver. If this were done, it would be possible to use trainees and lower grade operatives more extensively.


**The Management Panel. Left to right: J. W. Simpson, managing director of Leetham Simpson Limited, Montreal; F. C. Toombs, associate professor, Institute of Business Administration, University of Toronto; S. M. Finlayson, Chairman, president of Canadian Marconi Limited; Dr. P. J. Nicholson, president of St. Francis Xavier University; N. T. Smith, general manager, Nova Scotia Light & Power Co.**

There seems to be too much repetition of some musical passages. Scores should be drastically pruned. No useful purpose is served by repeating on the horns a passage which has already been handled by the strings. It is estimated that if all redundant passages were eliminated, the whole concert time of two hours could be reduced to twenty minutes, and there would be no need for an interval.

The conductor agrees generally with these recommendations, but expresses the opinion that there might be some falling-off in box-office receipts. In that unlikely event it should be possible to close sections of the auditorium entirely, with a consequential saving of overhead expenses . . . lighting, attendants, etc. If the worst came to the worst, the whole thing could be abandoned, and the public could go to the Albert Hall instead.

It seems to me that the title of our panel discussion: "Management — Its Responsibility to Stabilize the Development of Technical and Social Sciences", is symptomatic of the problem that confronts us. We have learned to enhance our material and physical circumstances through improved technology, and we have endeavoured to cope with our human or social relations through improved technology . . . "social technology". We are finding that spiritual enhancement is much more dearly won. I suspect that we are fearful in the face of technological development that does not appear to give us the security and inner space that we would like.

May I tell you of two bits of evidence that should make us all think. A number of years ago, a curious physical disability found in infants was identified with some clarity. It is called "marasmus". Infants of a week or so old may very suddenly begin to waste away: refuse to assimilate food; lose muscle-tone; and generally disintegrate to the point of death. It was found in such cases that these infants could have this disintegrative process stopped and customary development processes restored by giving them tender human love . . . fondling and affectionate care seem to be needed to support life. This suggests that man literally may need affection to grow and develop. The second piece of evidence comes from the research done under the auspices of the National Research Council of the United States. When endeavouring to understand more about the conditions of "fatigue" and "monotony" in work situations, it became quite clear that these concepts were most complex. Human beings fatigued or tired most easily and found work monotonous when the work was meaningless to them or when they were emotionally disturbed. Neither fatigue nor monotony could be understood on the basis of a simple absolute condition, such as "overwork" or "repetition".

With these brief notes, I shall stop . . . only to raise the questions: How do we teach people to "love" . . . to have affection for another . . . and how do we stimulate in another person interest in work and freedom from fear and anxiety ?

Perhaps the most important bit of information the social sciences can offer you as engineers is the knowledge that "listening" is the most crucial facility in the process of interpersonal relations. Perhaps I behave as a person with a mission on this score, for I believe that until we can listen well there is slight chance that we can understand the meaning of human feelings and behaviour.

*Mr. Finlayson* — Thank you Mr. Toombs. We now have some scientific facts to ponder, these may promote questions with which I hope you will test the merit of our panel.

Mr. Simpson will now discuss this problem from the management consulting viewpoint.

#### Statistics Not the Complete Answer

*Mr. Simpson* — Management's responsibilities are certainly not disproportionately divided between the technical and social aspects.

But too many management men today are prone to size up their performance not in terms of what changes and improvements have taken place in the company's employees, but rather through an extensive use of statistics, reports, trend charts and so on.

Since the only way in which management can obtain its objectives, is by obtaining efficient performance from its personnel through increasing their knowledge, adding to their skills, changing habits and influencing their attitudes, then perhaps a more realistic appraisal of management effectiveness might be obtained by getting an answer to the question—what changes are taking place in the "climate" of the workplace, the calibre of the workforce, the relationship of supervisor and supervised ?

What can be done to improve in these areas, because improvement in these areas will certainly be a most major factor in controlling the economical and profitable operation of any business. What do employees want ? Are they unreasonable or have we brought an apparent unreasonableness upon ourselves by neglecting to provide job satisfaction and sufficient motivation to ensure the urge and desire to produce effectively—to be part of a team—to be respected—to be a person rather than a number.

I do not believe that the average employee is unreasonable—I speak from my own personal experience, since a good part of our work involves direct dealings at, and below the supervisory level.

Then, if this is true, where are we falling down and what can be done about it—or to put it another way—how should we go about harnessing this "reasonableness" ?

What makes an employee a satisfied worker ? Many surveys have been carried out recently by universities, leading business publications as well as by consultants, directed towards trying to formalize an answer to this question. While it is impractical to say that any cut and dried formula can be established from these surveys, I believe the following points summarize the main objectives of the worker:—

1. Security—not the security necessarily of guaranteed wages, sick benefits, pensions, etc., but the security emanating from a healthy and fundamentally strong business structure, in which all employees can have a justified confidence.
2. Fair and just pay, as compared with pay in neighbouring plants and as between different jobs in the same plant.
3. An opportunity to utilize his skills to the fullest.
4. Recognition—a desire to be known to his fellow employees and neighbours as an important part of an enterprise.
5. Superiors he can look up to and be guided by.
6. A job he enjoys and is capable of doing.

None of these points are really any different than what each of us is after in his respective job.

How then should management go about satisfying these "wants" ? If we were just starting a new company, the problem would be much simpler than it is in the case of the vast majority of companies who have already been in business for years and who are only now starting to wonder what part human relations can play in making a more efficient operation.

First of all, you must find out where you are falling down. This can be done in a variety of ways through attitude surveys, appraisal of supervisory practices, method of upgrading, selection of employees for a given task, effectiveness of communication, pre-job training, etc.

Once you feel you know where you do not measure up, then, and only then, can you instigate corrective action.

In our work, we have found that generally management fails to appreciate the significance of "humanics"—they are too prone to say "give us the good old days when people were glad to do a good day's work", rather than "there's something wrong with our approach—let's try and find out what it is and try to improve it".

One approach is destructive—the other constructive. Unfortunately, there seems to be more of the former than the latter.

I believe that a more desirable substitute to the rather prevalent hit or miss approach in dealing with people can be achieved through—

1. Proper selection of personnel.
2. Development of pride of workmanship in the employee by "glamorizing" the job—bringing out his importance in the scheme of things.
3. Development of effective supervision.
4. Provision of a "bank" of qualified personnel.
5. Development programs tailored to individual or group requirements.

There is no magic formula—no easy way out. "Human" management is something that has to be worked at—continuously—and if we are to achieve our maximum effectiveness, it is something we cannot afford to ignore.

#### Questions and Answers

*Mr. Finlayson* — Thank you Mr. Simpson. I see we already have some written questions, and I am sure Mr. Simpson's remarks will stir up more. I was asked to speak on the subject as well, but as time is slipping by and I have said enough already, we will proceed to the questions. May I reiterate that it is quite in order for you to raise your questions from the floor or to enter the discussion of any particular question if you will indicate your desire to do so. The first question I have, reads as follows:

#### The "Spare Time" Problem

"Is the basic problem underlying the panel discussion not that of extra spare time enjoyed by elements of the community, especially labour, which they do not know how to utilize intelligently and constructively"?

Mr. Toombs, would you like to try this one?

*Mr. Toombs* — I am not clear about this question. It appears that the assumption is that hourly-rated workers know less how to manage their time constructively than do administrative workers. I would like to tell you of a graduate seminar that I have conducted for the past few years. A good many engineers have been in it. It has alarmed me to discover that many of these men cannot undertake the responsibility of thinking freshly for themselves. They expect "the teacher" to "tell" them, and they are most annoyed and confused when he refuses to play this role. This suggests, I believe, that we have a problem in reference to our system of education. Perhaps we are more interested in conformity and security than we are in creativity and experimentation. For some reason we cannot tolerate deviation. I suspect that the inability to utilize time—to think and play meaningfully—is not only a problem for the hourly-rated worker but also for management personnel. It is a problem of our society.

### Remuneration Scale

*Mr. Finlayson* — Our next question is not directed to any particular member of the panel but has to do with remuneration, so I will pass it to our representative of industry, Mr. Smith. The question reads:—

"Does the panel consider that management has any basic responsibility for the lack of appreciation on the part of labour of the relative contribution of unskilled and semi-skilled labour to the overall welfare of the community as compared with that of say, the engineer, as evidenced by the relative scales of remuneration which labour unions seek and which engineers enjoy"?

*Mr. Smith* — I find it very hard to answer this question and I don't think that the scale of remuneration is responsible for the lack of appreciation on the part of labour to the overall welfare of the community. I don't know that I agree that labour does not appreciate the overall welfare of the community. The suspicion that existed between management and labour of over 50 years ago is at last dying out, but tradition dies hard.

In Great Britain several years ago, management and labour in the coal mining industry were so far apart that it was doubtful that they would ever come together and the government felt there was only one solution—nationalization. The very first morning of nationalization, the unskilled men were surprised to find that the various foremen and under managers were still employed as such, showing that they could not understand the meaning of the word "management". Management has a responsibility to try and break this misunderstanding down and it is slowly being overcome. This barrier can be broken down by giving an opportunity to all unskilled trades to train in a trade or even a profession by giving them opportunities to go through college or to obtain a degree in later years.

### Technical Progress and Social Amenities

*Mr. Finlayson* — Our next question reads as follows:—

"Are not social amenities obtained by really forcing technical progress to keep industry in business at all? Industries now have—short work week, pension plans, sickness plans, training plans, etc., etc. All of this is pricing Canadian products out of overseas markets and it is only technical progress that keeps us alive, why worry about technology"?

Perhaps Mr. Simpson would undertake to reply to this one.

*Mr. Simpson* — This could be a very involved question to answer since so many factors enter into it other than that being discussed this afternoon, such as standards of living, tariffs, foreign currency values, etc. However, let's look at it from the standpoint of whether or not the cost of bettering the employees' lot can result in pricing a product out of the market or placing the onus on technology to maintain a competitive price structure.

There is certainly no contention that technology should assume any minor role as against the social aspects in business. However, it seems reasonable to assume that industry cannot get by on technology alone, since employee productivity is a conclusive force in determining the end result—a profit or a loss. Therefore, it would seem desirable to exert equal efforts towards increasing productivity through not only technological improvements, but also through employee improvement, which can only be brought about by making a concerted effort towards providing job satisfaction and the desire on the part of employees to produce effectively.

Time and money objectively used in this direction—towards increased productivity—will certainly not result in a company pricing itself out of the market, either at home or abroad. Technological improvement and employee improvement must go hand in glove, if we are to maintain and better our present standard of living.

*Mr. Finlayson* — We still have a number of questions to discuss, but we have been informed by the committee that our time has been used up and we must close our session so as not to jeopardize the plans for this evening.

I would like to say that I have enjoyed every minute of this discussion and from your attention and desire to continue, it is evident you are enjoying it also. It seems a shame to close here, when I am sure we could go on for another hour without losing interest.

We must bow to the wishes of the committee, however, and I would like to thank you for your panel and myself for your attention and participation in the discussion.

The meeting is now adjourned.

NOTE — The following members participated in the discussion, but the text of their remarks were not satisfactorily recorded: Dr. Lillian Gilbreth, Mr. Nelson Mann, Mr. J. L. Wickwire, Mr. J. T. M. Smith, Mr. Fred Lawton.

# Marginal Cost in Engineering Design

by

**D. F. Coates, M.E.I.C.**

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Mr. Coates applies the method of marginal cost analysis to determining the economic height of a hydro-electric dam, but it can equally well be used in the solution of many other similar problems. This type of analysis is shorter than others and when it has been completed, the user has the satisfaction of knowing that he has covered every possible case within the limits he has set for himself.

"It is a subject that will bear repeated emphasis and Canadian engineers will no doubt welcome this latest presentation", was the comment of one engineer who read this paper before publication.

The design engineer is dealing not only with technical problems, but also with financial problems. If the structure the engineer designs is to be built, someone must put up the money and thus an investment will be made. Of course, the investment will be made only if there be some prospect of earning a reasonable return on the immobilized capital. Therefore, the engineer must not only provide a technically sound design, but he must also show that the project is economically feasible and that it is the most economic of all possible methods of providing the service.

Usually, there is more than one solution for a given problem, so the financial aspect requires that at least alternate designs be studied. In many cases the design problem is not simply to choose the best from a few possibilities, but to select the most economic among a large or infinite number, e.g., to determine the optimum diameter of pipe for an oil line. To calculate the comparative costs of all possible designs would require a long time. In many cases it is simplest to use marginal cost analysis.

Marginal cost analysis was originated and developed by academic economists. The principal conclusion in applying this analysis to the theory of the firm is that if the production of a company is expanded to the point where the cost of an extra unit of production is just equal to the revenue from that extra output, then profits will reach a maximum. If the firm is operating in the red, then losses are reduced to a minimum when the marginal cost equals the marginal revenue. This simply means that one or two factors are usually in operation: (1) continuing expansion of production from a single plant will eventually result in higher unit costs, and (2) if a significant part of the market is being supplied, this expansion may result in a lowering of the market price. Consequently, by increasing output a point will be reached where the increase in output costs more than the increase in revenue.

As engineers we can express this principle mathematically:

$$R_n = R_g - C_t$$

where $R_n$ = net revenue,
$R_g$ = gross revenue.
$C_t$ = total cost of production.
$R_n$ will be a maximum when

$$\frac{R_n}{dZ} = 0$$

or

$$\frac{dR_g}{dZ} = \frac{dC_t}{dZ}$$

where $Z$ = output per unit time.

This theory has been of great interest and value to academic economists, but owing to the complexity of business activity, it seldom has been used in practice. However, it would seem that it can be useful in solving those types of purely engineering problems of design that either cannot be analysed under conditions of constant output, or that offer a continuous series of possible solutions.

One of the problems that may best be solved by using this analysis is that of determining the economic height of a hydro-electric dam. The equivalent annual cost of the dam can be considered to be composed of investment and of operating costs. The investment costs will include capital recovery (or depreciation), interest (or a minimum attractive return), property taxes and insurance; these items will be a function of the size of dam. The operating charges will be composed of such items as maintenance, repairs, inspection, gate operation, etc. Without being much in error these charges may be assumed to be constant for dams of the same order of size.

The gross revenue from a dam is the value of the electrical energy that can be produced; this is principally dependent on the head and on the volume of water that is delivered to the turbines. The head is a function of the size of the dam, where the power house is at the dam or connected to it by a penstock. The volume of water delivered to the turbines is a function of the size of the dam where it provides storage capacity, i.e., where it reduces the volume of water lost to the turbines by spilling over the dam.

A storage dam, remote from the power house and thus not influencing the head, presents a simple case. Here the gross revenue from the dam is influenced by only one variable, the volume of water stored.

Expressing these conditions mathematically, it was shown above that $R_n$ will be a maximum when

$$\frac{dR_g}{dZ}=\frac{dC_t}{dZ}$$

where $R_n$ = net revenue in \$/yr.
$R_g$ = gross revenue in \$/yr.
$C_t$ = total cost of production in \$/yr.
$Z$ = output in kwh/yr.

but $C_t=C_i+C_o$

where $C_i$ = investment charge in \$/yr.
$C_o$ = operating cost in \$/yr.

and $\frac{dC_t}{dZ}=\frac{dC_i}{dZ}+\frac{dC_o}{dZ}$

or $\frac{dC_t}{dZ}\cdot\frac{dZ}{dH}=\frac{dC_i}{dZ}\cdot\frac{dZ}{dH}+\frac{dC_o}{dZ}\cdot\frac{dZ}{dH}$

where $H$ = dam height at the maximum section in ft.

or $\frac{dC_t}{dH}=\frac{dC_i}{dH}+\frac{dC_o}{dH}$

thus $\frac{dC_i}{dH}=\frac{dC_t}{dH}$

if $H$ is limited to a range where $C_o$ can be assumed to be constant with respect to $H$.

Also, $R_g=W_s.p$

where $W_s$ = average volume of water stored for use during the dry seasons in acre-feet (AF) per year.
$p$ = value of this water in generating electricity in \$/AF, derived from the retail price of electricity, which in turn is usually, by rate setting procedures, based on the cost of production at existing plants, both thermal and hydro, in the area.

and $R_g=(W_t-W_w)p$

where $Wt$ = average total amount of water available to be stored in AF/yr,
$Ww$ = average amount of water wasted or spilled in AF/yr.

Thus, $\frac{dR_g}{dZ}=(\frac{dW_t}{dZ}-\frac{dW_w}{dZ})p$

and $\frac{dR_g}{dZ}=-p.\frac{dW_w}{dZ}$

as $W_t$, an average, is constant.

or $\frac{dR_g}{dH}=-p.\frac{dW_w}{dH}$.

Therefore $R_n$ will be a maximum when

$$dC_i=-p.dW_w.$$

In other words, the optimum height of the dam is such that any increase in size will result in a greater increase in the annual cost, due to the increased investment charge, than the increase in gross revenue from the increased electricity generated.

Consider the following example. The economic height for a concrete storage dam for a hydro-electric development is to be determined.

**Table I. Value of Reducing Spilled Water**

| Year | Volume of floods* AF | Water lost with various dam heights and storage: 80 ft. 70,000 AF | 85 ft. 80,000 AF | 90 ft. 90,000 AF | 95 ft. 130,000 AF | 100 ft. 150,000 AF |
|---|---|---|---|---|---|---|
| 1 | 130,000 | 60,000 | 50,000 | 40,000 | | |
| 2 | 110,000 | 40,000 | 40,000 | 20,000 | | |
| 3 | 90,000 | 20,000 | 10,000 | | | |
| 3 | 80,000 | 10,000 | | | | |
| 4 | 160,000 | 90,000 | 80,000 | 70,000 | 30,000 | 10,000 |
| 5 | 120,000 | 50,000 | 40,000 | 30,000 | | |
| 6 | 150,000 | 80,000 | 70,000 | 60,000 | 20,000 | |
| 7 | 70,000 | | | | | |
| 8 | 90,000 | 20,000 | 10,000 | | | |
| 9 | 110,000 | 40,000 | 30,000 | 20,000 | | |
| 10 | 100,000 | 30,000 | 20,000 | 10,000 | | |
| Totals.... | 1,220,000 | 440,000 | 350,000 | 250,000 | 50,000 | 10,000 |
| Av./yr.... | 122,000 | 44,000 | 35,000 | 25,000 | 5,000 | 1,000 |
| Marginal Revenue ($p.dWw$) \$/yr/ft.......... | | | 1,800 | 2,000 | 4,000 | 800 |

(*Volume in excess of usable flow).

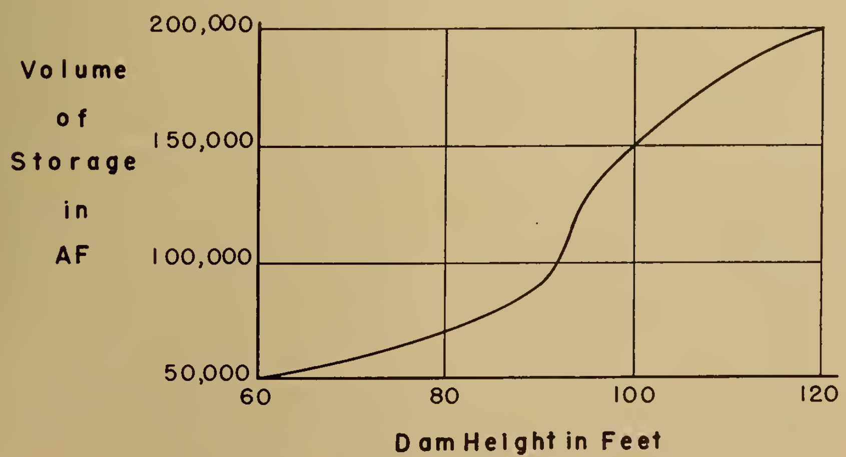


Fig. 1. Storage capacity curve.

**Data and Assumptions:**

1. Flow records at the dam site for 10 years.
2. Topography of the reservoir area and of the dam site.
3. The value of a kwh of energy at the low-tension side of the stepup transformer is 7.5 mills; the overall efficiency of the plant to this point is 82 per cent.
4. The stored water will be used at only one power house, where the average net head on the turbines during the time when the stored water will be used is 159 ft.
5. The write-off period or economic life of the dam is considered as 30 years.
6. Being a publicly owned utility

the cost of money to the owners is estimated to be 6 per cent, including both interest and administrative charges connected with borrowing: no property taxes or insurance charges are assumed to be incurred by this structure.

### Procedure

1. Determine the feasible range of heights to study by plotting the storage capacity curve (Fig. 1):. By comparing this curve with the volume of flood flows that occurred each year of record (see Table I) it is judged that between 80 and 100 feet is the most likely range of economic height.

2. Determine the change in revenue with a change in dam height. First, the value of one AF of water, $p$, is found by calculating the energy it will generate.

Energy from one AF of storage
$= 4{,}840 \times 9 \times 62.4 \times 159 \times 0.82 \times 3.77 \times 10^{-7}$
$= 133$ kwh.

Value of one AF of storage
$= 133 \times 0.0075 = \$1.00$.

3. Determine the change in annual cost with a change in dam height. For a first approximation it may be assumed that the cost of a dam between 80 and 100 feet high is principally a function of the cost of concrete.

Thus $C_i = Y + y.C_c + C_c$

where $Ci$ = investment charge for the dam in \$/yr.

$Y$ = constant cost in \$/yr., covering such items as design cost, job and general overhead.

$y$ = constant in \$/\$ of concrete cost, covering such items as excavation, grouting, outlet structure, i.e., those that can be assumed to vary directly as concrete costs.

$C_c$ = equivalent annual cost of the concrete in \$/yr.

From estimates it is determined that the other variable items in the cost of the dam will be about 52 per cent of the cost of concrete for heights between 80 and 100 feet, thus

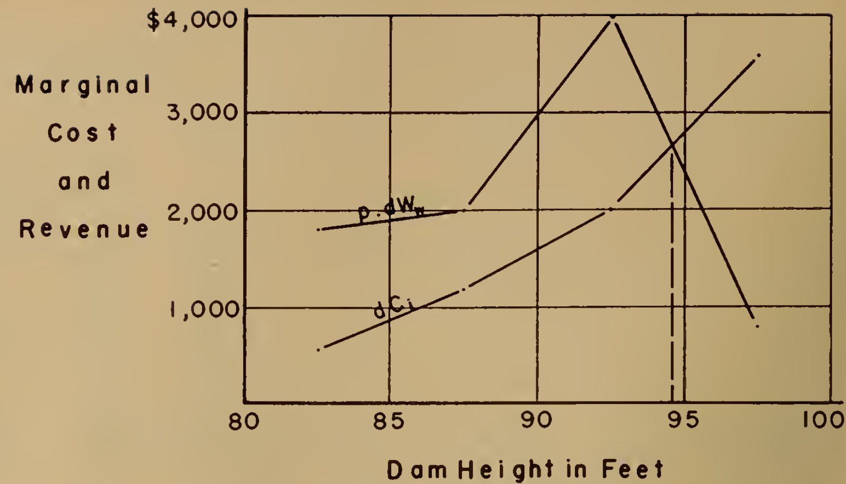


**Fig. 2.** Economic height of dam.

$$C_i = Y + 1.52C_c$$
$$\text{and } dC_i = 1.52dC_c.$$

Note in Table II that the amortization of the capital cost of the structure with a return of 6 per cent requires a yearly payment of \$0.07265/\$ of capital cost, i.e., $\frac{0.06}{1-1.06^{-30}}$; thus the equivalent annual cost of \$400,000, the capital cost of the concrete in a dam of height 80 feet, is \$29,000. As an example of the marginal cost determination,

$$\frac{1.52\ (31{,}000-29{,}000)}{5} = 610$$

for the height interval of 80 to 85 feet.

4. Draw the curves of marginal cost $dC_i/dH$, and marginal revenue, $p.dWw/dH$, (Fig. 2).

The most economic height of this dam, for the assumptions that have been made, is close to 95 feet.

5. Determine the total cost of a dam 95 feet high; then find the rate of return on the investment (the economic height can be the point simply where losses are the least): The capital cost of a 95 foot dam is estimated as \$1,200,000. The operating cost is estimated as \$4,000 per year.

Over the 10 years of record an average of 122,000AF/yr. of water was available for storage. With a 95 foot dam an average of 5,000 AF/yr. would have been wasted, leaving a net average volume of usable storage of 117,000 AF/yr. With one AF of stored water being worth \$1.00 a 95-foot dam would earn a gross revenue of \$117,000 per year. The revenue net of operating expense would be (\$117,000 − \$4,000) or \$113,000 per year.

The rate of return on the investment would thus be 9 per cent, obtained from the expression

$$1{,}200{,}000 = 113{,}000\frac{1-(1+i)^{-30}}{i}.$$

where $i$ is the rate of return. This means that not only would the capital be recovered and the interest paid, but that there would also be an extra return of 3 per cent on the investment.

It is sometimes concluded at this stage that, as the owner is a government commission, this extra 3 per cent need not be earned and that therefore the dam should be built higher, so as to use all the water available for generating electricity. This, of course, is a false conclusion. One of the most favourable aspects of the marginal approach is that it makes this point clear. Beyond the optimum height, 95 feet, the *additional* revenue earned is exceeded by the *additional* cost, thus the *extra* investment would be made at a loss, notwithstanding the fact that the project as a whole would still earn a return great enough to pay all charges.

6. The final step, as in all studies, would be to consider the extreme values which each item, estimated or assumed, could have and then to determine their combined effects on the conclusion. The ultimate decision would probably be made by superior executive judgement, taking into account this mathematical analysis and factors that cannot be reduced to quantitative terms. √

**Table II. Cost of Increasing the Height of the Dam**

| Height ft. | Capital cost of concrete | Equivalent Annual cost of concrete ($Cc$) | Marginal cost, ($dCi$) |
|---|---|---|---|
| 80 | \$400,000 | \$29,000/yr. | |
| | | | \$ 610/yr./ft. |
| 85 | 426,000 | 31,000 | |
| | | | 1,190 |
| 90 | 480,000 | 34,900 | |
| | | | 2,000 |
| 95 | 571,000 | 41,500 | |
| | | | 3,580 |
| 100 | 734,000 | 53,300 | |

# Air Pollution Control in Canada

*by*

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A general consideration of the Canadian situation is followed by an analysis of the by-laws pertaining thereto. Details are given of the results obtained in Toronto from 1950-53. Special cases are then described, including sulphur dioxide pollution in Trail, Sudbury and Detroit-Windsor. The work of the International Joint Commission is briefly described and a summary is given of the arsenic trioxide investigation at Yellowknife. Smoke from railways and steamships and danger from radioactive emissions are also discussed.

A paper presented before the joint session of the Committee on Air Pollution Control and Fuels and Power Divisions at the Annual Meeting, New York, N.Y.—November 29 to December 4, 1953, of The American Society of Mechanical Engineers.

Canada is a sparsely populated country and, therefore, the problem of atmospheric pollution has not yet become serious, save in certain industrialized areas, most of which are situated near the United States border. As smoke is the most obvious kind of pollution, most of the early attempts at control took the form of smoke abatement ordinances or of clauses in a local building or other by-laws. These were very general in form and, in most instances, did not contain any definite provisions for measurement or enforcement.

The bibliography appended to this paper contains references to papers by Canadian authors or relating specifically to Canadian situations. The earliest of these papers(1) appeared in the Fourth Annual Report of the Commission of Conservation (Ottawa 1913). It dealt entirely with smoke, but was a good general summary of experience in the United States and Europe and contained recommendations suitable for appropriate action in Canada. It emphasized the importance of public opinion in facilitating enforcement and stated that "the smoke nuisance is an economic question and that the people most concerned are not those who make the smoke, but those who suffer because it is made."

Subsequently, attention was drawn to pollution by sulphur dioxide. This culminated in an investigation made by the International Joint Commission(23), including the assessment of damages and the adoption of remedial works by the company concerned. Similar conditions now exist elsewhere, albeit to a smaller extent.

The rapid and extensive industrialization of Canada, the greater prevalence of metallurgical and chemical plants and the danger from radioactive materials has directed increasing attention to the broader aspects of the problem. These factors largely account for the considerable number of investigations made and papers published since 1930, and the more elaborate and specific by-laws which have been adopted by the larger cities since the end of World War II. (Table 1).

### Anti-Pollution Ordinances and By-laws

Benner and O'Connor(1) quote S. B. Flagg of the United States Department of Mines, as follows:—"The requirements should represent the best practice, the standard set should not be an impossible nor an impracticable one, neither should it represent ordinary or poor practice." By and large, this wise admonition is observed in the anti-pollution laws of Canada and their enforcement. Education and persuasion are preferred to coercion and only in recalcitrant cases is the offender prosecuted.

Information obtained from 44 of the larger population centres in different parts of Canada is summarized in Table 1. In most of the cases in Ontario and Quebec the smoke clauses are based on the Ringelmann chart which, with all its faults, is the most convenient means available to outside inspectors for checking pollution. In a few cases, the emission of dust and fly-ash is limited to a maximum stack loading of 0.85 lb. per 1,000 lb. of gases (adjusted to 12 per cent $CO_2$) but this provision is of doubtful value, owing to difficulties of measurement and enforcement.

Most by-laws prescribe smoke indicators (or some means whereby the operator can see the top of the stack) and require installation and operating permits. Suppliers of combustion equipment are also directed to report all sales of such equipment, but in very few cases is there any limit to the volatile content of the coal that may be sold.

The fees for permits vary in amount and in some instances they are scaled to suit variations in the size or capacity of the equipment. One or two corporations also specify annual inspections of combustion apparatus. In most cases, domestic installations are exempted from the provisions of the by-law. Most of the ordinances contain general statements prohibiting the emission of odours and noxious gases, but no provision is made otherwise for their measurement or control.

In view of these variations and envisaging the greater necessity of standardization with increasing in-

**Table 1. Status of Antipollution Control in Canada**

| CITY | Population | Date of ordinance | Dept. in charge | Domiciles included ? | Smoke Density (Ringelmann) No. 2 min./hr. | Smoke Density (Ringelmann) No. 3 min./hr. | Weight or loading per 1000 lb. gas | Smoke indicators | Installation permit ? | Operating permit ? | Permit fees $ | Advisory Board ? | Reports from dealers ? | Fines $ | Fuel Limitations | Nuisance clause (other than smoke) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALBERTA | | | | | | | | | | | | | | | | |
| Calgary | 129,060 | No By-law | | | | | | | | | | | | | | |
| Edmonton | 159,631 | No By-law | | | | | | | | | | | | | | |
| Lethbridge | 22,947 | No By-law | | | | | | | | | | | | | | |
| BRITISH COLUMBIA | | | | | | | | | | | | | | | | |
| Trail | 11,430 | | General Nuisance Clause in Zoning By-law. | | | | | | | | | | | | | |
| Vancouver | 344,833 | 1952 | | No | 6 | | | Yes | Yes | Yes | 3–7 | Yes | No | 100 | No | General |
| Vernon | 7,822 | 1946 | Engineer | No | | 2* | | | | | | | No | 100 | No | None |
| MANITOBA | | | | | | | | | | | | | | | | |
| Brandon | 20,598 | No By-law | | | | | | | | | | | | | | |
| Winnipeg | 235,710 | 1948 | Health | Yes | Not specified | | | No | No | No | | No | No | 50 | No | General |
| NEW BRUNSWICK | | | | | | | | | | | | | | | | |
| Fredericton | 16,018 | No By-law | | | | | | | | | | | | | | |
| Moncton | 27,334 | No By-law | | | | | | | | | | | | | | |
| Saint John | 50,779 | 1950 | | Yes | 9 | 6 | 0.75 grains/cu.ft. | Yes | Yes | Yes | 1–5 | Yes | Yes | 25–100*** | Yes | General |
| NOVA SCOTIA | | | | | | | | | | | | | | | | |
| Halifax | 85,589 | No By law | | | | | | | | | | | | | | |
| Sydney | 31,317 | No By-law | | | | | | | | | | | | | | |
| ONTARIO | | | | | | | | | | | | | | | | |
| Brantford | 36,727 | 1937 | | No | | 6 | | No | No | No | | No | No | | No | |
| Chatham | 21,218 | No By-law | | | | | | | | | | | | | | |
| Cornwall | 16,899 | 1949 | Clauses in By-law for Prohibiting and Abating Public Nuisance. | | | | | | | | | | | | | |
| Fort William | 34,947 | No By-law | | | | | | | | | | | | | | |
| Galt | 19,207 | No By-law | | | | | | | | | | | | | | General |
| Guelph | 27,386 | 1920 | | No | | 6 | | | | | | | | | | |
| Hamilton | 208,321 | 1950 | Building | No | 10 | 6 | | Yes | Yes | Yes | | Yes | Yes | 50 | No | None |
| Kingston | 33,459 | 1952 | Works | No | 10 | 6 | 0.85 lb. | No | Yes | Yes | 10 | Yes | No | 5–50 | No | General |
| Kitchener | 44,867 | | | No | | 6 | Clauses in Building By-law. | | | | | | | | | None |
| London | 95,343 | 1952 | | No | 4* | 3** | 0.85 lb. | Yes | Yes | Yes | 5 | Yes | Yes | 50 | No | None |
| Niagara Falls | 22,874 | | | No | | 6 | | | | | | | | 50–200 | | None |
| Oshawa | 41,545 | 1940 | | No | | 6 | | | | | | | | | | None |
| Ottawa | 202,045 | 1947 | Works | Yes | 4* | 3** | 0.85 lb. | | Yes | Yes | | Yes | No | 50–200 | No | None |
| Owen Sound | 16,423 | 1947 | | | Not Specified | | | | | | | | No | 50 | No | None |
| Peterborough | 38,272 | No By-law | | | | | | | | | | | | | | General |
| St. Catharines | 37,984 | 1918 | | No | | 6 | | No | No | No | | No | No | 50 | No | None |
| St. Thomas | 18,173 | 1911 | | No | | 6 | | | | | | | | 50 | | |
| Sarnia | 34,697 | | By-law drafted but not yet passed. | | | | | | | | | | | | | |
| Toronto | 675,754 | 1949 | Property | No | 10 | 6 | 0.85 lb. | Yes | Yes | Yes | 5 | Yes | Yes | 50–200 | No | General |
| Welland | 15,382 | 1924 | | No | | 6 | | | | | | | | 50 | | None |
| Windsor | 120,049 | 1949 | | Yes | 4* | 3** | 0.85 lb. | Yes | Yes | Yes | 5 | Yes | Yes | 50–200 | No | General |
| QUEBEC | | | | | | | | | | | | | | | | |
| Arvida | 11,078 | No By-law | | | | | | | | | | | | | | |
| Hull | 43,483 | 1905 | Nuisance Clause in General By-law only. | | | | | | | | | | | | | |
| Montreal | 1,021,520 | 1950 | Planning | Partly | 9 | 6 | 0.85 lb. | Yes | Yes | Yes | 0–17 | Yes | No | 40 | Yes | General Fumes & noxious gases |
| Quebec | 164,016 | 1941 | | No | 6 | | | No | No | No | | No | No | 40 | No | General |
| Sherbrooke | 50,543 | 1905 | | | | | | | | | | | | 50 | | General |
| Trois-Rivières | 46,074 | No By-law | | | | | | | | | | | | | | |
| SASKATCHEWAN | | | | | | | | | | | | | | | | |
| Moose Jaw | 24,355 | | Nuisance Clause in Building By-law. | | | | | | | | | | | | | General |
| Regina | 71,319 | No By-law | | | | | | | | | | | | | | |
| Saskatoon | 53,268 | No By-law | | | | | | | | | | | | | | |
| NEWFOUNDLAND | | | | | | | | | | | | | | | | |
| St. John's | 52,873 | No By-law | | | | | | | | | | | | | | |

NOTE: *In each half hour; **In any 15 minutes; ***Plant liable to be sealed after third violation in 12 months.

dustrialization, the Committee on Atmospheric Pollution in Canada was appointed in 1949 to study the situation and to draw up a skeleton code which would cover all types of pollution, a variety of possible sources of pollution and recognize differences that exist in the prevailing conditions across the Dominion.

It is recognized that in many instances control measures have been deferred because of the absence of suitable standards and because enforcement in the smaller cities would be too expensive. The committee considered, moreover, that pollution is a regional and not a municipal problem and reported in favour of setting up pollution control areas(18) under the jurisdiction of the provinces. They also considered that the crux of the problem is the amount of pollutant emitted and not its density in stacks of different sizes.

Recommendations were made regarding the organization and powers of the controlling body, with provision for variations to suit different local conditions. There still remains, however, the necessity of a greater degree of standardization and instrumentation in methods of measurement, so that results obtained in one area may be comparable with those in other areas.(17)

### Results Obtained

There appear to be no reports available comparable with those from Great Britain and some of the larger American cities (e.g. Pittsburgh) but Table 2 gives some idea of the activities of the Smoke Abatement authorities in Toronto, and shows that the number of convictions obtained varied from 80 to 90 per cent of the number of summonses issued. Both Toronto and Windsor report the willingness of building owners and industrial firms to spend large sums of money to reduce or eliminate their own contributions to the general pollution problem.

An air pollution survey is presently being made in Toronto, under the direction of Dr. D. Y. Solandt of the University of Toronto, and it is hoped that a comparison of the results obtained, with those of a similar survey made in 1932-3, will indicate what progress has been made during the past twenty years. The scope of the survey is less than that originally planned owing to the difficulty of getting competent technical assistance.

Some difficulties have been experienced in urban areas due to the emission of fly-ash or oxides from

**Table 2. Activities of the Smoke Abatement Authorities in Toronto**

| | 1950 | 1951 | 1952 | Up to July 31 1953 |
|---|---|---|---|---|
| Inspections | | | | |
| Industrial Plants | 9,364 | 11,177 | 10,106 | 5,940 |
| Locomotives | 3,911 | 6,121 | 6,570 | 3,787 |
| Ships | 75 | 42 | 50 | 24 |
| | 13,350 | 17,340 | 16,726 | 9,751 |
| Unsatisfactory Inspections | | | | |
| Industrial Plants | 904 | 850 | 784 | 398 |
| Locomotives | 42 | 75 | 97 | 108 |
| Shipping | 25 | 16 | 19 | 22 |
| | 971 | 941 | 900 | 528 |
| Court Proceedings | | | | |
| No. of Summonses issued | 128 | 155 | 182 | 55 |
| No. of Convictions | 103 | 134 | 166 | 45 |
| No. of Cases given suspended sentences due to improvements being effected | 25 | 21 | 12 | 9 |
| No. of Cases withdrawn | — | — | 4 | 1 |
| | 128 | 155 | 182 | 55 |
| Applications for Installation Permits | | | | |
| Boilers | 40 | 133 | 155 | 104 |
| Stokers | 61 | 79 | 52 | 19 |
| Oil Burners | 144 | 318 | 270 | 169 |
| Steam Package Oil Fired Units | 8 | 15 | 19 | 6 |
| Dust Collectors | 1 | 2 | 3 | 1 |
| Incinerators | 5 | 2 | 14 | 10 |
| Chimneys | — | 7 | 4 | 7 |
| | 259 | 556 | 517 | 316 |

| Summary: | | | | | |
|---|---|---|---|---|---|
| Inspections | — | 57,167 | Court Proceedings | — | 520 |
| Violations | — | 3,340 | Permits Issued | — | 1,648 |
| | | | Number of Inspectors | — | 9 |

foundry cupolas and metallurgical furnaces. In at least two Ontario cases injunctions have been obtained and damages assessed. This situation is complicated by the fact that existing plants of this kind have been exempted by the Provincial Government from the requirements of the by-law and, on account of the expense involved, some operators threaten to move their plants out of the municipal area if the by-law is amended to include them. These difficulties will disappear in time, however, as all new plants must obtain permits and observe the by-laws.

No detailed studies have been made (as far as the author is aware) regarding the contributions of automotive engines to atmospheric pollution in the larger cities, but experience in Toronto appears to indicate that this factor is not important save, perhaps, when temperature inversions occur.

### Special Cases

#### *(A) Sulphur*

This element is vital for many industrial processes, but deposits of native sulphur are comparatively limited. However, large quantities of sulphur dioxide and hydrogen sulphide are wasted annually from smelting, refining and combustion processes. These gases add to atmospheric pollution, poison living matter and cause corrosion. The Committee on Atmospheric Pollution in Canada, therefore, recommended a limit of 0.20 per cent of $SO_2$ (by volume) in the stack gases and a maximum concentration at the ground level of 0.5 parts per million, for one hour.

In 1925, complaints were received of damage to farm and forest lands in northern Stevens County, Washington, from sulphur dioxide originating in Trail, B.C., and travelling along the Columbia River Valley. During the next five years the capacity of the plant was doubled and the emission of $SO_2$ rose to 600-650 tons daily. Substantial damages were awarded by an international tribunal(23) and the matter was investigated by the National Research Council of Canada 1929-1937(5) (6) (22).

The $SO_2$ concentrations are now recorded continuously by Thomas autometers and the mass rate of emission is controlled by regulating the operation of the roasting furnaces in accordance with the prevailing meteorological conditions(23). The current loss to the atmosphere is less than 9 per cent of the sulphur charged and the six acid plants have a capacity of 1,300 tons of sulphuric acid a day(22). Thus is a liability transformed into a valuable asset.

A similar situation exists in the Sudbury, Ontario area where about 90,000 tons of sulphur dioxide are now being recovered annually from stack gas in nickel-copper smelting. Nevertheless, Katz states(22) that the annual emission of sulphur from the three smelters in this area may be as high as 1,000,000 tons. He further states that other plants now operating, or under construction, have an additional capacity of 246,000 tons per annum.

*(B) Arsenic Trioxide at Yellowknife.*

The emission of arsenic trioxide from the roasters at Yellowknife, N.W.T., has resulted in a somewhat unusual problem that is being studied by Dr. Kingsley Kay, Chief of the Occupational Health Laboratory, Ottawa. This study has been under way for the past eighteen months and is still going on. The two mines concerned are three miles apart and the town of Yellowknife lies between them. Their two stacks emitted twelve tons per day of arsenic trioxide in submicron form and, as a result, twenty expensive cattle died, wild life was destroyed and people siekened by arsenical poisoning.

To meet this difficulty, one mine installed Cottrell precipitators and the dry dust was dumped into caverns in the permafrost zone. The other requested, and ultimately obtained, permission to use wet scrubbers from which the wet effluent was pumped into a nearby lake. This ultimately produced a water pollution problem, as the arsenic spread from one lake to another and contaminated drinking water. A bio-chemical survey was made and it was noted that, as the evolution of pollutants into the air and the surrounding environment was reduced, the concentration of arsenic in the urine of a selected group was also reduced.

A new roaster was installed, doubling the capacity (and the loading of the Cottrell) and the environmental levels rose again. Measurements of arsenic content are now being made in the air, water, soil and vegetation for the purpose of throwing more light on the allowable limits of contamination.

*(C) The Windsor-Detroit Border Problem*

Another investigation undertaken by the International Joint Commission, relates to the Detroit-Windsor area, which is the third largest manufacturing area in North America. Coal consumption amounts to about 16 million tons annually and it is estimated that about 430,000 tons of $SO_2$ are released by combustion. There are also other contaminants.

From 1949 onward, records have been kept of meteorological data, smoke emissions from vessels, $SO_2$ concentrations, gaseous and particulate contaminants and deposited matter (dustfall). These investigations have already been published in detail by Dr. Katz(23) (25) (26). It is a notable and gratifying example of international co-operation in this important field.

*(D) The St. Clair River Research Group*

In February 1952, a research group was set up under the auspices of the Ontario Research Council, to study air and water pollution in the St. Clair River Basin. The committee appointed included representatives of the local industries concerned and of government departments. Initially a research program was arranged to determine the extent and nature of the air pollution in the Sarnia area. This, also, is a border problem, as Port Huron (Mich.) is situated on the opposite side of the St. Clair River.

The funds necessary for the study were provided jointly by the companies concerned and by the Ontario Research Council; the actual survey was commenced in October 1952 and is expected to continue for at least two years. Collaboration is being arranged with the International Joint Commission and the techniques employed are similar to those used in the Windsor-Detroit area.

A fixed station for collecting meteorological data was set up along the lines of prevailing winds in the residential area of Sarnia. This station contained apparatus for determining wind velocity, a Thomas Autometer for $SO_2$, dust collecting equipment, etc. A similar station mounted on a trailer has also been provided by the Research Foundation for a complete analysis of air in other locations in the area.

A number of dust cans have been set up at various points in the Sarnia area to determine dust fall. Advice on the meteorological aspects of the problem is being received from the Canadian Meteorological Service.

In addition to the above activities, the Council of the City of Sarnia have authorized the formation of an Advisory Committee on Smoke Abatement and have asked the St. Clair River Research Group to appoint a representative to sit on the committee. The function of the committee is to provide technical advice to the City Manager's Department in respect to ways and means of reducing air borne contaminants.

This is a long range project and no significant results have yet been obtained, but there is some evidence to indicate that the dust-fall in the Sarnia residential area is low compared to other cities having a similar concentration of industry.

*(E) Transportation*

Among the worst offenders with regard to smoke emission are the railroads and steamships, but the municipal authorities have no control over these agencies, as they are under the jurisdiction of the Board of Transport Commissioners for Canada. This is a Federal board and has the usual characteristics of a governmental department.

The problem has been acute in the Detroit River, where about 28,000 passages are made in a season and thousands of smoke readings have been taken by the Ringelmann chart method. These reveal that, as a result of improved boiler equipment, firing methods and the use of over-fire air jets, the percentage of the time of smoke observations from vessels, corresponding to No. 3 Ringelmann chart or darker, fell from nearly 51 per cent in 1950 to 27.5 per cent. in 1953. Table 3 was taken from the 1953 report of the Technieal Advisory Board of the International Joint Commission.

Other cities with port areas have similar problems which are very difficult to solve, particularly when the ships are of different nationalities. However, as far as the Great Lakes and St. Lawrence areas are

**Table 3. Smoke Performance of Vessels on Detroit River**

| Year | Total Time of Observations in Minutes | | Percent Time Corresponding to Ringelmann Number | | |
|---|---|---|---|---|---|
| | No. 1 or lighter | Readings at all densities | No. 1 or lighter | No. 2 | No. 3 or darker |
| 1950 | 12,331 | 33,676 | 36.5 | 12.8 | 50.7 |
| 1951 | 31,447 | 66,919 | 47.1 | 18.15 | 34.75 |
| 1952 | 31,001 | 63,028 | 49.4 | 19.45 | 31.15 |
| 1953 | 31,276 | 52,297 | 59.8 | 12.7 | 27.5 |

concerned, the local steamship lines are showing willingness to co-operate.

The railways also are causing some trouble, particularly in the round houses. They are, however, installing oil lighting-up systems and external steam-starting equipment in several places. They are also giving special instruction to firemen on proper methods of lighting up and feeding the fires. They have their own inspectors to observe results.

A general order was issued in 1908 prohibiting the unnecessary and unreasonable emission of dense smoke from locomotives in cities, towns and villages which have anti-smoke by-laws, but this is a general and not a specific directive. Its effectiveness is doubtful. The principal relief would appear to come from the increasing use of diesel engines to replace steam locomotives.

The following figures give an indication of the rate at which oil is replacing steam on the two principal Canadian railways:—

Canadian National Railways
- 1948 1928 steam locomotives and 500 switchers
- Aug. 1953 1901 steam locomotives and 500 switchers; 445 diesel locomotives (50 in 1953)

Canadian Pacific Railway
- 1948 Nearly 2,000 steam locomotives
- Aug. 1953 1654 steam locomotives; 367 diesel locomotives (50-60 per annum)

While this trend is eminently desirable from the standpoint of atmospheric pollution, it accelerates the present tendency to put all our transportation on a liquid fuel basis. The reasons for this are obvious, but, in time of crisis, our almost total abandonment of solid fuels may be catastrophic. In such times, the North American continent will probably have to be self-supporting, as far as liquid fuel is concerned.

It is true that oil supplies from Canada are increasing and that new sources are being discovered elsewhere, but for how long can this self-sufficiency be maintained ? The United States is already importing about 7.7 per cent (net) of its petroleum requirements and the rise in the American consumption curve is phenomenal. One can only regard this aspect of the fuel situation with apprehension.

### (F) Miscellaneous

Potential danger arising from the emission of radio-active materials from atomic energy plants is illustrated by a small leakage that occurred at Chalk River in December 1952. It was described as a "pin point break in the outer structure" but all operations throughout the 100 odd buildings in the 500 acre plant site were shut down for some time.

The concentration of radioactive material at ground level was attributed in this case to a down draft. In most cases, ground level concentrations are prevented by dispersing waste gases at high levels, sometimes using stacks 450 to 550 feet high(17) (23). Bosanquet and others have studied the theoretical distribution of pollutants from factory chimneys but their results are always subject to considerable modification with changing meteorological conditions.

Apart from combustion processes, considerable pollution can arise from dust produced in pulverizing, grinding and other similar operations. If this occurs in enclosed spaces, the situation can be met by installing the usual cyclones or filters but, in the case of open fires, or where there is no agency for collecting the particles by suction or otherwise, the measurement of the amount of pollution may be impracticable. In such instances, the only form of protection possible appears to be under a general nuisance clause and a nuisance is a difficult thing to define or prove.

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# The ASME Boiler Code

In the July 1952 issue of *Mechanical Engineering*, the ASME commenced publication in serial form, of a history of events leading up to the present ASME Boiler Code, from the first development of boilers in the 18th Century. This history, continued through some ten issues, was prepared by Arthur M. Green, Jr., of Princeton University.

As a preface to the regular publication in future issues of *The Engineering Journal*, of Boiler Code Regulations, this history is here presented in condensed form. It will appear in several issues of the *Journal*, of which this is the fith.

## V. Administration of the 1937 Code and More Revisions 1938-40

A protest from the Ohio Board of Boiler Rules against the large number of revisions acted upon by the Committee for adoption during 1938, was discussed at a committee meeting in June 1938. The Board had not been called upon by its Industrial Commission, by industry or by operators to change the Ohio Rules as broadly as indicated by the Committee, and until called upon for relief from present boiler and pressure vessel regulations by its constituents, it would not consider further revisions.

A minute from the Engineers' Conference of the National Bureau of Casualty and Surety Underwriters was read at this meeting, directing that it be placed before the Boiler Code Committee in opposition to the great number of revisions and interpretations of the Code. It recommended these be carefully analyzed from a safety point of view, and if costs only were involved, no revisions should be made.

At the July, 1938 meeting of the Committee, the chairman called attention to the growing criticism from the States about this activity of the Boiler Code Committee. It was feared some of the states would refuse to adopt some of the revisions, then others would follow, and no one could foresee the result of differences in state laws. The chairman recommended that the Committee follow the suggestion of the "Engineers Conference", presented in June. It was also suggested that the Committee should not try to standardize details, but use broad requirements for safety and so reduce the need for many revisions.

### Hearings

#### A—Stainless Steel

An informal hearing and conference was held in February, 1938, with manufacturers of stainless steel and high alloy steels. The need of fabricating companies for rules which would control the use of stainless steel was expressed. A set of rules prepared by the Committee and the AWS was read and discussed.

Five suggestions were made: (1) Allow stabilized materials for vessels under Para U-68; (2) Allow a U-69 vessel of not more than 5/8 in. thickness of stabilized steel with stress relief; (3) Allow unstabilized steel without relief for U-69 and U-70 vessels, if not over 3/8 in. thickness; (4) Limit all U-69 vessels to a pressure not over 400 p.s.i. and a maximum temperature of 600°F. and (5) Limit U-70 vessels of unstabilized steel to maximum pressures of 100 p.s.i. and maximum temperature of 250°F. These suggestions were referred to the Subcommittee on Ferrous Metals and on Welding.

#### B—Safety Valves

In July, 1938, it was reported that tentative agreement had been reached with manufacturers of safety valves regarding Table P-16, Relieving Capacity of Safety Valves. It was pointed out that there was no change in principle from that which had been in the Code for 15 or 18 years. The recommendations were approved for publication, after the special committees had received and reviewed comments from manufacturers. After changes made at a number of meetings the final form was approved in June, 1939.

#### C—Table P-2 for Tubes

A hearing with manufacturers of tubes, held in June 1939 to discuss table P-2, was reported the same month. It was held at request of the manufacturers of seamless tubes, who maintained that Table P-2 gave equal value to welded and seamless tubes, and this had not been sustained by tests at Purdue University. No agreement was reached.

At the committee meeting, after discussion, it was finally voted that adoption of Table P-2 as published be considered at the September meeting. A special committee was appointed to consider how the Table as published, could be made more acceptable. This Committee suggested, in September, the use of Table P-2 as published in April, 1939, as far as the formula; the insertion of two formulas; renumbering the stepped lines on Tables I, II and III; and statement of their use as given in the report.

As the Committee could not make a unanimous report, it was discharged, and reappointed with two added members. It was directed to report at the November meeting. A unanimous report was presented in December, 1939, to the effect that Table P-2 be revised in accordance with the form appearing in the appendix of the minutes. This report had the approval of tube manufacturers, and appeared in the January 1940 issue of *Mechanical Engineering*. After the many conferences and hearings, Table P-2 was approved by the Council in March, 1940.

#### *D—Conference on Para. U-1(a)*

A controversy arose between the Westinghouse Air Brake Company and the Inspection Department of California as to whether air reservoir cylinders should be built in compliance with the ASME Code for unfired pressure vessels. A letter from the Industrial Accident Commission of California describing the situation was discussed by the Committee in December 1939. This Commission contended the Code should state what a Code vessel was, and allow the states to fix minimum limits. A revision was suggested, fixing the minimum limits of the application of the Code, and providing that all vessels, regardless of size, should be equipped with safety devices.

At the meeting of June, 1940, it was decided to call a public hearing in October 1940. This hearing resulted in the form of paragraph U-1(a), allowing vessels below 5 cubic feet and sectional area of 64 sq. in. to be accepted without inspection, and permitting stamping if accompanied by manufacturers certificates. The Boiler Code Committee referred the recommended revisions to the Subcommittees on Unfired Pressure Vessels. The Committee did not report on this suggestion during 1940, as time did not allow its inclusion in the 1940 Edition.

#### *E—Hearing of Manufacturers of Dished Heads*

A hearing on under-tolerances of thickness for dished heads was held in September 1939, attended by the Executive Committee and representatives of five manufacturers. The rejection of the ASME type of flanged and dished heads for non-conformance with Code requirements by insurance inspectors was discussed. The purpose of the hearing was not to discuss acceptance of non-standard heads, but to clarify the rules for proper use by all dished head fabricators.

The Committee pointed out that its belief was that an under-thickness tolerance was not in harmony with Committee practice. Committee members expressed reluctance to make changes in the Code to provide under-gage tolerances. Steel manufacturers' representatives made it plain they did not object to elimination of under-tolerances in Code type heads, but they objected to elimination or change of the amount of under-gage of 0.10 in. permitted by Code material specifications.

#### Miscellaneous Welding—Penatrameters

In February, 1938, the Henry Vogt Machine Company pointed out that the penatrameter (Para. P-102(i) of the Code) took up considerable space on the X-ray film, and asked whether individual strips of 2 per cent of the base plate in thickness would be permitted, placed at the end of each exposed section of the weld. Their letter was referred to the Special Committee on Radiographic Examination of Welded Joints.

At the meeting of March, 1938, the Executive Committee reported that permission to use the single strip should not be granted without informing other manufacturers, hence a proposed revision should be formulated and published. This action was not approved, and the Henry Vogt Machine Co. was informed that the subject was being considered by the Special Committee and a report was expected in June.

The Special Committee considered the matter at its meeting of June, 1938, but no final action was taken. In June, 1939, it was agreed to confirm the action of June 1938, and to recommend revisions to paragraph P-102(i) and paragraph U-68(i) providing for the use of the strip penatrameters. This was accepted by the Committee for publication as a revision. It became part of I(e) of paragraph P-102(i) and paragraph U-68(i)b as appearing in the two sections of the Code of 1940.

#### Porosity

In September, 1940, the Special Committee on Radiographic Examinations of Welded Joints recommended the eliminations of films No. 1 and No. 2 and a change of label on No. 3, due to inspectors' complaints that many films as good or better than No. 3 had been rejected. Porosity less than that of No. 4 would be acceptable, and such change would eliminate half of the present unwarranted rejections.

This report was discussed at the Committee's October 1940 meeting, some members strongly urging a film showing less porosity than No. 3. The matter was referred back to the Special Committee.

#### Welded Tubes and Standard Qualifications

The Special Committee on Extension of the Use of Fusion Welding, in March 1938, reported proposed additions to the Code on Welded Joints in Boiler and Other Tubes, paragraph P-112, defining tubes and their positions, qualifications of process, tests of welds and operators, details of welded joints, and use of a backing ring. The Special Committee asked the Committee's opinion about the stress-relieving of welded joints of tubes, and the magnaflux test on circumferential joints of pipes and tubes.

After discussion, the Committee voted that stress-relieving should be required for welded joints in tubes in contact with furnace gases, irrespective of size and thickness, and that no provision be made for magnafluxing welded tubes. They then presented a new arrangement of paragraph P-112, Welded Connections. In March, 1939, the Special Committee reported a revision of their proposal for paragraph P-112. The Boiler Code Committee adopted the revision and with it the Qualification Rules mentioned in P-112 as part of the Appendix.

A recommendation was made to the subcommittee on Unfired Pressure Vessels that the latest AWS qualifications be considered as promptly as possible for incorporation in the Code. Minor revisions or additions to the Qualifications Procedure were made in April and May, 1939, and in June 1940 the Procedure became paragraphs UA-30 to UA-70 of the Appendix. After some further revisions and additions the final form of the AWS Qualifications Procedure, with modifications, were approved for publication in March, 1940.

#### Qualifications for Operators for Machine Welding

The Vancouver Iron Works requested an opinion in February, 1939, on the qualifications of operators of an automatic welding machine requiring no skilled operator. The Subcommittee on Welding was not in accord with the suggestion that no qualification be required for the operators. The Committee voted to reply that no evidence had been submitted to the Committee to justify a revision to the Code at that time.

#### Repairs by Fusion Welding

In November, 1940, the Executive Committee of the National

Board of Boiler and Pressure Vessel Inspectors had considered recommended revisions to rules for repairs by fusion welding, proposed by the Engineers Conference of the NBCSU. The need for changes appeared most urgent in New York and Maryland. The Boiler Code Committee considered the rules were so old that they did not cover welding work. The Committee voted that a copy of the revised rules be sent to each committee member, and that comments be sent to a designated special committee.

#### Welding Dissimilar Metals

An inquiry in September 1940, with drawing showing a silicon bronze coupling welded to a copper lined steel hull, asked whether the Code covered the welding of dissimilar metals. The Subcommittee on Welding reported that under procedures a satisfactory structure could be made, but to consider the broad subject a procedure would have to be established. A reply was approved to the effect that if the manufacturer could set up a procedure and demonstrate that satisfactory welds could be made, permission for the constructions presented would be given.

#### Shop Examination of Welded Joints

The 1940 edition of section VIII contained paragraph U-78(g), Shop Examination of Welded Joints. At a meeting in April, 1938, the Subcommittee on Unfired Pressure Vessels reported a draft of this paragraph intended to answer questions on the determination of the nature of the weld after completion, and stated insurance companies had worked out a satisfactory method of trepanning. A revision of the draft was reported at the June 1938 meeting. The Subcommittee considered this matter again in July, 1938, and authorized a special committee to review the rules for shop examination of welded joints. They voted that its final report be referred to the Executive Committee, with power to authorize publication.

These paragraphs referred to welds in vessels built in accordance with paragraphs U-69 and U-70 only, and fixed the size and frequency of trepanning plugs at locations designated by an authorized inspector. Modifications were made in paragraph U-78(g), and in September, 1939, three minor changes were approved, as well as paragraph UA-47 on etching of the removed specimen of the weld metal of paragraph U-78(g).

#### Stress Relieving

Stress relieving of vessels of ordinary steel and chrome nickel steel was discussed in January 1939, in a letter from the Struthers Wells Co., regarding such relief for a vessel containing parts of each of these steels. The Subcommittee on Welding, after discussion, referred the inquiry to the Special Committee on Approval of New Materials, to secure additional information. The Special Committee pointed out in September, 1940, that the rules for stress-relieving should be permitted in this case.

In October, 1940, the Special Committee formulated a reply, also proposing revisions for paragraph U-59(n), (p) and (r). This was discussed and referred back to the Special Committee. In November another form of reply was made, proposing that nozzles and other welded attachments to unrelieved U-69 vessels need not be stress-relieved, but that this be done before attachment. Because of objections raised by the Committee members, the reply was again referred to the Special Committee.

#### Special Committee to Revise Section VIII

Publication of the joint API-ASME Code for Unfired Pressure Vessels in 1934, with its lower factor of safety of four, led some Committee members to suggest that a revision of section VIII might serve the petroleum industry, and eliminate the need for two Codes. With this purpose the Special Committee to Revise Section VIII had been appointed in February 1935.

In January, 1939, the Subcommittee on Ferrous Materials was asked by the Boiler Code Committee to prepare additional tables for the revision of section VIII, giving working stresses for ferrous material using a safety factor of four. In February it requested the Subcommittee on Non-Ferrous Materials to prepare a similar table for non-ferrous materials.

In October, 1938, the Special Committee to Revise Section VIII held a three day session, covering the high spots of the revision. By April, 1940, a draft of the revision had been sent to certain members of the Boiler Code Committee. The report was sent to the Committee in April, suggesting the calling of a Committee meeting to consider the advisability of sending the report out for discussion. This meeting was called for April 30. The release of the report was discussed by the Committee, which voted to transmit the draft of the revision to the API through the proper channels.

The feeling of the Committee members connected with the petroleum industry was that the API should have representation equal to that of the Committee in matters relating to Unfired Pressure Vessels. At the Committee meeting of May, 1940, objections were made to the action at the special meeting of April 30. Attention was called to the confusion resulting from the issuance of the 1934 API-ASME Code. It was suggested there was no reason why one committee could not be responsible for power vessels and another for unfired pressure vessels.

In October 1940, it was reported a draft of the proposed revisions of section VIII had been considered at a meeting of the API. Certain administrative principles were considered essential before the revised Code could replace the API-ASME Code. It was proposed that comments received by the Special Revision Committee should be sent to the API Code Committee, which was to meet in Chicago in November.

#### Materials

*A—Specifications*

During the period 1938-40 the Subcommittee on Material Specifications arranged for the introduction of the latest ASTM specifications to replace their predecessors in the 1937 edition of section II of the Code. Much of the work was the examination of ASTM specifications of materials for which the Committee, in replies to cases, had given permission for use in vessels. The replies had contained limitations for the use of these materials.

The added specifications were S-42 to S-57 inclusive. These were all identical with ASTM specifications. Deletions included specifications S-3, S-6, S-12, S-26, S-27, S-29, S-30 and S-31. A few of the specifications were changed to those for similar materials of slightly different properties. Of the 47 specifications of section II, all were identical with ASTM specifications except four, of which one was based on ASTM, one was in substantial agreement, one adapted from, and one for which there was no ASTM equivalent.

The grouping of these specifications under their ASTM designation number had been suggested by the Subcommittee on Ferrous Materials in January, 1938. This

Subcommittee also recommended the publication of section II as a special volume. The policy established for the 1940 editions was the printing of sections I and VI in one volume, with the Appendix and the other Sections, including section II, as separate volumes.

*B—Use of Non-Code Materials*

Paragraphs such as P-1(b), L-1(b) and V-12(b) provided for applications for use of materials other than those for which specifications were given in section II. In October 1937, a Special Committee was appointed to prepare a schedule of the chemical and physical properties of new materials needed by the Committee in these applications.

This Special Committee reported in February 1938, and after acceptance of its report the requirements it specified became Paras. A-78 to A-85 of the Appendix, entitled "Approval of new Materials under the ASME Boiler Construction Code". These were added to the other sections. They identified the materials as the same as, or similar to, one of the ASTM specifications, or stated the properties in the order found in the text of ASTM specifications.

*C—Clad Vessels*

The Lukens Steel Company asked permission to use the strength of full-thickness nickel-clad steel plate in designing any type of pressure vessel, instead of the steel thickness only, and for a hot water storage tank, under paragraphs U-69 and U-70. The Special Committee on Clad Vessels (April 1938) did not agree. The Committee referred to this Special Committee the preparation of an interpretation covering the various recommendations made by it for granting the requests. This was made Case 860.

In January, 1940 the Special Committee reported it had considered an inquiry from the Jessop Steel Co., asking permission to use stainless clad steel in welded unfired pressure vessels. It recommended annulment of the earlier cases Nos. 828 and 860, relating to nickel clad sheets, and the reopening of Case 828 to have it cover nickel-clad material for all fusion welded construction.

The Special Committee then presented a reply to a similar case for the use of chrome-nickel steel. This resulted in a unanimous report for the reopened Case 828 and Case 896 (chrome-nickel steel) which were adopted to issue as interpretations. Although the Special Committee voted that the quench test or the reverse bend test might be applied to a sample cut from the plate, the efficiency of the weld was more important than the efficiency of bond.

*D—Material Committees*

During 1938-40 the Special Committee on Approval of New Material was seeking materials which might cover a number of interpretations, while subcommittees on Ferrous and Non-Ferrous Materials were fixing allowable stresses and considering their properties and treatment.

In December, 1938, the Timken Roller Bearing Co. asked a ruling on conditions for the use of carbon molybdenum intermediate and high-alloy boiler and superheated tubes, which could be certified as satisfactory under Code requirements. This was referred to the Subcommittees on Ferrous Materials and on Material Specifications.

The reply stated that in the absence of a suitable ASTM specification, and until one was adopted, the material proposed met requirements of the Code if (1) requirements of S-17, S-40, S-48 and S-49 were met: (2) test requirements and other applicable parts were met: (3) the hardness be limited where tubes were to be expanded and (4) the material be of weldable quality.

In March, 1940, the Special Committee for Approval of New Materials reported Cases 834, 836 and 861 could be combined in a new Case 897, by the use of ASTM-A-167-38T for chrome-nickel steel. The Special Committee was directed to reply to Case 791 as for new Case 897.

*E—Cast Aluminum Heads*

A request by the American Laundry Machinery Co. to use cast aluminum heads on steam containers was considered in April, 1939. These heads were tested according to paragraphs UA-1 and UA-9, which referred to tests on steel, and did not apply for non-ferrous materials. Moreover the material was one, the specifications for which could not be used under the Code, because of lack of stress requirements.

The need for a specification for aluminum under the Code was expressed, because of demands from industry that vessels using this material be stamped as complying with the Code. The Special Committee on Non-Ferrous Pressure Vessels wrote to the Industrial Research Division of the Welding Research Committee, stressing the need of a satisfactory ASTM specification for aluminum.

*F—Wrought Iron*

A letter from the A. M. Beyers Co. in September 1938, asking as to the possible use of wrought-iron plates and structural shapes for boiler and vessel parts, was considered by the Committee. It was voted to advise the inquirer that to provide for the use of this metal, except as already provided for pipes, tubes etc., would require new rules, and unless there was evidence of a demand for such, the Committee did not feel warranted in preparing them.

*G—Bronze Fittings in Heating Boilers*

Letters asking permission to use bronze fittings and Tobin bronze fittings and silver alloys in heating boilers, were discussed in October, 1938. The Miniature Boiler Code provided for the use of bronze. Permission to use these fittings brazed to copper tubes was asked. The report on the subcommittee findings recommended permission be granted.

*H—Allowable Stresses for Non-Silicon-Killed Steel*

Tables P-9 and U-3 on maximum allowable stresses, prepared by the Subcommittee on Non-Ferrous Materials, was amended to include steels in a number of the adopted specifications providing for several grades of non-silicon-killed steel. This action was approved in December, 1938, as well as additions for materials which had been added to section II.

*I—Proposed Reduction of Ductility*

The A. O. Smith Corp. recommended that elongation requirements of Paras. P-101 (later P-102) and U-68(e) be decreased with an increase in tensile strength of the weld. The Subcommittee on Welding reported in June, 1938, that much information was needed before action could be taken, and suggested the question be referred to the AWS Conference Committee.

In July the AWS Conference Committee expressed agreement, though without test results nothing could be fixed. The A. O. Smith Corp. agreed to carry out tests on welds and steels if the Boiler Code Committee would supply "run-of-mill" welds, and steel from various manufacturers, for determining ductility of steel and specimens.

Other manufacturers maintained it was always possible to secure 20 per cent ductility by proper welding, and recommended no change, as it was of advantage to have the weld metal ductile. It was voted to inform the A. O. Smith Corp. that the Committee was of the opinion that no change was desirable in the requirements for ductility in weld metal.

*J—Cast Iron*

The strength of cast iron was considered at the meeting of February, 1939. Though the three classes had tensile strengths of 20,000, 30,000 and 40,000 p.s.i. respectively, paragraph U-13(g) limited the working stress to 2,500 p.s.i. for any of them. Some members expressed belief that higher strengths cast iron should be allowed a higher working stress. Others stated if cast iron were used, the working stresses in tension, compression and bending should also be given. The question was referred to the Subcommittee on Ferrous Materials.

*K—Special Emergency Use of Steels*

A letter from a boiler inspector of California was considered in November, 1940. He enquired if, in view of the demand from the defence program, if it would be permissible to build fusion welded vessels for hot water tanks not in contact with products of combustion, of steels of ASTM specifications A-7, A-28 and A-30. In view of the emergency, the Committee advised the inspector as a state official to act so as to allow this.

*L—Monel Metal Seamless Tubes*

Permission was asked by the Griscom Russell Co. to use and circumferentially weld seamless-Monel-metal tubes under paragraph U-71(c), as there were no specifications for Monel-metal tubes in section II, nor were they mentioned in paragraph U-71(a). The reply, formulated by the Special Committee on Welding Requirements and the Subcommittee on Welding, was discussed in June, 1939. The inquiry was then formed to include the properties of Monel-metal to be used, and to call for the use of Specification S-47 for copper-nickel tubing for oxyacetylene welding, provided: (1) tests were made on flat 3/8 in. plates (2) tubes were welded in horizontal positions and revolved, (3) hydrostatic tests were made at minimum of 1,000 p.s.i., and (4) stress relieving was not required. Similar action was taken in Case 880, giving permission to use naval rolled brass, after consideration by the Subcommittee on Non-Ferrous Materials.

*M—Stainless Steel*

In May, 1939, the Special Committee on the Approval of New Materials made a full report of the required changes in replies to Cases 836 and 861 on the use of stainless steel, as well as for three other cases on the same grade of an ASTM specification for chrome-nickel sheet. The only change in Case 836 was in the minimum temperature of heat treatment from 190°F. to 195°F.

In Case 861, the inquiry and reply related to stabilized austenitic chrome-nickel steel of ASTM specification A-167-38T. This was limited to grades 5 and 9 using columbium or titanium, for stabilizing with the last heat treatment, at not less than 185°F. The inquiry referred to vessels conforming to paragraph U-69. The reply covered this point, and a paragraph gave conditions permitting stamping under paragraph U-70. The reply gave chemical treatment of the weld material with each kind of stabilization.

The new Case A referred to the use of grades 2, 4 and 6 of Specification A-167-38T for vessels built to conform with paragraph U-69, chemical composition and heat treatment before welding were given, and limitations of 3/8 in. in thickness, 600°F. maximum temperature, 15,000 p.s.i. allowable working stress, with joint efficiency 80 per cent. This also applied to U-70 vessels.

The new Case B was drawn for the use of grade 6 steel for paragraph U-68 vessels, and inquired into the applicability of the same heat treatment to U-69 vessels. The new Case C for grades 5 and 9 was for U-69 vessels, and the reply gave minimum temperatures of 1,550°F. for heat treatment of the complete vessel of columbium-bearing steels and 1,650°F. for titanium-bearing steels.

These requirements were considered again in March, 1940. Cases 834, 836 and 861 were annulled, and replaced by Case 897, in answer to the inquiry: "May chrome-nickel steel as such, or alloyed with columbium, titanium or molybdenum, be used for unfired pressure vessels under ASTM Code rules ?"

The reply stated they might be used for unfired pressure vessels with certain limitations: (1) Users were recommended to assure themselves by tests or otherwise that the alloy selected, and the treatment following fabrication, were suitable for the intended service. Where service data were not available, the procedure under paragraph U-11(b) would apply. (2) The chrome-nickel material should conform to ASTM Specification A-167-38T, and only the grades tabulated should be used, subject to certain added restrictions and requirements. (3) Different heat treatments (a), (b), and (c) were described for different classes and use of these steels. Check tests of heat treatments were required for each lot. (4), (5), (6) and (7), Limitations for thickness, pressure, temperature and allowable working stresses were listed, and (8) Welding was to be done in accordance with paragraphs U-68, U-69, and U-70, with additional requirements (a) to (e) inclusive.

In April and May, 1940, certain changes were made in the wording of the reply, and specification A-167-39 replaced that of 1938. In April special item 4 was introduced, dealing with heat treatment of U-68 vessels, subsequent numbers being changed. Later, seamless forgings were added as the tenth item.

*N—Materials for Vessels Under External Pressure*

A joint meeting of groups of two committees of AWS and the Subcommittee of Ferrous Materials of the Boiler Code Committee was held in October, 1940, to consider questions of mutual interest. The group recommended the following: (1) A note should be added to the Boiler Code text, stating that the quality factors for castings in Tables P-9 and U-3 did not apply to cast steel fittings and dimensional standards of ASA Stand B16(c)-1939, since a 50 per cent shape factor was inherent in the designs. (2) When the welding end of cast steel valves or fittings was finish-machined and inspected, a quality factor of 100 per cent might be applied, but thickness of the welding end should not be less than that of the adjoining pipe. (3) Members of ASA Committees B-16 and B-31 who were actively engaged in setting allowable stresses should be appointed to the Subcommittee on Ferrous Materials. (4) A co-ordinating committee should be appointed fo Boiler Code Committee members and those of the ASA B-16 and B-31 groups to promote uniform action.

In November, 1940, the Committee appointed members to recommend a suitable revision of the Code to provide for (1) and (2) above. Recommendation (3) was questioned. Committees B-16 and B-31 would be invited to suggest representatives to serve on the Sub-Committee to co-ordinate the work. (4) was referred to the Special Committee on the Work of the Boiler Code Committee, to work out a procedure to accomplish the object of the recommendation.

### Testing Large Welded Gas Containers

In earlier years, the Committee had made an interpretation and an addition to paragraph U-64(b) (e) for the testing of large riveted gas containers, for which the foundations, and possibly the vessels, could not resist the weight or pressure brought on them from the weight or head of water. An inquiry from the Maryland Casualty Co. was considered at the June, 1938, meeting, asking if paragraph U-64(e) for riveted vessels could be applied to similar vessels of welded construction. This was referred to a special committee, which reported in December, 1938, that it could not reach agreement, and that this should be referred to the Special Committee to Revise Section VIII.

### Revision of Inspection Requirement in Code

Difficulties resulting from the inclusion of inspectors of municipalities in the Code arose when a state had not adopted the Code, and one of its municipalities had passed an ordinance creating a bureau of boiler inspection. In March, 1938, a Committee member recommended the word "municipality" be deleted from paragraph P-332.

### Written Examination for Qualification of Inspectors

In June, 1938, a major revision of paragraph P-338 was proposed, calling for inspection by a state inspector, a municipal inspector, or one regularly employed by an insurance company. Another sentence required that these inspectors be qualified by a written examination under rules of the State adopting the Code. In January 1939 a committee was appointed to consider the proposed form of revision of paragraph P-332.

The final draft was reported in January 1940, and adopted as it appeared in the 1940 edition. Inspection sections of the Codes for Locomotive, Miniature and Low Pressure Heating Boilers were amended to bring them into general agreement with the important parts of paragraph P-332.

### Hydrostatic Test After Seal Welding

An inquiry considered in July, 1938, related to the welding of screwed sections and nozzles installed on superheaters, economizers and water wall headers. The reply in this case, No. 862, permitted seal-welded threaded sections or nozzles not exceeding 2½ in. pipe size, without making a hydrostatic test before welding, provided the requirements of paragraph P-268(b) were met.

### International Relations

#### *A—Canadian Use of the Code*

At the February, 1938, meeting, it was announced that Canada had proposed the adoption of sections I, VIII and IX of The ASME Boiler Code. The Toronto Iron Works planned to build an unfired pressure vessel under paragraph U-69, and the customer asked that it should bear the ASME Code symbol stamp.

The Special Committee on the Issuance of Code Symbols reported that the usual form letter and form of agreement should be sent to this company. When the application was received, a letter would explain inspection and stamping requirements. The form of this letter, approved by the Special and Executive Committees, was read and all actions were accepted by the Boiler Code Committee.

#### *B—Australian Use of the Code*

A draft of a proposed revision of the section of the Boiler Code of the Standards Association of Australia was presented to the Committee in March, 1938, for comment. This related to a hydrostatic test under paragraphs A-22 to A-30 of the ASME Boiler Code. The ASME Secretary was requested to transmit the comments, with the appreciation of the Society that the SAA had so approved the ASME Code that it had used parts of it.

#### *C—Brit'sh Use of the Code*

In March, 1940, the British Standards Institution submitted the draft of its Rules for Carbon Steel Welded Boiler Drums, for comment. In its reply the Committee called attention to Tables P–2, P-3, P-9 of section I, and U-3 of its Code. Following further correspondence, D. B. Rossheim was requested to prepare a reply for consideration of the Executive Committee.

### Technically Qualified Secretary

In discussing the future work of the Committee in January 1939, mention was made of the increasing volume of work, and the fact that most of it was being carried by a small group of members. The Special Committee to Revise Section VIII called attention to the need of permanent highly qualified help.

Suggestions by the Special Committee on the Work of the Boiler Code Committee were reported in April, 1939, and included changes in the rules of procedure of the Code Committee, a review of membership of all Committees by the Executive Committee, recommendations for membership on the Executive Committee, a new Subcommittee on Power Boilers, and the setting up of a Special Committee, a new Subcommittee on Power Boilers, and the setting up of a Special Committee to study the problem of a secretarial technical staff.

In October an extensive report was presented, including a review of the membership of the 32 committees. The scope of the Boiler Code Committee's work was pointed out, and the conditions that would result if some of its members were prevented from devoting much of their time to Boiler Code Committee activities, were stressed.

In January, 1940 it was reported that the Special Committee of the ASME Council and Secretary Davis favored the appointment of a technical secretary when the problem of sufficient funds had been solved. A list of subscribers to a fund was suggested from corporations, individuals or holders of the Code symbol, in return for which they would receive interpretations and copies of the Code. The report was made to ascertain members' views regarding other methods of securing such a fund.

### API—ASME Code for Unfired Pressure Vessels

A third edition of the API-ASME Code for Unfired Pressure Vessels bore the date of 1938. New acceptable materials for which ASTM Specifications had been issued appeared in the Code, and some paragraphs were altered. Allowable stresses were indicated on charts rather than by a table. Section W on Fusion Welded Vessels was increased to 75 pages. Section R was smaller by one page. Section F was slightly increased. Section I was unchanged in length. Section S on Specifications was omitted. In all parts of the Code changes were made to meet requirements of the petroleum industry, and in certain parts by changes in the ASME Boiler Code.

### Tube Holes Through Welds

Permission had been granted in Case 850 for drilling holes in welded vessels to within ¼ in. of the weld metal, because results from tests had shown the practice a safe one. Since the tests of 1937 further tests had been carried out on vessels, with holes intersecting the welds.

Based on these tests, the Committee was asked to sanction the drilling through welds. Many reports and tests were made through 1940, and the matter was discussed at several committee meetings. Finally at the meeting in November, 1940, the Committee voted to hold the matter in abeyance until results from further tests to be made by the Combustion Engineering Company were made availailable through the Special Committee.

#### Non-Pressure Welding for Fusion Welding

In October 1938 the AWS had proposed to change the term "fusion welding" to "non-pressure welding", and to abandon the definition of fusion welding adopted by it and the Committee in 1931. Dr. Jacobus had written letters of protest, pointing out that the term fusion welding had a firmly established meaning in industry and in foreign rules and Codes. The Committee approved these letters of protest.

#### Caustic Embrittlement

In October, 1939, the Subcommittee on the Care of Power Boilers, pointed out that section VII had first been planned for small industrial plants with steam below 260 p.s.i. There had been no requests by revisions, though there had been requests for statements on the sulphate ratio for caustic embrittlement, paragraph CA-5. The Subcommittee believed the remainder of section VII should be extended to include superheat and high pressure.

In January, 1940, it reported an enlarged committee of chemists and feedwater specialists had been working on caustic embrittlement remedies for two years. Questionnaires had been sent out to some 500 plants operating at 400 p.s.i. and over. The chairman of the Feedwater Committee reported the investigation was being continued for boilers working at pressure below 400 p.s.i.

#### Misuse of Code Symbol

Improper uses of the Code Symbol in Florida, Oklahoma and Texas were discussed at many meetings of the Committee during 1939 and 1940. Mr. C. O. Myers made a number of trips to the Southwest for conferences with various state and city authorities, with the Railroad Commission of Texas, the National Board of Boiler and Pressure Vessel Inspectors, and many individuals, with a view to clearing up misunderstandings.

At the Committee meeting of January 1940 Mr. Myers was commended by vote for the excellent way he had conducted these matters and at a later meeting of the A.S.M.E. Council that body expressed its appreciation and thanks. A statement was made at one time during this period that over 1,000 symbols were on record at the office of the Boiler Code Committee.

#### Future Editions

In February, 1938, it was proposed that no future printing of all Sections of the Code in one volume, similar to the 1935 edition, would be issued, as at least three of the sections had become too large.

In October, 1939, the Special Committee on the Work of the Boiler Code Committee reported on the revised rules of procedure of the Boiler Code Committee, 13 Subcommittees and 18 continuing Special Committees.

#### Investigation by Department of Justice

The minutes of June 28, 1940, record that a representative of the Anti-Trust Division of the Department of Justice had called that day for information about the activities of the Boiler Code Committee, and that four members of the Committee had been designated to meet with him. After receiving much information about the Committee's practices, access to the minutes of Committee meetings was requested. No objection was offered except that the request should have come through the office of the ASME Secretary. The cause of the Department's action was evidently the complaints of actions by certain insurance companies in refusing inspection for just reasons.

### The Codes of 1940

#### *Section I, Power Boilers*

Section I, Power Boilers, VI, Rules for Inspection and the Appendix, were published in one volume in the 1940 Edition. Addenda included additional materials available and significant changes in welding requirements. Paragraph P-1(b) now called for submission of properties of materials other than described in the Code, as given in the Appendix paragraphs A-75 to A-85. Paragraph P-2(a) listed specifications for proper steels for plates, and paragraph P-3 dealt with available tubes for drums or parts exposed to the fire, and pipes.

Changes were made in tables for crushing strengths of steel plates and for shearing strength of rivets. The available specifications for superheater tubes and pipes were changed. A new Table P-2 for working pressures for tubes and nipples was added. Table P-3 for pressures on copper tubes was unchanged from the 1937 edition. Table P-5 for the factor "S" was greatly extended. Table P-6 for working stresses of non-ferrous materials for pipes in the formula of paragraph P-26, was enlarged.

Table P-7, Stresses in Ferrous Materials, was extended up to 950° and 1,200°F. paragraph P-101, Rules for Fusion Welding now included superheater headers. The specific gravity test of weld metal was omitted from former paragraph P-102(g), and paragraph P-102(h) was altered to use a new form of penetrameter. Paragraph P-103 contained five new specifications. Minor changes were made in paragraph P-104. Paragraph P-111 was enlarged but P-112 was reworded and enlarged. 30 pages of new rules for welding and operators were given in the Appendix.

Paragraphs A-100 to A-123. Use of the Lame formula for allowable pressure was introduced in paragraph P-180(b). Paragraph P-194(b) on domes was added. Throughout the 1940 edition, stress was to be taken from Table P-7, or P-6 where temperature exceeded 650°F. Paragraph 195(m) contained an additional formula and other new paragraphs. One new category for flat heads was added to paragraph P-198(a) and a paragraph P-212(e) was added. The minimum size of hand holes was given in paragraph P-258.

In paragraph P-269 parts were omitted and paragraph P-269(b) was added. Paragraph P-273(b) was changed and a new Table P-14 replaced the former table. Table P-15 was enlarged, paragraph P-322 was reworded. Changes were made in paragraph 329 on Hydrostatic Pressure Tests, and a paragraph was added.

#### *Changes in Appendix*

The Appendix contained the latest tables of American Standards for Steel Pipe Flanges and Fittings (1939), extended to 2,500 p.s.i., and new Tables A-6, A-7 and A-8. New Tables A-9, A-10, and A-12 were added. Paragraphs A-22 to A-32 on Hydrostatic Tests were altered and contained additions. Fig. A-13 was added.

A new section on approval of new materials under the ASME Boiler Construction Code, paragraphs A-75 to A-85, described how application should be made to the Committee for permission to use a material not included in section II.

Paragraphs A-100 to A-110 were more extensive than paragraphs UV-30 to UA-46 of the 1937 edition, and included Standard Qualification for Welding Procedure and Welding Operators, Manual Arc and Gas-Welding for Ferrous Materials, and a four page Appendix was added.

Section I of the Code contained 136 pages of text with an appendix of 107 pages. Section I, Power Boilers, showed a decreased list of cities.

*Section II—Material Specifications*

Paragraphs S-12, S-3, S-6 and S-27 were deleted. There were 16 new specifications, S-42 to S-57 inclusive.

*Section III—Boilers of Locomotives*

The 1940 edition contained no paragraphs dealing with fusion welding of the boiler shell. S-27 and S-28 had been omitted from the list of available materials in paragraph L-2. The table for crushing strengths of steel plates was increased by giving values for S-42, S-43 and S-44. Paragraphs L-59 to L-71 were altered to agree with the Power Boiler Section. Paragraph L-82 was changed for the same reason. The Appendix contained the same paragraphs in paragraphs LA-1 to LA-11 as appeared in the 1940 edition of the Power Boiler Code. The Appendix closed with Fig. LA-1. This covered 29 pages and a 3 page index was added.

*Section IV—Low Pressure Heating Boilers*

In this section, the principal changes were in paragraphs H-43 to H-54 of Part I, and the corresponding paragraphs H-96 to H-107 of Part 2. Tables H-6 and H-7 and their correspondents in part 2, Tables H-9 and H-10 were unchanged. Provision for applications to use materials other than those of section II was added, requiring the use of new rules, paragraphs HA-1 to HA-11, given in the Appendix. A paragraph in paragraph H-12 defined the application of Table H-1. New paragraphs H-64(c) and H-117(c) were added.

Alterations were made in paragraph H-65 of Section I and paragraphs H-118 of Part 2 on Hydrostatic Tests, to fix test pressures on vessels to operate above 40 p.s.i. and below 30 p.s.i. Inspection was described in paragraph H-66 to H-68 in the 1937 edition, but in the 1940 edition inspectors were required to have been "qualified by written examination . . ." A new Form No. H-1 was added to the appendix. This section covered 44 pages and an index of 4 added pages.

*Section V—Miniature Boilers*

In this Section, paragraphs MA-30 to MA-40 were added respeeting permission to use materials other than those listed in section II. Paragraph M-2 referred to them. Paragraph M-16 was changed to agree with changes in the Power Boiler Section. This enlarged section of the Appendix included Standard Qualifications of Welding Procedure, described under the Power Boiler Code.

This part of the Appendix covered 30 pages, while paragraphs M-1 to M-20 covered only eight pages. A paragraph was added to paragraph M-13. Low water fuel cutoffs were called for in paragraph M-18, and inspectors "must have been qualified under state rules". The Appendix now contained paragraphs MA-30 to MA-40. Section V was extended to 42 pages, with an index of 1½ pages.

*Section VI—Rules for Inspection*

The 1940 edition of Rules for Inspection contained no changes.

*Section VII—Care of Power Boilers*

The only changes made in this Section, as described earlier, were those in paragraph CA-5 of the Appendix, dealing with caustic embritement. The statement was made that insufficient operating data at present did not indicate the value of other preventive measures. Section VII contained 88 pages with no index, but a table of contents of 2½ pages preceded the text.

*Section VIII—Unfired Pressure Vessels*

The 1940 edition of Section VII was made more definite. The number of available materials was increased. Tables for allowable stresses were more extensive and more detailed. Paragraph U-3(b) included marking and paragraph U-9 was omitted. Paragraphs U-3(a) and U-4 were changed. Paragraph U-11(b) recommended frequent inspections of vessels containing corrosive substances. Two specifications for shell plates were removed, but four were added for alloy steels. New specifications for tubes were added. Paragraph U-13 (g) (3) gave maximum stresses and paragraph U-13(g) (6), required use of the American Standard as given in Tables UA-3 and UA-4.

A new paragraph U-13(j) on non-ferrous plate material was added. New Table U-2 was the same as Table P-7 of the Power Boiler Code. Paras U-20(e) and U-20(f) listed additional requirements. Figure U-1 contained an added note. The Section on Dished Heads, paragraphs U-36 to U-38, was altered, and paragraphs U-37(c) and U-37(d) were added, with a formula and new Fig. U-2. Paragraph U-39 contained an additional figure, and minor changes were made in paragraphs for manholes, handholes and nozzle openings.

Paragraph U-61(c) on marking of plates was new. Paragraph U-64 was altered. Inspectors described in paragraph U-65 were now required to have written examinations. Minor changes were made in paragraphs U-67 and U-68 on fusion welding. The test for specific gravity of the weld metal was deleted, and a paragraph was added to those on retests. Paragraph U-68(b) contained one new paragraph.

Paragraph U-69(c) referred to qualifications given in Appendix, Paras U-30 to U-53, and rules for this in paragraphs U-54 to U-70, thus removing much from the body of the 1937 edition. Paragraphs U-69(d) and U-70(d) now provided for certain procedures when paragraphs of the Appendix were used. Paragraph U-71 provided for four new specifications, though four former ones were deleted from those of 1937, and four new specifications for tubes were added. Paragraphs U-71(c) was amended. The use of 65F for fixing hydrostatic test pressure in paragraph U-77(c) was the same as that then given in paragraph U-64

Paragraph U-78(g) gave the manufacturer the right to remove specimens from the weld metal of joints, for examination for soundness during inspection. New paragraphs U-88 and U-93 permitted openings for pipe connections. Paragraph U-91 permitted material for brazing to be taken from shells conforming to specifications under paragraph U-71. No changes were made in paragraphs on enamelled vessels, or in those on electric resistance butt welding.

Paragraph U-120 gave eight new specifications for steel plates and tubes, retaining seven from the 1937 edition. In paragraph 140 the tensile properties called for in S-18 were made minimum requirements. Four illustrations were added to Fig. U-28. A number of additional paragraphs were given in paragraph U-142. Paragraph U-142(b) was altered. U-142(c) was made U-142(e) and paragraphs U-142(c) and (d) and (f) were added, the latter being accompanied by Fig. U-29.

Two additional record forms, Form No. U-1 and Form No. U-2,

(*Continued on page 267*)

*An address delivered at the Annual Meeting of the Engineers' Council for Professional Development, New York City, October 16, 1953.*

# The Great and Growing Need for More Trained Engineers

*by*

Horace Liversidge

*Chairman of the Board, Philadelphia Electric Company.*

#### Little Things Make Lasting Impressions

Little things that happen during the formative period of our lives oft'times leave lasting impressions. I can well recall one of my earliest experiences as an embryo engineer under the practical tutelage of a man who was given two weeks' time to discover whether I had the requisite amount of brains and brawn to fill the job for which I had applied. On the tenth day, with a hodgepodge knowledge of the rudiments of the job I hoped I might be given, my instructor said, "I'm going to turn you in tomorrow with a good record." "But," I protested, "I hardly know anything yet about this job." "Well," said he, "I think you do; you're the only fellow with a college education who, in my time, has ever applied for a job with this company who didn't try to tell us all he knew before he had been here a week."

That observation has served me well these many years. It appears particularly apt on this occasion, for I am keenly aware of the fact that this audience is more familiar than I am with the subject of this evening's presentation. It behooves me, therefore, to be exceptionally careful to stay well within the bounds of factual information.

#### Serious Shortage of Engineers

However, I can at least hope that my comments will serve to emphasize the seriousness of the present shortage of engineers, and perhaps help to create a better understanding of what must be done by those interests which have not only the greatest stake in America's future, but the greatest potential resources to safeguard the *well-being of that future.*

It appears self-evident that the shortage of engineers today has already produced some highly precarious situations in our economic life. It is also apparent that this shortage has been occasioned in large measure by the rapid and broad industrial expansion of recent years — without corresponding attention being given to concurrent demands for more technically-trained men and women. The most disturbing feature of all is that there seems no practical way to substantially improve matters before they become worse. It is a subject which presents so many complex and diversified problems that any attempt by me to point out more than a few of the reasons for the crisis or to suggest any all-inclusive solution would indeed be presumptuous.

Back in the 30's, — in fact even as late as the middle 40's, there was much loose talk about overcrowding in the engineering professions. Some of that talk came from industrialists themselves. These men not only underestimated the number wanted for strictly professional employment in engineering posts, but also disregarded or discounted industry's need for technically-trained men in management, in sales, and in fact at every point where scientific knowledge is transforming our methods of production and control. We are all acquainted with the wide publicity given similar unsound forecasts in government publications, popular magazines, and newspapers which discouraged young people from scientific careers. Yet, contrasted with this, a recent statement estimates that while industrial research and development has increased nearly 500 per cent in a little more than the past decade, the number of scientists and engineers has barely doubled in that same period.

#### Problem Not Widely Recognized

Two major segments of our society — our educators and our industrial leaders — have a vital interest in this problem. The educators have been especially cognizant of it during the past decade and their studies and recommendations deserve great credit. Industry, on the other hand, has only lately shown any serious concern about the matter. Even so, this concern largely has been devoted to wishful thinking, which concludes that the problem will somehow correct itself. In fact, we can count on the fingers of one hand those few outstanding leaders in industry who have demonstrated a clear-cut appreciation of the situation and have taken some steps towards its improvement.

The general public has little awareness of the problem and the serious consequences it may portend. People traditionally accept the contributions of science and engineering as an everyday matter. And what serves to aggravate things is that it has come to expect an ever-increasing improvement in their standards of living. But, just as surely as we are here today, this improvement will cease if we fail to recognize the interdependence of industry and technology in our social and economic future.

#### Science Adds to Cultural Values

And right here I would like to make this personal observation. It seems to me that we often underestimate the true social and cultural values of industrial science and technology. We speak as if our modern progress in engineering had merely given us new tools and physical comforts. But the civilizing influences, even the spiritual powers of our people, have been strengthened and broadened as a result of our progress in applications of science. I would like to add further that in the industrial expansion ahead, we make certain that these same influences are given even greater attention than has been shown them in the past.

It is surely no mere coincidence that the period of growth of our school system and the growth of all our colleges and universities is precisely the period of our greatest gains in industrialization. Our hope of a general school system was not possible until we had mechanical power to replace hand power. Until then the young people could not be released from daily work on farms and in mills to attend school. Today in the United States we have some 34 million young people in our schools, easily ten times the number that we had fifty years ago. Our colleges and universities have ten times the total population they had in 1900. This is a cultural value added to our common weal because we have acquired new tools, new methods, new economic organizations, and new national economy. All of these, to a considerable part, are derived from the improvement in our knowledge and use of technology.

#### Technological Progress

We have not yet come to realize how fully and how vitally modern technological progress has changed our national thinking. When you put new tools into men's hands you change everything, even their systems of government and the relationships between governments.

We used to hear a great deal about technological unemployment. The phrase is not so familiar now because when one looks at the total balance sheet of productive employment in this country, he finds that the use of new tools and new methods, although inconvenient at a given time or at a given place, in the long run increases both total employment and the number of jobs which require the higher skills.

Our great national strength, whether for war or for peace, lies in the industrial power we can mobilize. Our greatest dangers come from the abuse by us or by others of the technology we now command. Our greatest opportunity to make conditions favorable to freedom elsewhere in the world and more secure in our own country is by helping to spread technological knowledge and skill.

#### Engineering Shortage Slows Progress

It is a recognized fact today, supported, if you please, by columns of bold-faced, help-wanted advertisements covering every known branch of science and technology, that engineering developments basic to our country's long-range planning will require not only all the brains available, but if we are not careful, may deplete the supply of engineers to the point where it is likely to have serious effects on our future standards of living.

#### Lure of Atomic Research

Today in all the various plans of industrial expansion we hear much about the great and growing field of atomic energy and electronics. Important as they are, the real significance of these developments, so far as demand for skilled engineers is concerned, is that nuclear physics and electronics have drawn heavily on an already limited supply of technically-trained youths who are badly needed both for expansion and for replacements in engineering ranks generally.

The public concept of the great need of the electronic and nuclear sciences for large numbers of engineers is greatly distorted, and somewhere along the line this should be corrected. (At present, in the senior electrical group at one technical school, three out of four men want to enter the electronics field. This is out of all proportion to industrial requirements. This is clearly illustrated by the fact that one large electrical manufacturing company used only 25 per cent of its new engineers in direct electronics applications.)

Our future industrial program, however, *does* call for more and more technical researchers. In fact, one large manufacturing corporation recently reported it now has in its research organization *alone* more than twice the number employed in the entire company about twenty years ago.

#### Shortage Will Continue

The discouraging part of this manpower situation is that there is no apparent means whereby we can quickly prevent a further shortage. Personally, I am inclined to believe we will continue to have a serious shortage for a long time to come.

Highly-trained technical assistance is an absolute essential to the business life of our nation. The supply must keep pace with the expanding industrial economy. Yet a backward glance will show that for years we have concentrated our principal attention on production facilities and have left the developing of engineering and scientific brains to our educators. Thus far we have been extremely fortunate. I sympathize with those educators, who for many years have been sounding the alarm of an increasing critical scarcity of engineers, but in frustration have felt like a voice crying in the wilderness.

The urgency of the present shortage is compellingly dramatized by the fact that the placement office of just one school in which I am personally interested, Drexel Institute of Technology, had 8,344 positions described to it as available to its graduates at a time when the school was graduating a grand total of only 414 engineering and business administration students.

#### New Era of Expansion

We would be blind indeed if we failed to recognize that the door has been opened to an era of industrial and commercial development unequalled in world history. The leaders of industry will be extremely short-sighted if this program is carried forward without a parallel expansion of facilities for higher technological education.

We have already experienced a totally unexpected increase in the number of professional engineers in this country — an increase in the order of tenfold since 1900 — but there has also been a corresponding rise in the ratio of engineers to the total number of industrial workers. In 1900 there was in round figures one engineer for every 255 workers. In 1950 there was one engineer for every 65 workers. Dean Hollister of Cornell University has estimated that there was one engineer for every 50 workers last year, and I have no doubt that if he has reviewed his data recently they will show an even greater need for engineers.

### Great Opportunities for Engineers

It seems quite obvious that an initial step toward relieving the shortage of engineers can be taken by creating an atmosphere of better public understanding and an appreciation by young people of the great opportunities in the field of engineering and scientific pursuits.

An interesting illustration of this conclusion and one that sounds an encouraging note in one instance occurred about a year ago when the Drexel Institute of Technology, which has an enrollment in its engineering courses of approximately 1,500 students, made a survey of Philadelphia and suburban high schools to ascertain what percentage of graduates planned to study engineering. The results showed that the percentage of graduates preparing for college had not changed during the previous year, but that there was an increase of 20 per cent in the number *planning* to enter engineering colleges.

The American Institute of Electrical Engineers, The American Society of Mechanical Engineers, The American Society of Engineering Education, The Engineers' Joint Council, and others have committees on guidance and on manpower which advertise in the secondary schools not only the public need for engineers, but also the opportunities for technical and general education which are offered by colleges of engineering. These efforts have been well timed, and should be productive of great good.

### Need for Greater Educational Facilities

However, this is but one phase of the problem. In addition to attracting increasing numbers of young people to the engineering profession, the colleges must be prepared to cope successfully with a vastly increased student body through additional instructors; by providing for the higher costs of technical instruction; and by expanding their facilities in building and equipment.

This need for expansion is one of the most important phases of the problem and, in my opinion, should be given a primary place in our future planning. Its solution will certainly require the combined attention of both educational administrators and industrial leaders. Right here, it seems to me, we have a pretty hard nut to crack. While industry is the principal cause of this shortage of engineers, it does not seem to understand the problem and thus far has evidenced almost an indifferent attitude toward its solution. Now please don't ask me to give a reason for this. I don't know. I only know it is a real problem, and one that must be solved before ready headway can be made.

### Realistic Approach Needed

As I view the matter, the correction of today's shortage of engineers requires a realistic approach in which stockholders, directors, and executives realize that their business future demands an ever-increasing number of trained scientists and engineers. They must be thoroughly aware of the fact that such personnel cannot be picked off the sidewalks. It takes years of training and costly facilities to produce the needed technological manpower.

Now there is very little in what I have said that is not already common knowledge to most of you in this audience. Nevertheless, I hope it will serve to emphasize a situation that seems quite clear to educators, quite hazy to industrialists, and is neither understood nor appreciated by the general public.

Unfortunately, industry's apparent well-being today is largely taken for granted. This is one of the reasons for the dilemma in which we find ourselves. The bold conclusion we are forced to accept is that industry should pay for its additional scientific and engineering brains just as it now pays for its other facilities for doing business. Industrial leaders must learn to understand that contributions in support of engineering and scientific education should be a direct charge against the business, not a charitable gift. Management has the responsibility of selling this to directors and stockholders. The outstanding fact is that the problem will not be solved unless and until those responsible for directing industry take the lead.

### Action Needed Now

So that I may not be misunderstood, permit me to re-emphasize briefly what has already been pointed out, that our industrial economy is in the initial stage of an emergency. There is a definite scarcity of scientists and engineers, and this scarcity will become worse rather than better during the next decade. It may well be longer before conditions return to normal. This situation demands action now, not five or ten years hence. Our engineering colleges are presently the only available sources of supply of technically-trained men and women. We know there is little possibility of increasing their student bodies without greatly expanding their facilities and teaching forces. This requires large cash outlays. The one segment of our economy that has the greatest stake in this program is industry and, in my opinion, industry must assume the responsibility of providing the major part of such requisite financial aid.

I repeat, we are in an emergency, but on the other hand, one that *can be* short-lived if we face it squarely and act accordingly. Furthermore, this is not a problem to be confused with the complexities of higher education generally. In simplest terms, it is the problem of insuring an adequate supply of scientific and engineering students. It is a problem which rests squarely on the shoulders of industry, a problem which industry in its spectacular developments has itself created. Actually, industry and educational institutions share in the responsibility to provide a workable solution.

### Electric Utilities Vitally Concerned

Electric utilities particularly should be energetic in the support of such a program. Here we have a business that is strongly dependent on the industrial growth of the community for its own expansion. It not only has an individual interest in obtaining engineering personnel, but should have a vital interest in the health of business generally. I suggest that utility executives have an especial obligation for leadership in seeing that the needs of engineering colleges in their particular communities are met.

### American Industry Cannot Fail

The development of our national economy is predicated on the latent ability of American industry to meet crises as they arise — to grasp, as well, the opportunities the future may have in store. I, for one, am confident that business men, properly alerted to the problems confronting them, will not fail to respond adequately and promptly to these emergencies.

Humanity is today poised on the threshold of an unpredictable future. Yet who is there among us to say that we are not woefully unprepared spiritually, morally, and physically to cope with the problems confronting us ? The present generation has created these conditions — now it faces the responsibility of determining whether these fantastic forces that have been unleashed shall be used for our ultimate destruction or for a future un-

(*Continued on page 267*)

# Metropolitan Toronto

*by*

**Frederick G. Gardiner, Q.C.**

*Chairman, Toronto Metropolitan Council, Toronto, Ontario.*

Though this paper is not directly concerned with engineering, it is of interest because it describes the organization of a form of administration designed to overcome the difficulties of municipal government in metropolitan areas. It discusses a unique venture on this continent, the operations of which are sure to be closely watched by engineers, so many of whom have a professional interest in municipal affairs.

Our article is a condensation of an address delivered before the Toronto Branch on December 3, 1953.

In the Toronto area a contributing factor to the creation of satellite municipalities around the city was the decision made by the city fathers in 1912 that there should be no more annexations. The Town of East Toronto was annexed in 1909, the Town of West Toronto in 1910 and the Town of North Toronto in 1912. These annexations gave rise to administrative difficulties, the city government contended that after each annexation the city taxpayer paid $2 for each $1 paid by the taxpayer in the annexed area to bring the municipal services in that area up to standards prevailing in the city. The decision that there should be no more annexations was as final as it was unfortunate; it failed to recognize that time marches on and that you cannot stand in the way of progress.

Over the forty years from 1912 to 1952 the metropolitan area became divided into 13 separate municipalities, composed of one city, three villages, four towns and five urbanized townships. Each was geared to a local pattern of development, none was much concerned about what was happening to its neighbour and none was interested in the general and proper development of the whole area. With this impractical and unrealistic development something was bound to happen and it did not take long to occur.

The Toronto and York Planning Board lined its walls with maps, but in the absence of power to tax the constituent municipalities nothing was accomplished. We had to be driven by intolerable inconvenience and the threat of financial difficulty to necessary steps to solve our problems. When some of our municipalities had difficulty in selling their bonds it was evident that a major operation was necessary.

### Toronto Metropolitan Act

The Toronto Metropolitan Act was the result of an application by the City of Toronto to the Ontario Municipal Board for an order directing the amalgamation of the 13 municipalities into one municipal corporation.

Eleven of the 12 suburban municipalities righteously and indignantly defended their local autonomy. In the face of violent and vitriolic opposition the Board concluded that it was not advisable to force the opposing municipalities arbitrarily into one amalgamated unit. On the other hand it recognized that the dangers inherent in the situation required early and effective action and so recommended that the Province pass legislation to establish a metropolitan system of municipal government for the whole area. Because of the comprehensive nature of the services which will be administered by the Metropolitan Corporation, the plan is unique in North America. The closest approximation is the London County Council in England, which is composed of 150 members from 28 boroughs and provides metropolitan services for 3½ million people.

The Metropolitan Toronto Act establishes a system whereby the 13 municipalities may preserve their identity and continue to administer those services which are local in nature and at the same time combine for the provision of those services which are metropolitan in nature. By establishing an additional level of government for the provision of metropolitan services, the way is left open for eventual amalgamation of the constituent municipalities if that is considered to be the best course to follow. On the other hand, if this new metropolitan form of government operates successfully, there may never be any necessity for actual amalgamation and enforcement upon the dissenters of that political union which they so violently oppose.

The services for which the Metropolitan Corporation is responsible are water supply, sewerage and sewage disposal, housing, education, arterial highways, metropolitan parks, certain welfare services and the overall planning of the area.

### Responsibility for Services Outlined

With respect to water supply, on January, 1954, the Metropolitan

Corporation will automatically become the owner of all pumping stations, treatment plants, reservoirs and trunk mains in all the 13 municipalities. No compensation for these works will be paid to the local municipalities, but the Metropolitan Corporation will assume outstanding debentures issued in connection with their establishment. The Metropolitan Corporation will sell water to each of the 13 municipalities by meters at a rate sufficient to pay the cost of the operation and extension of the metropolitan water system. The local municipalities will continue to own their water distribution systems and will sell water to individual consumers at prices fixed by themselves.

With respect to sewage disposal the situation is the same. The Metropolitan Corporation will own all sewage treatment plants and trunk mains and will accept sewage from the 13 municipalities through meters at a fixed rate. The municipalities will retain their local collection systems and will charge their residents for sewage service upon such basis as the municipalities may determine.

As to arterial highways, the Metropolitan Corporation will designate those highways which will become metropolitan roads on January 1, 1954, will assume the outstanding debentures issued for their construction and will pay the cost involved in the maintenance and extension of such highways. The Metropolitan Corporation will also undertake the building of future expressways, parkways and arterial highways and will provide the area with an adequate system. Metropolitan roads will be paid for 50 per cent by the Metropolitan Corporation and 50 per cent by the Province.

With respect to public transportation, the Toronto Transportation Commission, which has been a separate authority for 30 years, will be expanded into the Toronto Transit Commission. The new Commission will have a monopoly of public transportation in the metropolitan area, with the corresponding responsibility of providing public transportation throughout it. The Toronto subway, which is now nearing completion, will become the main stem of the transit system, which, with surface lines, trolley coaches and bus facilities, will provide the required public transportation.

All independent bus lines now operating in the suburbs will be acquired by the new Toronto Transit Commission on July 1, 1954. Compensation will be paid to their proprietors, such compensation to be settled by mutual agreement, or, if mutual agreement cannot be arrived at, by the Ontario Municipal Board.

#### Education, Health, Housing

In order to equalize the cost of education throughout the area, the Metropolitan Corporation will assume all outstanding debenture debt for schools in the whole area and will pay each year to the school boards in each of the constituent municipalities a maintenance grant of $150 for each primary pupil, $250 for each secondary pupil and $300 for each vocational pupil. This will permit each of the local municipalities to provide a reasonable standard of education for its children. If any local municipality desires to provide a higher standard of education than these payments will permit, it may do so, but at extra cost to its taxpayers.

The Metropolitan Corporation will be paralleled by a Metropolitan School Board, which will choose the location of new schools and coordinate the activities of each of the local school boards, which will be continued.

Certain health and welfare services, such as the hospitalization of indigent patients, the provision of homes for the aged and the maintenance of wards of children's aid societies, will become the financial responsibility of the Metropolitan Corporation. The Metropolitan Corporation will also provide and maintain a courthouse and a jail.

The Metropolitan Corporation will have all the powers of a municipality with respect to the provision of housing and redevelopment, which will be one of its major problems.

A Metropolitan Planning Board will have jurisdiction not only throughout the metropolitan area, but also on a regional basis, extending over each of the adjoining townships on the borders of the metropolitan area.

The Metropolitan Corporation is empowered to establish metropolitan parks and green belts; up to date it has been quite impossible to procure the necessary cooperation between the 13 municipalities.

#### Metropolitan Budget

The whole metropolitan undertaking will be financed by a metropolitan budget. The cost of operating the Metropolitan Corporation will be charged to the 13 municipalities in the ratio of their aggregate assessments. During the past two years, the Greater Toronto Assessment Board, established by the Provincial government, has been reassessing all the industrial, commercial and residential properties in each of the 13 municipalities on the same basis. This reassessment will be completed before December 31, 1953, so that each of the local municipalities will contribute to the cost of operating the Metropolitan Corporation in the ratio that its total assessment bears to the total assessment of the whole metropolitan area. The aggregate assessment of all properties in the metropolitan area will be approximately $2½ billion.

The Metropolitan Corporation will issue tax bills to each of the 13 municipalities. The metropolitan tax rate will be sufficient to provide the funds necessary for its current operation and to finance the capital expenditures to be undertaken. Each of the 13 individual municipalities in turn will incorporate its contribution to the Metropolitan Corporation in its local budget. Thus each municipality will pay its appropriate share to the Metropolitan Corporation and, in addition, will tax its taxpayers for the amount needed to provide the local services for which it remains responsible.

The local municipalities will no longer issue debentures for any of their requirements If they need capital for local undertakings, they will apply to the Metropolitan Corporation to issue such debentures; if the Metropolitan Corporation agrees that the debentures tures should be issued it will issue them; if the Metropolitan Corporation considers that such debentures should not be issued, the local municipality may appeal to the Ontario Municipal Board, whose decision is final. All debentures will be backed by the total assessment of the whole area. In respect of debentures issued for the account of a local municipality, that municipality will tax its proprietors each year an amount sufficient to carry the annual payments necessary to amortize such debentures.

The Province of Ontario, recognizing that substantially increased expenditures will have to be made to correct a situation which is the accumulation of 40 years of unsound municipal development and that the only tax source for municipalities is real property has established a system of grants which will be made by the Province to the Metropolitan Corporation. The Provincial grant will be $4 per capita; as there are approximately 1¼ million people in the Metropolitan area, the Metropolitan Corporation will receive initially from the Province about $5 million. This Provincial contribution will lighten the burden on the taxpayers of the area and will make it possible for the necessary metropolitan services to be provided over a reasonable period, in accordance with well defined plans and without increased taxation.

In addition to the annual grant, the Province has paid the organizational costs of the Metropolitan Corporation up to January, 1954, when the Metropolitan Corporation actually took over the administration of metropolitan services.

### Council of Elected Members

The Metropolitan Corporation will be governed by a Metropolitan Council of 24 members, which is already in operation. Twelve members are from the City of Toronto and 12 are from the 12 suburban municipalities. In order that the plan may conform to the accepted principle that there should be no taxation without representation, the 24 members are elected members of their local councils. The 12 from the City of Toronto are the mayor, the two controllers who led the poll at the latest municipal election and the 9 aldermen who led the poll at that election. The 12 representatives from the suburbs are the heads of their respective municipalities, whether they be mayors, as is the case in the four towns, or reeves, as is the case in the three villages and the five townships.

For the rest of 1953 and for 1954, the chairman of the Metropolitan Council was appointed by the Province commencing on January 1, 1955, the 24 members of the Metropolitan Council will elect their own chairman from among their own number or from outside, as the council decides.

This metropolitan system of municipal government is the solution offered by the Province of Ontario for the problems that confront metropolitan areas. It is a calculated attempt to allow the municipalities in a metropolitan area to preserve their autonomy in respect of matters which are local in nature and to combine them for the provision of municipal services which are metropolitan in nature. √

## THE ASME BOILER CODE. Part V

(*Continued from page 261*)

were added. The Appendix was enlarged to include Tables UA-1 to UA-4 and Table UA-5, taken from the 1939 edition of American Standards. Paras. UA-1 to UA-11 were enlarged. No changes were made in paragraphs UA-12 to UA-17, but slight changes were made in paragraphs U-18 to U-24.

Reports and bulletins of the AWS led to a new section, paragraphs UA-30 to UA-70, which replaced the matter in the Appendix of 1937 on welding. This dealt with Standard Qualifications for Welding Procedure UA-30 to UA-40, and Operator Qualifications UA-41 to UA-53, with an appendix of four pages. The former rules in paragraphs U-69 to U-70 vessels now only referred to paragraphs U-54 to U-61 and paragraphs U-63 to U-70. The standard qualification contained 24 figures and five tables. The Rules contained 10 figures.

The new Section on the Approval for New Materials, paragraphs UA-71 to UA-81, was simliar to that of Sections I, II, IV and V. Fig. UA-44 gave acceptable forms of rivet heads after driving. A section on Etch Tests, paragraph U-85 and Fig. UA-45, were added to the Appendix. Section VIII of the Code contained 177 pages, with an index of 11 pages. √

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## THE GREAT AND GROWING NEED FOR MORE TRAINED ENGINEERS

(*Continued from page 264*)

believable in its potentital contributions to mankind's social and economic well-being.

If our groping steps shall lead to this better future — as I firmly believe they will — then we must face the startling fact that the demands for technological know-how is not something that can wait until the next decade or so to be satisfied. These demands will become more insistent as time goes on. It may prove of even greater importance in the ultimate scheme of things than the most extravagant ideas of our present day forecasters.

If we accept this view of the future as a real possibility, then our obligation demands that we take positive steps now to insure a reasonable solution of this problem before it reaches unmanageable proportions.

However, our immediate concern is not the distant future but a demanding problem of the present. What we plan now, what we do now is certain to have far-reaching effects on our long-range program. To express it mildly, very mildly, if you please, it behooves all of us, industry especially, to take a far greater interest in the future of technological education than has been shown in the past.

Should this be neglected, industry will fail to meet its full responsibilities and the only alternative remaining appears to be complete government subsidy.

Heaven protect us from such an eventuality. √

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# Trans-Canada Highway Progress

Construction rate of the Trans-Canada Highway increased during the year 1953, according to a report issued in January by Public Works Minister Robert H. Winters, M.E.I.C. Ontario, Saskatchewan, Alberta, British Columbia and Manitoba, in that order, have the longest stretches of completed highway. P.E.I. with better than 44 per cent of its total mileage completed leads the field in this respect.

Nova Scotia spent the first year since the provincial government signed the Trans-Canada Highway agreement, conducting tests and surveys along the proposed route. Construction was expected to start early this year. The Canso Causeway which will provide an important link in the Trans-Canada Highway system will be completed in 1955.

Contractual commitments made by the provincial governments and authorized for Trans-Canada Highway construction as at the end of December 1953, amounted to $137,825,383.97.

# "Progress of Engineering Science" Part 3

From the London Quarterly Review, October, 1863

Art I.—1. *Lives of British Engineers.* By Samuel Smiles, 3 vols. 8 vo. London, 1862.

2. *Proceedings of the Institute of Civil Engineers*, 1842 to 1863.

3. *Sir W. Armstrong's Address delivered at the Meeting of the British Association at Newcastle*, 1863.

Among the various contrivances which have been introduced to assist in rendering the great ocean available as a highway to the nations, none are more beautiful than the lighthouses that crown the headlands of every maritime country, or point out the dangers of the mid-ocean. Those that are erected on the shore too often, it is true, partake of the absurdities of modern shore-going architecture in general. There are Grecian and Gothic lighthouses, and even Egyptian towers, that would fain cheat us into the belief that they belong to long past ages; but even then we forget these absurdities in contemplating the beauty and perfection of their photogenic arrangements. These have occupied the attention of some of the ablest scientific men of modern times, and they now send their rays through the darkness with a space-penetrating power that a few years ago would have been deemed impossible, and vary or alternate them with a steadiness and precision that has given confidence to thousands, and saved many a storm-tossed vessel from destruction.

To Smeaton is due the honour of having fixed the form of the best class of these structures; and even now the Eddystone remains a model which has hardly been surpassed. Nothing could exceed the patient ingenuity with which that great engineer mortised his tall tower to the wave-worn rock, and then dovetailed the whole together so as to make rock and tower practically one stone, and that of the very best form for resisting, or rather for deadening, the action of the waves. The Bell Rock of the elder Stevenson, which succeeded this, is taller, and even more graceful, but its foundation was larger, and the difficulties far less. The Skerryvore lighthouse of the younger Stevenson surpasses both, whether in beauty of construction or grace of form, and would excite equal admiration for skill in overcoming difficulties, were it not that it is the third of its class, and the work was lightened by the experience previously gained.

It is to be regretted that these structures are generally placed so far at sea that they are very little seen, for they are, taken all together perhaps the most perfect specimens of modern architecture which exist. Tall and graceful as the minar of an Eastern mosque, they possess far more solidity and beauty of construction; and, in addition to this, their form is as appropriate to the purposes for which it was designed, as anything ever done by the Greeks, and consequently meets the requirements of good architecture quite as much as a column of the Parthenon.

Among English lighthouses that on the pier at Sunderland is remarkable, not for the beauty of its form, certainly, but for the operation performed upon it by Mr. Murray in 1841. In consequence of a breach made in the pier by the sea, and the pier being lengthened, it was requisite either to take the lighthouse down, or to carry it a distance of 475 feet, to a spot one foot, seven inches higher, at the end of the new pier, and it was necessary to carry it round a corner, and turn it partly round, to suit its new situation; a task from which the mightiest Genie of Oriental fable might have shrunk appalled.

The mode in which this was effected was simple as it was ingenious. Holes were first cut through the building north and south, a little above the foundation, and timbers passed through them and wedged tightly up against the masonry. The same operation was repeated east and west, and, alternately supporting each portion in succession, a complete platform of timber was placed under the building. Each portion of this was again supported in succession by screws and wedges, and eight lines of rails were inserted, and over these eight baulks of timber, to the underside of which were attached 144 little wheels, each five inches in diameter. Another platform was inserted under the

October, 1863 — Queen Victoria has recently celebrated the twenty-fifth anniversary of her accession, the American civil war is at its height, Confederation is nearly four years from birth, and the "London Quarterly Review" publishes an article on the "Progress of Engineering Science" by an unknown author.

At first, we thought of trying to digest this article, with frequent quotations, but have come to the conclusion that the flavour of the original would be wholly lost by any interference with its continuity and so have decided to publish it in full in four instalments. We hope our readers may enjoy as much as we have the relaxing rhythm of the writer's Victorian prose, the profundities of his rhetoric, his prophesies — right and wrong — his comments on current engineering projects and his breathless admiration for the engineers of his day.

To turn the author's pounds sterling into 1953 Canadian dollars, multiply by fourteen.

lantern, and tied to the lower platform by a chain inside the tower, and straps of iron outside; and great shores from the outriggers of the lower platform completed the cradle in which the building was supported. It was then pushed and pulled by screws 28 feet northward, when the railway and the wheel baulks were taken out one after the other and reversed, and it was then drawn by winches 447 feet eastward, at an average rate of 33 feet per hour; but at one time it was moved 84 feet in one hour. The light was never extinguished, and no hitch or accident occurred, though the building was sixty-nine feet seven inches in height (of masonry) and weighed 338 tons. And such is the familiarity since acquired with works of that class, that twice the dimensions, or thrice the weight would hardly make an engineer pause if asked to undertake such an operation.

At present the tendency, unfortunately, is to abandon these beautiful and permanent structures, and to adopt wrought-iron cylinders instead. Their cheapness is, of course, the great recommendation, but there is also the rapidity with which they can be designed and erected, which saves both time and thought, and is consequently too great a temptation. But harbour works in general are of so grand and so enduring a character that it may be hoped that something better than these flimsy expedients will soon again be adopted, for we have so few real works of architecture in modern times, that it is a pity to forego any chance that may procure us such examples as these sea-girt lighthouses certainly afford.

Strange though it may at first sight be thought, it seems nevertheless true that men sailed over the sea in ships, and provided ports and piers to shelter them, long before they thought of making roads to facilitate traffic on shore. In early times nations were content—as they are in most parts of the East now—with such loads as could be carried on the backs of beasts of burden. Long strings of camels or mules, or droves of bullocks wandering over the half cultivated plains, sufficed for all the rude wants of the Phœnician epoch. The Romans, living in a more closely-cultivated country, and with a more extended empire than had previously been known, seem to have been the first to think of employing wheeled carriages for purposes of transport, and consequently the first who deemed it necessary to make permanent roads or to build bridges.

In those days, however, the mechanical branch of the profession was so immeasurably behind that which we now designate as civil engineering, that the professors of the latter were content to effect by brute force what we now accomplish by infinite scientific contrivance. They drove their roads straight as an arrow up hill and down dale, and paved them with blocks of stone, that not only must have enormously increased the friction, but must have tended to destroy any waggon not provided with springs, and have required a Roman's power of endurance to survive a journey long upon them.

In order to understand this, it is necessary to bear in mind that the resistance to a load drawn along a road is made up of two parts, friction and weight. No human ingenuity has yet succeeded in taking one ounce off the weight, though by distributing it over a very long surface, by means of low gradients, it may to a certain extent be rendered practically innocuous. All our skill has been applied to the task of getting rid of friction, and on our railroads we have so far succeeded as to diminish the relative importance of these two elements to an extent never before dreamt of. An active horse, for instance, will draw a cart weighing a ton with tolerable ease along a well-made level road; and when he comes to such an incline as shall require a tractive force equal to what would draw two tons on a level, he can double his power for a short distance and overcome it. The same horse, however, will draw ten or even thirty tons along a perfectly level railway; but a very slight incline will double this, or require the exertion of ten or twenty times greater force to lift the train up the incline, than what is required to move it on the level, and no horse could even for a few yards accomplish this. Indeed up some such inclines as the locomotive now climbs he would require to put forth the power of 100 horses to lift the train while the friction remains constant at one horse power. With the Romans all this was reversed. Clumsy mechanical arrangements made friction the element to be overcome; so much so that it is difficult for us to understand how a four-wheeled plaustrum, without a perch, was ever coaxed round a curve—how it turned nobody knows—and with the rude wheels keyed on to the axles, as was generally the case in baggage-waggons, and without grease, the friction must have been so enormous that a slight addition to the lifting power required by a steep incline must have been of comparatively little consequence. Where pack-saddles are used this is even more apparent; the load a horse can carry on its back is so small in proportion to its tractive power, that the steepness of the road is of comparatively little consequence.

The mode by which all these difficulties were overcome was so graphically described by Sir W. Armstrong, in his opening address at the meeting of the British Association at Newcastle, that it may as well be given in his own words:—

"When coal was first conveyed in this neighbourhood from the pit to the shipping-place on the Tyne, the pack-horse, carrying a burden of 3 cwt., was the only mode of transport employed. As soon as roads suitable for wheeled carriages were formed carts were introduced, and this first step in mechanical appliance to facilitate the transport had the effect of increasing the load which the horse was enabled to convey from 3 cwt. to 17 cwt. The next improvement consisted in laying wooden bars or rails for the wheels of the carts to run upon, and this was followed by the substitution of the four-wheeled waggon for the two-wheeled cart. By this further application of mechanical principles the original horseload of 3 cwt. was augmented to 42 cwt. The next step in the progress of railways was the attachment of slips of iron to the wooden rails. Then came the iron tramway, consisting of cast-iron bars of an angular section; in this arrangement the upright flange of the bar acted as a guide to keep the wheel on the track. The next advance was an important one, and consisted in transferring the guiding flange from the rail to the wheel; this improvement enabled cast-iron edge rails to be used. Finally, in 1820, after the lapse of about 200 years from the first employment of wooden bars, wrought iron rails, rolled in long lengths, and of suitable section, were made in this neighbourhood, and eventually superseded all other forms of railway. Thus, the railway system, like all large inventions, has risen to its present importance by a series of steps; and so gradual has been its progress that Europe finds itself committed to a gauge fortuitously determined by the distance between the wheels of the carts for which wooden rails were originally laid down. Last of all came the locomotive engine, that crowning achievement of mechanical science, which enables us to convey a load of 200 tons at a cost of fuel scarcely exceeding that of the corn and hay which the original packhorse consumed in conveying its load of 3 cwt. an equal distance."

At the point at which we now stand our mechanical skill has become so great, that the civil engineers have been forced to seek out the lowest levels, to carry long viaducts across our valleys, to bore tunnels through mountains, and to scheme out a whole new system of intercommunication, in order to prevent the necessity of lifting a train up an incline from neutralising the advantages derived from the conquest achieved over the frictional element. Notwithstanding all our ingenuity, we can never, of course, get entirely rid of this difficulty; but we have done wonders in this direction, and are daily accomplishing more.

In addition to the normal difficulties from friction and weight, the crossing of rivers formed a third, that long impeded transport by land. Fords are not always practicable, ferries are always inconvenient; but to make a permanent roadway across a running stream was a difficulty which in early stages of the science seemed nearly insuperable. With all their architectural skill, the Egyptians never seem to have attempted it, at least they never tried to bridge the Nile; and as they made their own canals, and these were dry more than half the year, they had it all their own way as to how they would cross them, and were probably content with planks, or at the utmost with flags of stone resting on upright supports. The Greeks had few rivers that were not fordable, and never consequently gave their minds to the subject; but the Romans faced the problem boldly, and with that grandeur of conception which characterised most of their architectural undertakings. There are still standing arches built by them of more than 100 feet span, springing at more than 100 feet from the bed of the river. Their greatest undertaking of this sort was probably Trajan's Bridge, over the Danube; but the superstructure was only of wood, though the piers were of stone and 180 feet apart, as near as can now be ascertained.

In modern times the bridge over the Dee at Chester is the largest arch that has yet been attempted in stone. It is 200 feet span, with a rise of only 42 feet; and Brunel built a bridge of brick over the Thames at Maidenhead of two elliptical arches, each 128 feet span, with only 22 feet rise. Though these surpass all that has been done elsewhere in their respective materials, it is probable that these dimensions might be exceeded, if it were worth while; but it is scarcely probable it will be found worth while, as iron is every day more and more employed in the composition of such structures. Before, however, it entirely supersedes the more durable materials, it is fortunate for us that we possess such a beautiful building as London Bridge, perhaps the most perfect specimen of its class in the world. It is constructed wholly of granite, with a centre arch 152 feet span, and with a roadway slightly but gracefully curved. This is far more pleasing than a straight line, with elliptical arches, as may be seen by comparing it with Waterloo Bridge, which, with all its grandeur, fails in reaching the perfection of its younger rival, though this may perhaps be partly owing to the Doric columns, which were absurdly added with an idea of ornamenting its piers.

Long before these great bridges were erected, it had occurred to engineers that iron might probably be employed in building bridges. As early as 1775 Mr. Pritchard built one at Colebrook Dale, 100 feet span, and in 1795 Thomas Wilson erected one at Sunderland, 237 feet clear span, with only 260 tons of metal, while the centre arch of Southwark Bridge, only 3 feet more in width, contains 1665 tons. Hitherto these two have not been surpassed by any arches of the same kind; but Telford proposed to replace old London Bridge with one of a single arch, 600 feet span, and afterwards begged to be allowed to span the Menai Strait with one of nearly the same extent. More recently Mr. Page proposed to cross the Thames just above the Tower with a single arch of 750 feet clear span, to carry two lines of rails and a roadway 24 feet wide, besides footways. Bold as the project may appear, still Mr. Page's experience and admitted knowledge of the subject are such that no one doubts its feasibility. From various causes none of these great schemes have been carried out, though there seems no reason to doubt that they might have been executed with success. As the resistance to pressure in cast iron is as nearly as may be ten times that of stone, there seems at first sight no reason why an arch of iron, 1000 feet span, should not be made as easily with the same weight of material as one of 100 feet of stone; and as blocks can be cast with more precision than they can be hewn, and fitted with flanges and other constructive expedients, even the most gigantic arches ought to be far easier to build in this material. The one element of uncertainty is the contraction and expansion of the metal from heat; but there seems little cause to fear it. When we first made railroads we allowed a quarter of an inch free space between each bar, and took every precaution for freedom of expansion and contraction till one man, bolder than the rest, proposed to butt them one against the other and join them with fish-plates. This has now been done, so that the rail from London to Aberdeen is one continuous unbroken bar; it neither expands nor contracts, but submits, and so probably would a bridge, provided the abutments were sufficiently firm, or if it did expand, it would probably be marked only by a slight elevation at the crown of the arches.

Before, however, engineers had proceeded far in the application of iron to bridges, they perceived that though the metal possessed the quality of resisting compression to ten times the extent of the materials they had usually been employing, it was even more remarkable for its tenacity; nor were they long in finding out how best to avail themselves of this peculiarity. By suspending the roadway from a chain hanging from the summits of two tall towers, they in the first place got wholly rid of the bugbear of expansion or contraction, and were also able to span a greater space with an infinitely smaller quantity of metal than was required for a bridge in compression. So great, indeed, was the economy of weight, that there seemed no practical limit to the extent of the span, while all other structures were liable to be broken by their own weight when extended beyond certain moderate dimensions.

Unfortunately these good qualities were accompanied by others which disappointed the sanguine hopes that were at one time entertained of this mode of construction. Its very lightness rendered it liable to undulation, always unpleasant and sometimes dangerous; and its weight was frequently not even sufficient to resist the action of the wind, which ruined at one time the chain pier at Brighton, and seriously damaged the bridge over the Menai Straits, as well as that at Montrose. Notwithstanding this, Telford's great work has answered its purpose perfectly for the last thirty-seven years, and now that it has been strengthened, may still span the Straits for the next three centuries; while, considering the time when it was erected, it is one of the boldest as well as one of the most graceful works of modern engineering skill.

On the Continent, where scientific knowledge is generally in advance of practical skill, they have carried this principle to excess, by using wire, which is iron in the most perfect form for tenacity. This has reduced the weight of the bridge so much relatively to the load, as to render the undulation excessive, and frequently to lead to the most frightful accidents. Still the bridge over the Sarine at Friburg has stood for thirty years, with very slight repairs, though its span is 870 feet, while that of the Menai Strait is only 570, and the bridge which recently crossed the Thames at Hungerford Market, which was our largest and typical example of the class in England, was only 676½.

The boldest and grandest application of this principle is the bridge constructed for railway traffic by Mr. Roebling, just below the Falls of Niagara. So rapid has been the progress of engineering science, that if any one had proposed twenty years ago to throw a railway bridge over a chasm 800 feet wide and 245 feet above such a foaming torrent as that of the Niagara, he would have been looked on as a madman. Yet this has now been accomplished, and by very simple means. The bridge consists of a rectangular tube 20 feet deep by 26 feet wide, or rather two floors 18 feet apart—the upper carrying the railway, the lower the roadway for ordinary traffic. These are connected together by diagonal iron tie-rods. By bracketing out from the rocks, the free length of the tube is reduced to 700 feet, and it is then suspended from towers 821 feet apart from centre to centre by four wire cables of 10 inches section, and each containing 3640 separate wires. These are further assisted by numerous braces radiating from the towers, and a multitude of ingenious minor contrivances.

When a train weighing more than 300 tons passes over the bridge, the deflection is said to be only 10 inches; and certain it is that so far it has answered all the purposes for which it was intended, but nevertheless it seems too frail and fairy-like a structure for the rough usage of railway traffic; and trains are not allowed to move across it at a higher velocity than a man can walk. With great care and continuous repairs it may do its work for years to come, but it may any day deposit its load in the boiling flood beneath, and so again separate the provinces it has so boldly united. Indeed, taking it altogether, there can be little doubt that the tubular girder proposed by Robert Stephenson for the same purpose would have been a better piece of engineering. It would have cost more in the first instance, for if the published accounts are to be believed, the suspension bridge cost only 100*l.* per foot forward; but the durability of the tube would have been practically unlimited, its safety undoubted, and an occasional coat of paint all the repair it would have required.

Fortunately for the engineers it is their privilege to be allowed to think. They are not, like the architects, first forced to inquire whether or not a thing was done in the fifth century before, or the thirteenth century after Christ, before they are allowed to act, and the progress of improvement in iron bridge building has consequently been rapid. For certain purposes a cast-iron bridge, wholly in compression, was no doubt a very perfect thing, so also was a wrought-iron bridge wholly in tension; but it was easy to predict that the most perfect result would be attained by a structure which should combine these two properties, so as to take the greatest possible advantage of both.

The best method of effecting this was fully investigated, and practically settled, by the very complete and exhaustive set of experiments which were undertaken by Robert Stephenson and his associates before commencing his great work, the Britannia Bridge. The conclusions then arrived at were so sound and satisfactory that it is scarcely probable any extensive railway structures will in future be carried out on any other principle, though for local traffic simple compression or tension structures may still be used.

Although the principles then evolved are now thoroughly understood by every engineer, they are so novel and so little appreciated by the general reader, that it may be worth while to try to explain what they are before proceeding further.

In the above diagram the left-hand side represents the usual form of a cast-iron bridge, supported by abutments, in the same manner as stone bridges are; and its stability of course depends wholly on their immovability. Instead of this, let us suppose that the ends of the arch rested on iron shoes, as at A, and that these were tied together by a chain or bar of iron B: it is evident that by this expedient the arch would be prevented from spreading as well as by the abutments. It will also have this further advantage, that, as the tie expands equally with the arch, and the structure is one homogeneous whole, with only a perpendicular bearing in its supports, you have a better bridge than before.

It is remarkable that the Italian architects in the Middle Ages tried this principle in all their Gothic structures; but an iron tie to a stone arch is both mechanically and artistically a mistake. The expansion and contraction of the metal is always working when the stone is at rest, and the flimsiness of the one compared with the mass of the other always produces an effect so disagreeable that the true Gothic architects on this side of the Alps never adopted it. They always applied a stone abutment to a stone arch, which was as essentially the proper and legitimate mode of construction as the iron tie to the iron arch is now seen to be.

This principle of construction, once seized, was used in fifty different forms. One of the most obvious was to frame the arch and the tie strongly together, as shown in the right-hand side of the diagram, making what is called the bow-and-string bridge, and to run the roadway along the tie, in which form it has been extensively employed in railway structures. At the High Level Bridge at Newcastle the spandrils are filled up level (as on the left of the diagram), and the railway runs along the top, the roadway along the string. At Saltash and Chepstow, Brunel substituted a bent wrought-iron tube for the cast-iron arch, and tied the ends together by a chain drooping in the centre, and suspended his roadway from both. At Mayence, Dr. Pauli improved on this by substituting a wrought-iron T girder for the tube, and proportioning all the other parts more scientifically together, so as to produce what is theoretically perhaps the most perfect truss yet executed. The three spans of the German bridge are only 333 feet each, while the span of the two at Saltash is exactly 100 feet more; but the proportion of the parts is so perfect, that the principle admits of extension up to the limit at which a girder would tend to break itself by its own weight.

The defect of these bridges is that they are a little too clever. If the load were always evenly disposed over their whole surface, and at rest, no doubt every cubic inch of iron would always be doing all its work; but a railway train weighing 400 or 500 tons, and rushing at a speed of forty miles an hour, is a sad disturber of equilibriums; every part that ought to be in tension is at times thrown into compression, and every strut at times becomes a tie, so that engineers generally have agreed to adopt a plain straight girder instead of those with these beautifully calculated curves. The same thing occurred with rails in the infancy of the system. Every mechanic saw, and every mathematician calculated, that a fish-bellied rail must be stronger than a straight one; but the practical result is, that all rails are now made with parallel sides, and there is not one of the other class in existence on any locomotive railway in Europe. It will probably be the same with bridges when the true conditions of the problem come to be more perfectly appreciated, except, perhaps, in structures of such magnitude that the weight of the load bears a very small proportion to the weight of the girder, and where the saving of every ton of iron becomes of importance lest the weight of the bridge should itself become a source of weakness.

Barring such exceptional cases, engineers are generally agreed in making the top and bottom flanges of their girder bridges practically parallel to one another, and when these are of wrought-iron, in putting the same quantity of metal into both. According to strict calculation, the proportions between the top and bottom ought to be as six to five; but as the lower or tension part depends wholly on its rivets, and the top or compression piece might almost be stuck together with glue, the same amount of metal is practically required for both, and the form in which it is disposed is mechanically immaterial. The cellular system has some convenience, but it does not seem to give any strength proportioned to the additional cost and difficulty of construction.

One of the most obvious ways of applying these principles is by means of what is called the Warren girder. This consists of a series of straight cast-iron tubes above, butting one against the other, and a chain of wrought-iron links below, and then connecting these two systems by struts and ties placed diagonally where wanted. Theoretically nothing can be more perfect than this arrangement: it is simple, but almost too simple; if one thing goes wrong all goes wrong; and more margin is wanted for the violent irregularities of railway traffic.

Perhaps, after all, there is nothing better than the simple tubular girder, which was evolved out of the first experiments, and used with such success in carrying the Holly-head Railway across the Menai Straits. The first and most obvious proposal for this bridge was one of cast-iron in compression, which would have been the cheapest and most architectural mode of effecting the object, but the Admiralty interfered, and insisted that a clear head-way of 100 feet above high water should be maintained throughout. To meet this difficulty, a tube suspended by chains was then suggested, nearly similar in principle to the one recently erected at Niagara; but as the investigation proceeded, it was found that the chains might be dispensed with, if a tube of sufficient rigidity could be constructed to carry any railway train across the greatest opening, which here was 460 feet clear. So complete were the investigations, and so careful the execution of the whole work, that subsequent experience has added little to the knowledge then attained; and, besides being the first, it is, considering the difficulties of the execution, one of the most perfect works of its class. In extent, and in some respects for cleverness of execution, even this bridge is surpassed by that across the St. Lawrence at Montreal, which, though only a single tube, is 6,592 feet long, but the centre span is only 330 feet, and the remaining 24 openings average 242 feet. The great engineering difficulty was the erection of such a structure on so rapid a river, frozen at times, and at the breaking up of the ice bringing down great bergs which threaten to overwhelm everything. All these difficulties have been successfully surmounted, and the bridge promises to be as stable as it is efficient.

Neither of these, however, has reached the limits of the system. When, for instance, it was proposed to erect a railway bridge across the Rhine at Cologne, Mr. Fairbairn gave two designs: one for a bridge in four spans, which it was estimated would cost when complete 230*l.* per foot, and one in two spans, the expense of which would have been 280*l.* The latter would have consisted of two tubes, carrying the railway with the roadway between them and footways outside, each tube measuring 1140 feet, supported by one pier in the centre; the two spans being thus 100 feet in excess of those of the Menai Bridge. Indeed, there seems no reason why openings of 700 or 800 feet might not be bridged by these means. Whether or not this is the cheapest mode of accomplishing the object is not quite clear. The Menai, with its double road, cost 400*l.* per foot; and the Montreal, with its single line, 171*l.* But the only economy that could be made is in the vertical web that connects the top and bottom. All engineers are pretty well agreed as to the amount of metal which is required to provide a given amount of strength to the top and bottom for a given span, but they differ as to the mode of forming the sides. Thus the great tubes of the Menai Bridge weigh about 1,600 tons; 500 tons of this weight is in the top, and a like quantity in the bottom, and consequently 600 in the sides.* Half that quantity would suffice according to some, and consequently all conceivable forms of lattice girders and trusses have been employed for this purpose, and have economized metal to a great extent; but it has yet to be ascertained whether they are as stable. There is a grand simplicity in a wall of iron, every inch of which is as available in tension as it is in compression, and consequently can take all the varying strains of the traffic without suffering from the inequality; whereas the best designed truss must always be stronger and better in one position than another, and depends more or less on bolts and fastenings, which any inequality or sinking may throw out of work. If such be the case, it is to be regretted, for it is to be feared that the tubular girder can never be other than ugly; while many of those composed of diagonal framings are pleasing in themselves. A mere lattice like that at Cologne is not better than a tube, and is as flimsy as it looks; but a well-designed truss like that of the Charing-cross Bridge is a beautiful thing in itself, and, if the bridge really cost only 130*l.* per foot for four lines of rails, is as cheap an expedient as can well be adopted. The spans, however, are only 154 feet, which, of course, prevents its being compared with the great works just mentioned.†

---

* The smaller Montreal tubes weigh 252 tons, made up thus:—

| | Tons. |
|---|---|
| Top | 76 |
| Bottom | 92 |
| Sides | 84 |
| | 252 |

So the only economy could be effected in the last item, and this is very inconsiderable compared with the whole cost. For according to the published account the masonry of the piers cost 114*l.* per foot of the bridge, leaving only 57*l.* for the iron work, and the only saving that could be effected would be one-third of this.

† For the railway bridge now erecting between Southwark and London bridges Mr. Hawkshaw proposed, in order not to interfere with the traffic, to make the central arch 300 feet span,—which would have been a really grand object,—the side arches 150. The authorities decided that if there was one arch larger than the others all the traffic would go through it, and consequently ordered them all to be made equal, so that the bargees might be puzzled which to choose!√

Discussions on

# Prestressed Concrete

## Modern Developments in Prestressed Concrete

By Niels Thorsen, Chief Engineer, Freyssinet Company Inc., New York City.
*The Engineering Journal*, October 1953 issue, Page 1278.

**R. David, M.E.I.C.**[1]

The author of this paper, Mr. Thorsen, has said that recently in North Carolina there had been an advantage costwise in a design using prestressed concrete girders over that using steel trusses. If the author refers to the high school gymnasium recently built in Greensboro, N.C., I would like to point out the following:

The only valid comparison that can be made between the cost of prestressed concrete and that of structural steel is for the prestressed concrete girders only vs. steel trusses. Fortunately such a comparison can be made from bids to the general contractors by the prestressed concrete sub-contractor and the structural steel sub-contractor.

The prestressed concrete sub-contractor, who also furnishes and bids on precast concrete joists and Channelcrete roof slabs, first quoted general contractors a lump sum of $78,000.00 for all items he proposed to furnish. After an alternate bid on steel was required, he broke this down as follows:

| | |
|---|---|
| Precast concrete joists for 1st and 2nd floors | $31,330.00 |
| Channelcrete roof slabs | 20,220.00 |
| Seven prestressed concrete girders, precast concrete roof purlins and furnishing and placing cables in columns . . . . . . | 26,450.00 |
| | $78,000.00 |

From the above amount of $26,450.00, a deduction of $3,680.00 must be made for cost of roof purlins and column cables to arrive at the price of the girders only, namely $22,770.00.

The structural steel sub-contractor's price for the seven steel trusses and bracing was $13,735.00. Brick encasement for fire-proofing was required for the two end trusses over the balcony at a cost of $1,924.00.

The comparative cost of the two types of main roof framing, as separated from bids by the sub-contractors can then be summarized as follows:

| | |
|---|---|
| I. 7 prestressed concrete girders and bracing . . . . . . | $22,770.00 |
| II. 7 structural steel trusses and bracing . | 13,735.00 |
| Brick encasement of two end trusses and brick wall at ends of trusses | 9,924.00 |
| | $15,659.00 |
| Net saving in favor of steel . . . . . . . . | $ 7,111.00 |

**Niels Thorsen:**

It is correct that in the above-mentioned paper I referred to the High School in Greensboro, North Carolina, for which the prestressed concrete roof was designed by the Freyssinet Company Inc.

I disagree with Mr. David's cost comparison. Final judgment in this matter is best obtained by considering the actual bids for the job. The low bidding contractor priced the prestressed concrete alternate $10,000 below the steel design, which disagrees with Mr. David's "theoretical cost comparison". The total cost of the gymnasium was $348,500.

In this connection it will undoubtedly interest the readers to know that on other jobs too, similar economics have been achieved by the use of prestressed concrete, for example, in the Gymnasium for the Bishop Dubourg Catholic High School in St. Louis, Missouri, where similar spans are used (94 ft.) and a saving of approximately $15,000 was made over the steel design.

In comparing cost of long span prestressed girders only with steel trusses, the trusses will in most cases be cheaper but the prestressed girders afford considerable savings in the overall construction.

## Prestressed Concrete Buildings

By Philippe A. Benn, General Manager and Chief Engineer, Pre-Compressed Concrete Engineering Co. Ltd.

*The Engineering Journal*, December 1953 issue, Page 1613.

**F. P. Shearwood, Hon.M.E.I.C.:**[2]

In the introductory statements concerning prestressed concrete buildings, published by Philippe A. Benn, in the December number of the *Journal*, certain claims are made that there are numerous advantages in prestressed concrete over other types of construction. The conclusion of the introduction states that prestressed concrete alternatives were chosen on the basis of their structural or economic merits in competition with conventional reinforced concrete, or with structural steel. These remarks can only apply to reinforced concrete, since all of the here claimed structural advantages are more effectually met by structural steel designs, as for example, in bridging long spans with slim members, savings in time and trouble in erection, interference from climatic conditions and saving in total weight on foundations.

The claim of economy in the prestressed concrete is probably due to the use of a much smaller factor of safety (i.e., less than 2.), as compared with that demanded by standard specifications for structural steel (i.e., over 3.).

It is extremely difficult to follow the methods of construction as given in the description of the buildings, and therefore, the actual distribution of stresses; but there is

[1]District Engineer, Canadian Institute of Steel Construction, Montreal.

[2]Consulting Engineer, Dominion Bridge Co. Ltd., Montreal.

the fact that the prestressing cables are designed for an initial stress of more than half their ultimate strength before any external load, and fully half the dead load, is applied.

The application of a load on a beam, whether prestressed or not, must create a bending strain in it, causing tension and elongation in its tension flange. In prestressed beams, this will relieve some compression in the concrete but will also cause a corresponding increase in tension in the reinforcement of the prestressed flange.

The cable being already prestressed to over half its ultimate strength, the addition of the stress from bending will bring its factor of safety far below conventional practice.

Since the cable is the only member of the prestressed concrete beam capable of resisting tension, the safety factor of the whole structure is dependent on its strength.

Prestressed concrete has not been long enough in use in Canada to ensure complete confidence in its safety when meeting its alteration in volume from age and climatic changes. There is increasing evidence that concrete will sometimes grow in length, which would result in extremely dangerous strains in the cables.

At the present time it appears that this new form of construction is not subject to any standard specification or control but is often designed by advocates of prestressed concrete who might possibly design with the main object of underbidding designs of their competitors in structural steel, and reinforced concrete, which is controlled by officially recognized and accepted specifications.

To ensure public safety, this new type of construction, requiring precise manipulated straining in the field, should have its design and construction controlled by standard and accepted specifications just as structural steel and other types of construction are required to have.

**P. A. Benn:**

In my paper concerning prestressed concrete buildings, I have intentionally omitted to make any analysis, comparison or statement as to the advantages of prestressed concrete *over* other methods of construction and simply enumerated some of the characteristics and merits which made it in Canada a *competitive material* for numerous structural applications. I believe, indeed, that the relative or more effective advantage of a material or method of construction as compared with another for a given structure is only possible to establish by a thorough analysis of all the aspects of its functional and economic requirements.

The prestressed concrete buildings described in my paper were always constructed on the basis of alternative designs approved by a wide range of architects and consulting engineers both in private practice and government service. This fact, I believe, would probably constitute the best guarantee that any economy gained by the prestressed concrete alternative has not been obtained to the detriment of the safety of the structure.

As a matter of fact, contrary to the assumption of Mr. F. P. Shearwood, it is a well-proven fact by test that the safety factor of prestressed concrete structures is generally equal if not higher than the one secured by structural steel.

The notion of a safety factor of course has first to be established and defined corresponding to the function of the structure and its requirements for safety.

We know, indeed, that medium structural steel with an admissible working stress of 18,000—20,000 lb. per sq. in., minimum yield stress of 33,000 — 40,000 lb. per sq. in. and ultimate tensile stress of 55,000 — 70,000 lb. per sq. in. will present a safety factor of approximately 3-3½ as far as collapse under ultimate stress is concerned. However, under a slightly higher stress than the yield point stress, the plastic flow and deformation of the steel members will cause such deflections that for all practical purposes the structure will have to be abandoned. Under that consideration, the value of the safety factor will drop therefore to slightly less than 2.

On the other hand, these same values will be considerably less in cases where fatigue due to repeated stress-variation may occur, such as in bridge structures for instance and where the factors of safety of course depend to a large extent on the range to be allowed in the stress-variation.

Several tests have been carried out in Canada and United States on full scale prestressed concrete beams. A 60-ft.-long prestressed concrete girder, as used in the Mosquito Creek Bridge, Vancouver, B.C., was tested to failure which occurred under deadload + 5¼ times the maximum liveload, nearly twice as much as required by the specifications of the bridge engineer. (See August 1953 issue of *The Engineering Journal*, Page 996.)

A 100-ft.-long continuous prestressed concrete girder, as used in the Army Warehouse roof structure at the Central Ordnance Depot, Cobourg, Ont., has been tested on the site by the National Research Council. Final results, we understand, will be available shortly, but under deadload + 5¼ times the maximum liveload (more than three times the load required by the National Building Code for acceptance of a structural member), the beam still stood up and did not fail.

A 166-ft.-long prestressed concrete girder, as used in the Walnut Lane Bridge, Philadelphia, U.S.A., was tested to destruction which occurred under deadload + 7 times the maximum liveload, more than twice as much as required by the Specifications. (See Prestressed Concrete by Gustave Magnel, London Concrete Publication Limited, Second Edition Page 164.)

It is quite true that the application of a load on any beam creates a bending stress and induces tensile stresses in the tension flange. Contrary to Mr. F. P. Shearwood's statement however, the resultant increase in tension in the prestressed concrete wires is only 0-6% under maximum design load, more than compensated by the loss in prestressed concrete due to shrinkage and plastic flow which varies from 4% to a maximum of 12%. A justification of these figures can be found in any basic manual on prestressed concrete and easily checked by the following simplified example: Assuming that the concrete, as used, has generally an ultimate compressive strength of 5,000 lb. per sq. in. after 28 days, its admissible working stress according to Canadian Specifications will then be 0.4 x 5,000 = 2,000 lb. per sq. in. compression. Since generally no tension stresses are allowed to be taken by the concrete, the maximum stress in the flange of the prestressed concrete beam will not exceed 2,000 lb per sq. in. compression under prestress + deadload and the minimum stress equal to approximately 0 lb. per sq. in. under prestress + deadload + maximum liveload.

The maximum variation of the stress in the concrete is therefore 2,000 lb. per sq. in.

Assuming the module of elasticity of a 5,000 lb. per sq. in. strong concrete at 5,000,000 lb. per sq. in. and the module of elasticity of high tensile wire at 30,000,000 lb. per sq. in., the factor $n=\frac{E_s}{E_c}=6$ and the maximum variation in the stress in the steel, if placed at the very bottom of the beam will not exceed $6 \times 2,000 = 12,000$ lb. per sq. in.

Since the admissible working stress of high tensile wire is approximately 140,000 lb. per sq. in., this maximum variation under full live-load will not exceed 8½% and be, as stated, much less, depending on its position in the beam and on the initial compressive stress of the concrete at the bottom flange.

A similar analysis of possible strain variation due to eventual growth of concrete will prove it to be safe and insignificant when compared with the growth influence in conventional reinforced concrete.

Sufficient, if not abundant data are to-day available to assure a safe design by any engineer who so desires. Of course, prestressed concrete as well as reinforced concrete and structural steel has and will have its own specific problems which are constantly solved exactly as all our other engineering problems: By unprejudiced analysis of scientifically conducted tests which, explained by a reasonable theory and based on past experience, will guarantee a satisfactory safety for further applications.

**D. C. Beam, M.E.I.C.[3]:**

The use of prestressed concrete in buildings immediately raises the problem of relative fire resistance now that building codes are being based on performance under standard fire tests. It is now known, according to recent publications of fire test, that the steel in ordinary reinforced concrete must be better protected than hitherto thought necessary in some cases in order to attain the required hourly ratings in fire resistive buildings. This was forcibly brought out by the Rimouski fire during which concrete-framed buildings were destroyed by relatively light fire loads.

What does this mean in terms of fire resistance ratings for prestressed concrete ? The complete answer will not be known until full-scale tests are made. In the meantime preliminary tests on post-tensioned precast beams by the British Building Research Station indicate the trend. In a press release by the Department of Scientific and Industrial Research in Great Britain in February of 1953, and as reported by the *Architectural Forum*, May, 1953, the conclusions are summarized as follows:

> "For fire safety prestressing wires need a greater thickness of concrete around them than steel bar reinforcing. In heavy concrete members the prestressing steel will probably be covered enough but in smaller members additional fire proofing may be necessary.
>
> "The time of collapse is determined mainly by a temperature rise in the cables. Tests show that failure becomes imminent when the temperature of the steel exceeds 400°C. (as against about 600°C. for mild steel bars). A 2½ inch cover gives a fire resistance of about 2 hours (a 2 inch concrete cover on mild steel bars earns a 4-hour rating). For a 4-hour fire resistance the beams would probably be fireproofed in insulating plaster keyed into the concrete, or, if a thicker concrete is used, it should contain steel mesh to check spalling.
>
> "Sudden failure is not likely, but there is a noticeable progressive sagging. Cracks and a marked increase in deflection indicate that collapse is imminent. Explosive spalling is unlikely in sections over 2 inches thick. Beams partially exposed to fire retain same strength upon cooling but with marked deflection and loss of prestress."

Further tests are being carried out at the British Building Research Station and at the National Bureau of Standards in Washington. The results should indicate the proper classifications of fire resistance as measured by standard fire tests.

**P. A. Benn:**

The relative fire resistance of prestressed concrete as compared with other structural materials, is without any doubt a matter of interest to anybody concerned with the performance of structures under fire.

We agree with Mr. D. C. Beam that a complete answer will not be known until full scale test for all materials *under exactly the same conditions* will be made. We regret however to state that his very interesting quotation concerning some prestressed concrete fire resistance test results as released by the Department of Scientific and Industrial Research omits a very important and maybe principal conclusion made in that report and which states:

> "It appears that if the thermal shock can be minimized and the soffit concrete allowed to heat slowly, prestressed concrete units will tend to behave similarly to ordinary reinforced concrete."

The general conclusion of this report has been confirmed by a full scale test on a 40-ft.-long prestressed concrete beam carried out in Holland. The usual 2 in. cover with proper grouting provided adequate protection for the cable at temperatures up to 1,400°F. and a recovery of approximately 70% of the deflection occurred immediately after the heat has been turned off.

Since in addition the danger of buckling and twisting is non-existent in prestressed concrete members, it can be expected that due to final tests, prestressed concrete will have an even higher rating than reinforced concrete as fire resistant structure. √

[3]Chief Engineer, Canadian Institute of Steel Construction, Toronto.

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For details about the

## ANNUAL MEETING

### QUEBEC CITY

### MAY 12, 13, 14, 1954

Turn to pages 276, 277, 278
of this issue

The
# Engineering Institute of Canada

# 68th
# Annual General
# and
# Professional
# Meeting

## Quebec City, May 12, 13, 14, 1954

- Twenty-eight highly informative papers.
- Two panel discussions.
- Splendid ladies' program.
- Ample opportunities for sightseeing.
- Advance registration forms (to be mailed to members early in April to prevent last minute confusion).

## PROGRAM*

Mining Development and Engineering in Quebec:

JEAN-PAUL DROLET, M.E.I.C., Chief, Technical Information, Department of Mines, Quebec.

The Impact of Transistors on the Electrical Industry:

E. L. R. WEBB, in charge Electronic Equipment for Air Defence Group, National Research Council.
P. A. REDHEAD, in charge Electron Tube Development Laboratory, National Research Council.

Design of a 7,000-ton Press:

HANS ULMANN, M.E.I.C., Chief Engineer, Industrial Division, Dominion Engineering Works Limited.

The St. Lawrence Cement Company Plant at Quebec:

DR. BERNARD ULRICH, General Manager, St. Lawrence Cement Company.

The Impact of Electronic Computors on Industry:

W. J. M. MOORE, M.E.I.C., National Research Council.
N. L. KUSTERS, National Research Council.

Development of the Axial Flow Compressor for the Orenda Engine:

F. H. KEAST, Assistant Chief Engineer, Gas Turbine Division, A. V. Roe Canada Limited.

Quebec North Shore and Labrador Railway, Location, Construction and Terminal Facilities:

B. M. MONAGHAN, M.E.I.C., Assistant Chief Engineer, Quebec North Shore and Labrador Railway Company.

Underwater Television and its Application:

CAPT. H. R. SMYTH, National Research Council.

Electronics in the Paper Industry:

W. A. MESSERVEY, Pulp and Paper Application Engineer, Apparatus Division, Canadian General Electric Company Limited.

Menihek Power Development, Labrador:

L. A. CAREY, Jr.E.I.C., Resident Engineer, Montreal Engineering Company.

Job Control on the Yonge Street Subway:

W. H. PATERSON, M.E.I.C., Chief Engineer, Toronto Transit Commission.

*Subject to change.

Some Fire Protection Aspects of Building Design:

D. R. ABBEY, M.E.I.C., Engineer, Fire Protection Section, Underwriters' Laboratories of Canada.
W. E. EMMERSON, Jr.E.I.C., Division Engineer, Underwriters' Laboratories of Canada.

Hydro-Electric Developments on the Canadian Side of the Niagara River:

R. L. HEARN, M.E.I.C., General Manager and Chief Engineer, Hydro-Electric Power Commission of Ontario.

Installation of Electrical Equipment in the Yonge Street Subway:

J. Y. DORAN, Electrical Engineer, Toronto Transit Commission.

Natural Resources and the Engineer:

J. L. VAN CAMP, General Manager and Secretary, Canadian Forestry Association Inc.

Construction of 28,000-ton Tanker:

W. H. WHITE, Naval Architect.
R. W. McGILVRAY, Chief Engineer, Design, Davie Shipbuilding and Repairing Company.

Cars, Shops and Mechanical Equipment of the Toronto Subway:

J. G. INGLIS, Assistant Manager of Equipment, Toronto Transit Commission.

Transmission of the Power Developments on the Canadian Side of the Niagara River:

J. E. SPROULE, M.E.I.C., Consulting Transmission Engineer, Hydro-Electric Power Commission of Ontario.

Peribonka Power Plants:

R. E. HEARTZ, M.E.I.C., President, Shawinigan Engineering Company.

Instrumenting a Nylon Intermediates Plant:

F. G. CARSON, Chief Supervisor of Maintenance, Canadian Industries Limited, Maitland.

A Rational Design for Building Frames:

J. L. De STEIN, M.E.I.C., Assistant Professor of Civil Engineering, McGill University.

Kitimat Potroom Foundations:

R. M. HARDY, M.E.I.C., Dean of Engineering, University of Alberta
C. F. RIPLEY, M.E.I.C., Manager, Ripley & Associates.

The Development of a New Concept in Modern Office Building Construction:

G. LORNE WIGGS, M.E.I.C., Consulting Engineer.

Highway Approaches to the Quebec Bridge:

P. A. DUPUIS, M.E.I.C., Joint Chief Engineer, Department of Public Works, Quebec.

Design and Construction of Alcan's Kitimat Terminal Wharf:

W. L. PUGH, M.E.I.C., Chief Engineer, Aluminum Company of Canada Limited.

Telecommunications in Canada:

A. G. LESTER, Assistant General Manager, Bell Telephone Company of Canada.

Photography for Armament Development:

E. W. GREENWOOD, Canadian Armament Research and Development Establishment.

Instrumentation for Armament Development:

E. J. BOBYN, Canadian Armament Research and Development Establishment.

Air Pollution Control—A Panel Discussion:

Chairman, E. A. ALLCUT, M.E.I.C., Professor and Head of Department of Mechanical Engineering, University of Toronto.

Management—A Panel Discussion:

Chairman, J. EDGAR DION, M.E.I.C., Consulting Management Engineer, Montreal.

● See page 278 of this issue for further details about the program.

The Chateau Frontenac, Quebec City, where all meetings will be held.

# From Month To Month

**Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers**

## 68th Annual General and Professional Meeting

Arrangements for the forthcoming Annual General and Professional Meeting at the Chateau Frontenac in Quebec are well under way. The program commences Wednesday morning, May 12 and concludes Friday evening, May 14.

#### Transportation

It is expected that special reduced convention fares will be available for rail travel in Canada and special fare certificates will be sent to all members requesting same at time of registration. Please make your own travel arrangements through your local ticket agent.

#### Hotel Accommodation

All room accommodation for the meeting is in the Chateau Frontenac where all technical meetings and social events will take place.

#### Advance Registration

Registration and Advance Reservation cards will be mailed with advance copies of the meeting program, during the early part of April. Room allotments will be made in accordance with the receipt of reservation cards at Institute Headquarters. It is expected that all social functions will be fully attended, therefore members are urged to make reservations for luncheons, dinners, etc., as promptly as possible.

#### Annual Banquet and Ball

Friday evening, May 14, will mark the climax of the meeting when the Chateau will serve as the setting for the Annual Banquet and Ball.

#### Ladies' Events

As usual, there will be several special attractions for the ladies in addition to the joint functions which are open to all.

#### Muriel's Room

The usual hospitality will be dispensed on all appropriate occasions by that inimitable hostess, Muriel.

Detailed arrangements are being prepared for other entertainment features and announcements covering these will be made in the near future.

## Brockville Branch Opening

The inaugural meeting of the recently formed Brockville Branch of the Institute took place on Friday evening, January 15 at the Hotel Manitonna, Brockville, Ontario. The meeting took the form of a dinner followed by a dance and was attended by more than 180 members and guests with their wives.

President Ross L. Dobbin of Peterborough, Ontario, presented the Charter of the new branch to its chairman, J. S. Waddington of Brockville and S. H. Rochester, chairman of the Kingston Branch presented an E.I.C. banner to the newly-formed branch from the members of the parent Kingston Branch. The vice-chairman, Fred Walsh, on behalf of the local branch, expressed thanks to President Dobbin, Mr. Rochester and others for their expressions of appreciation and good will.

Brockville is the forty-seventh branch of the Institute and its territory includes the County of Leeds, formerly in the Kingston Branch, the County of Grenville formerly in the Cornwall Branch and the southern part of Carleton County formerly in the Ottawa Branch. The principal cities and

## Cover Picture

The cover picture shows a "worm's-eye" view of the 1200-kv. impulse generator built by the National Research Council to produce artificial lightning for industrial testing and research.

This phase of N.R.C. research is described in the paper "Modernization of N.R.C. Impulse Testing Facilities", by F. C. Creed, N. L. Kusters, and W. J. Purvis, which will appear in the April issue of the *Journal.*

towns in the area, outside of Brockville are Prescott, Cardinal, Perth and Smiths Falls. The first executive of the Branch consists of J. S. Waddington, chairman, Fred Walsh, vice-chairman, J. G. Kerfoot, secretary-treasurer, J. F. Preston, R. M. Powell and R. E. Davey. The Branch representative on the Institute Council is H. B. Brewer.

Many prominent local dignitaries attended the opening ceremonies and amongst the head table guests were Mayor Graeme Gorrie, C. G. MacOdrum, Q.C., M.L.A., H. Stanton, M.P., and G. T. Fulford. Mayor Gorrie in extending the greetings and good wishes of the citizens of Brockville invited all members of the new Branch to take an active part as well as an interest in the affairs of the communities in which they lived and worked.

Institute representation was drawn from many parts of the country and in addition to the chairman of the Kingston Branch, S. H. Rochester, the Cornwall chairman, J. M. Hawkes and J. P. Watts, Peterborough were present, as well as Past Vice-President W. L. Saunders, Councillors B. G. Ballard and T. M. Foulkes from Ottawa, D. Ross-Ross, Cornwall, S. Sillitoe, Belleville, D. L. Rigsby, Kingston, W. H. Paterson, Toronto, F. Alport, Orillia, as well as others. The Montreal delegation included Vice-President I. R. Tait, Past-President J. B. Stirling, Councillors A. S. Rutherford, E. R. Smallhorn, E. D. Gray-Donald, Henri Gaudefroy, F. L. Lawton, J. Benoit, A. D. Ross, Chairman G. N. Martin, Past-Councillor R. C. Flitton. As well as these, Branch representatives L. F. Grant, past president and field secretary with J. A. Ogilvie, assistant field secretary, Toronto, and Miss M. McLaren, assistant to the general secretary and H. G. Thompson, assistant general secretary were also present.

During the afternoon preceding the inauguration, a regional meeting of Council was held in the Manitonna Hotel at which President Dobbin presided, and a heavy agenda of varied matters of business was dealt with.

President R. L. Dobbin presented the charter of the new Brockville Branch to Chairman John Waddington. From left to right, front row: John F. Preston, Fred Walsh, John Waddington, R. L. Dobbin, I. R. Tait. Back row, left to right: R. M. Powell, John G. Kerfoot, Col. H. G. Thompson, R. D. Davey.

## Association of Professional Engineers of New Brunswick

J. M. M. Lamb, M.E.I.C., district marine agent of the Department of Transport, Saint John, was elected president of the Association of Professional Engineers of New Brunswick at the annual meeting on January 28.

The vice-president is D. J. Brewer, M.E.I.C., president of Planet Construction Co., Ltd., Fredericton; and the past-president is D. O. Turnbull, M.E.I.C., consulting engineer, Saint John. The secretary-treasurer is R. D. C. Clark, M.E.I.C.

Seven councillors will serve the Association in four districts, as follows: Saint John, D. R. Webb, M.E.I.C., and K. V. Cox, M.E.I.C.; Moncton, W. D. G. Stratton, M.E.I.C., and R. L. Parsons, M.E.I.C.; Fredericton, E. E. Wheatley, M.E.I.C., and S. B. Cassidy, M.E.I.C.; Chatham, H. G. Rogers, M.E.I.C.

A large number of Association members from all parts of the province were present for a business session held in the morning and afternoon. An estimated 110 persons attended a dinner at which the Engineering Institute's Saint John Branch members were hosts to the Association. Brigadier T. Eric Snow, officer commanding the New Brunswick Military area, was the guest speaker.

## Resources Conference

The present status of Canada's soils, waters, forests, wildlife and recreational resources will be surveyed by representatives of five of Canada's national organizations. Sponsors of the public Resources Conference, to be held at the Chateau Laurier, Ottawa, April 22-23, 1954, are the Canadian Institute of Agriculture, Canadian Chamber of Commerce, Canadian Forestry Association, Canadian Institute of Forestry, and the Engineering Institute of Canada. Delegations from more than 100 public service organizations will be in attendance.

The importance of the perpetuation and profitable use of natural resources by industry and government, will in this way be brought to the attention of the Canadian public; and the views of the Conference will be made available to industry and to provincial and national governments. The objective of the Resources Conference is to check known abuses, obtain greater co-ordination at all levels, and give the people of Canada the fullest possible advantage from their great wealth of resources.

All members of the Engineering Institute are invited to attend.

The program appears on the following page.

## Program of the Resources Conference
## Chateau Laurier, Ottawa

**April 22, 1954.**

**9.45 a.m.**

**Welcome:** Chairman of the Board, Canadian Forestry Association, James A. Vance, M.E.I.C.

**Official Opening:** For the Government of Canada, the Rt. Hon. C. D. Howe, Hon. M.E.I.C.

**"National Forestry Objectives and Policies"**—R. M. Fowler, President Canadian Pulp and Paper Association.

Discussion papers by four leading Canadians representing: (a) Quebec and Atlantic Provinces, Omer Lussier; (b) Ontario, Dean J. W. B. Sisam; (c) Prairie Provinces, Donald H. F. Black; (d) British Columbia, John Liersch.
Discussion of papers, and open forum.

**2.30 p.m.**

**Soil and Water:** Chairman, J. S. McGowan, F.A.I.C.

**"National Soil and Water Objectives"** —M. M. Porter, Q.C., Calgary.

Discussion papers by four leading Canadians representing: (a) Maritimes, John Walsh; (b) Quebec and Ontario, John A. Stewart; (c) Prairie Provinces, Dr. W. J. Parker; (d) British Columbia, Dr. D. B. Turner.
Discussion of papers and open forum.

**8.00 p.m.**

**Committee Meetings, Exhibits, Motion Pictures,** for delegates and guests.

**April 23, 1954.**

**9.45 a.m.**

**Wildlife and Recreation:** Chairman, F. H. Kortright, Toronto.

**"National Wildlife and Recreational Objectives"** — R. L. Haig-Brown, Campbell River, B.C.

Discussion papers by four leading Canadians representing: (a) Quebec and Atlantic Provinces, Dr. Harrison F. Lewis; (b) Ontario, Dr. W. W. H. Gunn; (c) Western Canada, Dr. W. F. Tisdale; (d) British Columbia, E. G. Oldham.
Discussion of papers and open forum.

**2.30 p.m.**

**Summary Session:** Chairman, Francis G. Winspear, Edmonton, Chamber of Commerce.

Forestry objectives, W. A. Delahey, president Canadian Forestry Association; Soil and Water Objectives, Dr. G. R. Smith, president Agricultural Institute of Canada; Wildlife and recreational objectives, R. L. Haig-Brown.
Committee to determine educational action from the Conference: Messrs. W. J. Borrie, R. L. Dobbin, W. A. E. Pepler, G. R. Smith, James A. Vance, chairman.

**6.00 p.m.**

**Reception:** E. B. Eddy Company.

**7.30 p.m.**

**Banquet.**

**"Our Renewable Natural Resources"**, address by Rt. Hon. Louis S. St. Laurent, Prime Minister of Canada.

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# Hydro-Electric Progress in Canada, 1953

Although a tremendous amount of hydro-electric construction was underway in Canada in 1953, the amount of capacity brought into operation during the year was somewhat lower than that of recent years, although still appreciably above that of the pre-war period. New capacity in 1953 amounted to 638,012 hp., bringing the total capacity of all water-power plants in Canada to 14,921,459 hp. Plants and extensions under construction for operation in 1954 total 1,500,000 hp. Total power consumption in 1953 was about seven per cent above 1952.

The British Columbia Power Commission completed the installation of the final two units each of 28,000 hp. in the John Hart development on the Campbell River, Vancouver Island. Redevelopment of the Puntledge River plant has been undertaken; a single unit of 35,000 hp. driving a 30,000 kva. generator will be installed with initial operation probably in 1954. Diesel installations totalling 2,835 kw. were placed in operation during the year. Transmission lines built include 100 miles of 63-kv. line, 22 miles of 60-kv. line, and 8 miles of 132-kv. line.

The British Columbia Electric Company Limited continued construction towards the installation of a fourth 62,000 hp. unit in its Bridge River plant for 1954 operation. The raising of the La Joie storage dam also was continued. Surveys were made covering a proposed development on Seton Creek to further utilize the water diverted through the Bridge River plant; active construction will begin in 1954. The company extended its 60-kv. lines and new substation facilities were provided at Vancouver, Victoria, Haney, Ladner and Langford.

The Consolidated Mining and Smelting Company expects to complete the construction of its Waneta development on the Pend d'Oreille River early in 1954. The plant will contain two turbines each of 105,000 hp. Favourable progress has been made on the Kemano-Kitimat project by the Aluminum Company of Canada. Drilling of the 10 mile, 25-foot diameter diversion tunnel from Tahsta Lake and of the penstock tunnel was expected to be completed by the year's end. The underground power-house has been completed and the work of installing three 140,000 hp. turbines and 106,000 kva. generators is well advanced. The 50-mile transmission line from Kemano to Kitimat has been completed.

Alaska Pine and Cellulose Limited completed the installation of a 3,200 hp. turbine. The East Kootenay Power Co. has completed the construction of a new dam on the Bull River. The Northern British Columbia Power Company Limited has installed a unit of 2,750 hp. and the Powell River Company Limited has added a 13,125 kw. steam turbo-generator to supply additional power to its mill at Stillwater. The city of Nelson has rebuilt its 10-mile transmission line from the Kootenay River plant and raised the voltage to 66 kv. New substations at both ends of the line have been completed.

A Pelton wheel of 940 hp. driving an 875 kva. generator was added to the Porter Creek plant of the Yukon Hydro Company Limited.

In Alberta, the Calgary Power Limited has under installation a third unit rated at 33,000 hp. in its Ghost plant on the Bow River. Construction of a 22,000 hp. installation is proceeding on the Bearpaw development and the addition of two pump stations at Goat Creek is expected to increase the annual output of the Spray and Rundle plants by about 75 million kw.-hrs. The transmission system was extended by 84 miles of 138-kv. line, 24 miles of 66-kv., 7 miles of 33-kv., and 76 miles of 22-kv.

Canadian Utilities Limited increased the capacity of their Diesel plants by 1,825 kw. New transmission lines included 37 miles at 69 kv. and 80 miles at 22 kv. The city of Medicine Hat added a steam-turbo generator of 30,000 kv. capacity. Edmonton completed the installation of a 30,000-kw. gas fired steam turbo-generator unit and substation capacity was increased by 15,000 kva. The city of Lethbridge completed the installation of 5,000 kw. in its steam-electric plant.

In Saskatchewan, the Saskatchewan Power Corporation completed a 20,000-kw. single unit addition to its steam plant at Estevan, and has undertaken for 1954 operation, the installation of a 25,000-kw. unit in Saskatoon. A 4,300-kw. gas engine generator set was installed at Unity. A new 69-kv. transmission line was built from Unity to Luseland and Kindersley, a distance of 45 miles. New substations were built for a total increase of 25,000 kva.

No new hydro-electric units were brought into operation in Manitoba in 1953, but the Manitoba Hydro-Electric Board continued construction on its McArthur Falls development of 80,000 hp. on the Winnipeg River. Improvements and repairs were carried out at the operating plants on the Winnipeg River. In connection with the Laurie River development of Sherritt-Gordon Mines Limited, a control dam was completed on the Loon River.

The Manitoba Power Commission continued to expand its distribution system. New transmission lines built include 85 miles at 115 kv., 64 miles at 66 kv., 32 miles at 33 kv., and 78 miles at lower voltage. The Parkdale and Neepawa terminal stations were increased by 15,000 kva. and distribution substations by 13,000 kva.

In Ontario, the eighth unit of 33,000 hp. at the Otto Holden Station was placed in service in April 1953. Construction progress on the 1,260,000 hp. development at the Sir Adam Beck-Niagara station on the Niagara River at Queenston is well advanced and the first units are expected to be placed in service early in 1954. In 1952 the Commission decided to install a third unit at the Pine Portage station and in April 1953 it was decided to proceed with a fourth unit; each of these units will be rated at 45,000 hp. and are scheduled for operation in September and December of 1954. At the Manitou Falls station three generating units which will have a combined capacity of about 46,000 hp. will be installed for scheduled service in 1956. All generating units at the Richard L. Hearn and J. Clark Keith steam-electric stations are now in service.

Extensions to transmission lines during the year are expected to be as follows: 42 miles of 230-kv. line; 204 miles of 115-kv.lines; 252 miles of 44 to 13-kv. lines; and 1,450 miles of rural lines.

Aside from the Commission's operations, the Great Lakes Power Company completed the construction of its development of 20,000 hp. at Scott Falls on the Michipicoten River. The Ontario and Minnesota Power Company will replace nine units at their Rainy River plant by eight turbines of 2,000 hp. each, for an overall increase of 650 hp.

The Quebec Hydro-Electric Commission added two units, one of 55,000 hp. and one of 56,000 hp. to its Beauharnois development on the St. Lawrence River.

On the Upper Ottawa, the construction of the two unit 32,000-hp. Rapid II development is proceeding on schedule and operation is expected in June 1954. Construction was commenced on a major hydro-electric development on the Bersimis River about 62 miles above its mouth. The site has an estimated capacity of 1,200,000 hp. of which 300,000 hp. will be developed initially, with operation scheduled for 1956. Preliminary field work for a line from the Bersimis development to Quebec was underway in 1953.

The Aluminum Company of Canada completed its Chute à la Savanne development of 285,000 hp. on the Peribonka River and Price Brothers and Company Limited completed its two plants on the Shipshaw River for a total capacity of 79,000 hp. The Manicougan Power Company brought into operation in January the second unit of 56,200 hp. The Shawinigan Water and Power Company has undertaken the installation of one additional unit in each of the Rapide Blanc, La Trenche and La Tuque plants, involving a total additional capacity of 149,500 hp., expected to be available in 1955. The Ste. Marguerite Power Company expects to complete, in May 1954, the construction of its hydro-electric development of 17,000 hp. in two units at "61 Falls" on the Ste. Marguerite River.

While not adding to their generating capacity, other companies extended their distribution systems and enlarged their storage facilities.

In New Brunswick, the New Brunswick Electric Power Commission brought into operation its two-unit 27,000-hp. plant at "The Narrows" on the Tobique River. In its steam plant at Grand Lake the addition of a 18,750-kw. unit was completed.

The Nova Scotia Light and Power Company completed the installation of an additional unit of 22,000 kw. in its steam plant at Halifax. No new developments were completed in 1953.

The Nova Scotia Power Commission extended its transmission lines with 7 miles at 23 kv. and 126 miles of secondary distribution lines. Proposed developments for 1955 include a 6,000 hp. unit on the Mersey River near Liverpool and a 20,000 kw. turbo generator for the steam plant at Trenton.

The Newfoundland Light and Power Company completed the construction of its second plant on the Horsechops River, a 10,000 hp. unit. A 3,850 hp. diesel unit has been installed at St. John's for stand-by purposes.

In Labrador, the Iron Ore Company made favorable progress on its 12,000 hp. development at Menihek Rapids on the Ashuanipi River.

Investigations and transmission line extensions were carried out by other companies.

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# Prestressed Concrete

Like any new material or method of design, prestressed concrete made but slow headway in its early years, but now that its promoters can point to real accomplishment, it seems to be in a fair way to find its proper place in the engineer's tool chest. Like conventional reinforced concrete in the first years of this century, it has had to prove itself and its methods of design and of construction have had to be established. Now the educational process of making these familiar to engineers outside the immediate circle of its proponents is in progress.

Engineering interest here in prestressed concrete is shown by the fact that 450 engineers and others gathered in Toronto on January 28 and 29 last, to listen to and discuss nine papers on the subject. These meetings, called the "Canadian Conference on Prestressed Concrete", were sponsored by the extension department of the University of Toronto and were arranged by a committee headed by Professor C. F. Morrison, M.E.I.C., representing both engineers and material suppliers. Its proceedings may be obtained for $2.50 in advance from J. R. Gilley, Simcoe Hall, University of Toronto, Toronto 6, Ont.

While all the papers deserve careful reading, to this writer there were two outstanding ones: "Why

Should we use Prestressed Concrete?", by R. F. Shaw, M.E.I.C., vice-president, The Foundation Co., Ltd., Montreal, and "An Introduction to Prestressed Concrete Theory", by Harold Fealdman, M.E.I.C., assistant research engineer, the Hydro-Electric Power Commission, Toronto.

Mr. Shaw quite properly asks a lot of questions, many of which have long been in the minds of engineers and contractors who have drawn their knowledge of prestressed concrete from the rather general — and laudatory — material which has been appearing in print about it. He wants a good definition of prestressed concrete and to know by whom and under what codes it will be designed. In more detail, he asks, "How do you handle spalling, bursting and bond? Are the anchorages safe? What about friction, shrinkage, deferred strain, end slip and thermal expansion? How fireproof is it? Will it stand up to weathering? Is construction difficult?"—and the burning question, "How much does it cost?" It may be that definite answers to all these questions now exist; if so, Mr. Shaw and most of the rest of us haven't heard them.

But Mr. Shaw is no pessimist. He concludes that prestressed concrete will find its rightful place if it can be proved that it is a step forward in structural design and says quite positively that he thinks the proof can be made.

Mr. Fealdman presents the theory underlying prestressed concrete design simply and logically enough so that any engineer familiar with conventional reinforced concrete designs can easily follow his paper. And unlike some authors, he works out some numerical examples, always a help to the uninitiated.

There are seven other papers, but it would take too much of our space to abstract them all in detail.

M. A. T. Waidelich, vice-president, The Austin Co., Cleveland, discusses the results of tests made under his direction on two prestressed concrete beams. R. B. Young, M.E.I.C., and J. B. Mustard, the Hydro-Electric Power Commission, Toronto, in "Control of Quality in Prestressed Concrete", feel that it is not too difficult to design and produce concrete having the 5,000-6,000 p.s.i. compressive strength required, but that trouble, if any, will come from what is done with the concrete after it is made, i.e., it is useless to make good concrete and then transport, place and cure it carelessly. They think there is plenty of room for improvements of our present methods in these operations.

"Steel for Prestressed Concrete" is discussed by Professor M. W. Huggins, M.E.I.C., University of Toronto; Professor G. Magnel, of the University of Ghent, known as one of the leading figures in the development of prestressed concrete, writes on "Significant Features of Prestressed Concrete". He limits his remarks to seven topics: (1) design and construction of statically indeterminate structures in prestressed concrete; (2) friction loss along poststressed cables; (3) design based on ultimate load for both statically determinate and indeterminate structures; (4) allowable working stresses; (5) has the time come for standard specifications and codes?; (6) can prestressing be applied to materials other than concrete?; (7) why has Europe been ahead of America in prestressed concrete?

Dr. T. O. Lazarides, consulting engineer, Toronto, emphasizes that prestressed concrete is a statically indeterminate material and must be so treated. This concept leads to rather definite procedures in construction. A. L. Parme, the Portland Cement Association, Chicago, gives a brief review of past research in prestressed concrete and some account of work in this field now going on.

And finally, Robert Shama, chief engineer, Empresas Campenon Bernard de Venezuela, Caracas, presents the only wholly descriptive paper of the conference, "The World's Largest Prestressed Concrete Spans", the three arch bridges on the new road, the "Autopista", between Caracas and its port, La Guaira. The ingenious methods of construction used there will no doubt impress all readers.

Every engineer with the slightest interest in prestressed concrete would do well to purchase these proceedings. They differ from some; these are well printed and copiously illustrated and appeared promptly—less than two weeks after the conference and while interest in it was still running high.

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# C.E.A. Winter Conference Held in Quebec

The twentieth annual winter conference of the Canadian Electrical Association was held at the Chateau Frontenac, Quebec City, January 18 to 22 inclusive. Some 300 delegates from Eastern Canada were in attendance, and discussed various problems concerning the generation, transmission, distribution and use of electricity to assure continued good service to customers at continued low cost.

Sessions on the opening day included those of the Residential and Farm Section, where problems relating to residential and farm customers were discussed, and the Lighting Section, where papers were presented on industrial, commercial and home lighting, as well as street and highway lighting.

The second day's sessions were devoted to affairs of the Industrial Power, Wiring, Accident Prevention, Public Relations and Commercial Power Sections. The Wiring Section heard a paper on "The Electric Utility and Television" by J. A. Winterbourne, who pointed out that safety is neither appreciated nor understood by the public, and regulations must be made to compensate for this. There was no section of the Canadian Electrical Code dealing with proper installation of TV and FM antennas, he said. If utilities would undertake employee training for linemen and field men to report on dangerous installations, and answer the more common technical questions by customers, many fatal accidents would be avoided.

Three papers were presented before the Public Relations Section; one on "The Industrial Film"; another on "The Promotion of a Film Library"; and a third on "The Need of a Public Relations Program and Its Planning". The Commercial Section heard a paper on "Commercial Cooking, A Utility Load Builder". The Accident Preventions Section saw a film entitled "Pole-Top Rescue".

Meetings were held the third day, January 20, for the Rate Research, Personnel Relations, Transmission and Distribution, and Thermal Power Sections. The Personnel Relations Section saw a film entitled "First Impressions Can Make or Break the Foreman", and heard papers on "Who is Responsible for Giving a New Employe a Good Start", and "How a Foreman Should Improve or Simplify Methods of Work".

The Thermal Power Section heard a paper on "Pulverized Fuel Furnaces" by W. H. D. Clarke. During the day, C.E.A. President C. I. Bacon, M.E.I.C., was honored by receiving a degree of doctor of science from Laval University. Dr. Bacon, who is also vice-president and general manager of the Cornwall Street Railway Light and Power Co., was also the speaker at the Association's dinner held on January 20.

Pointing out that Canada's per capita consumption of electricity was exceeded only by that of Norway, Dr. Bacon called for forward thinking by management and by power engineers; reasonable governmental attitudes on taxation; and wholehearted cooperation and understanding of the industry's problems by governments, management, and labor. The addition of 638,000 hp. during 1953, he said, had raised Canada's installed power to 14,921,459 hp., or some 23 per cent of Canada's resources, but we were hardly keeping pace with growing demands. Installations under way will add a further 1,500,000 hp. during 1954. The addition of the further 15 million horse power needed over the next decade, he said, presented many problems, but with faith in Canada's future by all, these needs would be met.

On the fourth day, sessions of the Thermal Power Section were continued. Delegates heard papers on "Modern Steam Turbine Discs and Blades" by J. K. Leeming, and "The Electrical Melting of Non-Ferrous Metals" by J. O. Edwards. Other papers related to coal-fired gas turbines, hydrogen cooling of steam turbo-generators, powdered fuel furnaces and thermal power station chemistry, while several films relating to steam power were shown.

The Electrical Apparatus Section reviewed progress on "Interchangeability of Transformer and OCB Bushings". The System Planning Section heard several papers, including one on "Operation of Phase Shifters on the Montreal System" by J. J. Villeneuve of Hydro-Québec. The Service Connections and Metering Section heard papers relating to new type meters, including one entitled "The Sangamo One-Second Thermal Converter and Its Uses". The Motor Vehicles Section discussed operational costs of aluminum bodies for line trucks, following a paper on the subject by J. R. Beale of the Aluminum Co. of Canada.

At a dinner on the evening of January 21, the Hon. Lionel Chevrier, federal minister of transport, addressed the delegates on the subject of the St. Lawrence Seaway and Power Project. Pointing out that two alternative projects were being considered for the Lachine Section, he stated the one solely for navigation "would be an exclusively federal undertaking", if the provincial authorities were not interested at this time in a joint power and navigation development.

Mr. Chevrier reiterated Canada's determination to build an all-Canadian seaway, but pointed out that Canada was committed to consider any firm proposal for U.S. participation that would not upset present power plans nor unduly delay completion of the Seaway.

During the fifth day, meetings of the Standardization Co-ordination, Hydraulic Power, Communications, Telemetering and Supervisory Control, Major Industrial Power, and Grounding Sections, were held. Among the papers presented was one on "Application of Supervisory Control to Hydro Electric Plants" by J. E. Hardy of the Canadian Westinghouse Co., before the Communications Section. The conference concluded on January 22.

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# 1953 E.I.C. Membership Directory

## Errata

With the completion and distribution of our 1953 Membership Directory, a small number of errors have come to light. Naturally these are very much regretted, but since the work had to be done under pressure against time, a certain number of mistakes were almost inevitable.

For the convenience of all members we are printing below the listings as they should have appeared in the Alphabetical Section where they were in error. For errors in the Geographical Section, the necessary correction is simply noted.—Editor.

**BURBIDGE, H. G.**, Queen's '44, Engr., Gen. Engrg. Dept., Aluminum Co. of Can., Sun Life Bldg., Montreal. S'43. J'46. M'51.

**BUSBY, A. H. W.**, Birmingham '23. Supt., Engrg. Res. and Dev., C.M. & S. Co., Trail, B.C. Mail: 14 Murray Dr. M'46.

**CLENDENING, C. S.**, Mgr. Lethbridge Northern Irrigation Dist., Box 630, Lethbridge, Alta. AM'22. M'40.

**GRANT, L. F.**, R.M.C. '05. Queen's '25. Laval '47. Field Sec., Engrg. Institute of Can., 236 Avenue Rd., Toronto. Mail: 115 Gore St., Kingston, Ont. S'08. AM'13. M'27.

**HAULTAIN, Prof. H. E. T.**, Tor. '89. Consltg. Engr.; Pres., Infrasizers Ltd., Toronto. Mail: Univ. of Toronto. M'01.

**MACAW, K. W.**, Man. '49. Engr., Macaw & Macdonald Ltd., 407 Youville St., St. Boniface, Man. Mail: 117 Kingsway Ave., Winnipeg. S'49. J'51,

**MacGILL, Elsie Gregory**, Tor. '27. Michigan '29. Consltg. Engr., 356-370 Physicians' & Surgeons' Bldg., 86 Bloor St. W., Toronto. Mail: 67 Highbourne Rd. AM'38. M'40.

**MacNEIL, D. J.**, Princeton '35. Consltg. Geologist, Prof. of Geology, St. Francis Xavier Univ., Antigonish, N.S. Mail: Box 26 University P.O. M'43.

**PORTER, J. William**, Consltg. Engr., 144 Brock St., Winnipeg. S'02. AM'10. M'18.

**SPOTTON, J. G.**, Tor. '22. Gen. Mgr., John Spotton Co., 21 Carson St., Toronto. S'20. J'24. AM'34. M'40.

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The April issue will contain . . .

- Eight important technical papers
- Biographies of E.I.C. officers-elect
- The program of the Annual Meeting

# C.C.A. Meets in Vancouver

The 36th Annual Convention of the Canadian Construction Association was held at the Vancouver Hotel, Vancouver, B.C., January 24-27 inclusive, with an attendance of some 400 out-of-town delegates and as many local members and guests. On arrival, President John Flood was honoured by presentation of Indian regalia, signifying his election as Honorary Chief of the Squamish Tribe, by Chief Joe Mathias.

The first official business was the Sunday luncheon for Builders Exchange secretaries, who heard a report on the International Association of Builders Exchange Managers, and engaged in discussions led by Harold Cole of Vancouver. Hope was raised that this inter-exchange consultation would be broadened in frequency and scope.

As usual, the Monday session began with presentation of committee reports. Lorne Bain reported for the Membership Committee that 115 new members and 25 resignations had brought the total to 1013. Chairman V. L. Leigh of the Housing Committee warned it was the industry's responsibility to see that increased costs did not nullify the advantages to purchasers through the proposed housing legislation. This responsibility, he said, was shared with labour, designers, suppliers and real estate agents.

Chairman R. A. Seasons of the Legislation Committee reported many important pieces of federal and provincial legislation are under review or likely to be reviewed this year, and urged maintenance of a close watch by the Association and by provincial and local bodies. For the Research and Education Committee, Chairman J. F. Parsons reported on C.C.A. grants to aid research programs. Proposed by the Committee and approved in principle by the management were four annual fellowships of $1,200 each for graduate study in construction. One of the maritime universities would inaugurate a construction engineering course in 1954.

Allan Ross, chairman of the Labour Relations Committee, told the meeting that building trade wage rates had been more stable in 1953 than in 1952. Only 15 per cent of the rates had risen more than 10 cents an hour. Average hourly earnings of construction workers had increased about five per cent. Time lost through work stoppages had decreased sharply from 1952.

An August 1953 amendment to the Unemployment Insurance Act, he said, provided benefits to insured persons who, otherwise unemployed, became incapacitated through illness or injury. Major labour bodies are urging a broader amendment, by which benefits would be paid to unemployed who had lost their jobs because of illness. This, he pointed out, would mean unemployment insurance funds would become a form of health insurance, which was not the intent of the Act. He urged employer representatives to watch any demands made on the fund or changes in the Act.

E. R. Smallhorn, chairman of the Publicity Committee, urged increased use of publicity to inform the construction purchasing public of the capacity and experience of Canadian firms.

J. M. Pigott, O.B.E., chairman, Apprenticeship Committee, stated there had been a gain of about 10 per cent in active apprentices in 1953 over 1952. Quebec showed 13,272 for 1953 compared with 10,000 for 1952; all other provinces showed 6,169 vs. 5,216 the previous year. The extraordinary growth of training in Quebec province, he said, illustrated the capacity of the industry as a whole to absorb this all-important work of training new mechanics for our growing needs.

Chairman J. M. Soules, speaking for the Provincial Activities Committee, recommended that the Association should enter more vigorously into provincial matters affecting the industry, through provincial or regional counterparts of builders exchanges or by the C.C.A. itself.

#### President's Address

C.C.A. President John N. Flood, in his annual address, told delegates that the year 1953 had broken all records with an estimated volume of work at $4½ billions, or some 2½ times the 1939 volume. The most significant development had been the strong effective demand for new houses. Volume had been divided 30 per cent for residential, another 30 per cent for industrial, commercial and institutional, and the remaining 40 per cent engineering construction. Of the latter, road building at $450 millions was the largest component.

Mortgage credit availability had been the most serious factor limiting the size of the housing program, but the announcement that chartered


**At the Canadian Construction Association's annual meeting in Vancouver. Left to right: Raymond Brunet, the new president; F. G. Rutley, M.E.I.C., Montreal; Robert Drummond, M.E.I.C., Toronto; Pipe Major Esson of the Seaforth Regiment; John N. Flood, M.E.I.C., Saint John, N.B., retiring president; John Clarke, M.E.I.C., of Toronto, a past-president.**

banks will be permitted to enter the direct residential mortgage field had been a major 1953 accomplishment, and should bring housebuilding closer to meeting the needs of our rising population.

In spite of large road building programs in recent years, rising volume and speed of highway traffic was steadily building up a growing backlog of road requirements. The success of federal-provincial co-operation in building the Trans-Canada Highway, he felt, showed the desirability and feasibility of continued federal participation in the expansion of our highways of national importance, without infringing upon provincial rights.

From all corners of Canada, signs pointed to long-term prospects for an increasing volume for the industry. A positive approach to the problems accompanying it, he observed, was to assure steady expansion of capacity to handle the greater tasks ahead, by developing greater supplies of trained manpower, materials and money. Any vacuum left by Canadian firms would be quickly occupied by foreign firms.

Costs, he warned, must be kept at levels that will continue to attract investors. Designers, manufacturers, suppliers, contractors and labour all shared the responsibility for producing projects speedily, efficiently and economically. Since over 90 per cent of costs, from raw materials to the completed job, appears in somebody's pay envelope, labour could affect the final price very materially.

When costs rise above competitive levels in any field, buyers invariably turn to other sources. Only recently we had seen merchant vessels changing registry, mines closed, the totem-pole industry threatened by Japanese imports, production cut in our textile mills. The lesson was clear. We must watch that our cost structure does not get out of balance.

A great disservice to all workers and to industry could result, he continued, if incentive and initiative were seriously impaired by too wide a range of guarantees and fringe benefits, under the guise of security. Economic security does not lie in that direction. The price of "complete security", if there is such a thing, is the loss of freedom. The delicate balance between the two must not be upset. But incentive to employers, a reasonable return on risk capital, are equally essential ingredients of a healthy economy.

Deploring the diminishing degree of personal contact between employer and worker, he pointed out that second-hand relationships through experts are all too often second-best for either party. Conciliation boards have gained a reputation from recommending middle-of-the-road settlements as a compromise, resulting in initial union proposals being often tailored to this formula, rather than as a basis for true negotiations and examination of facts. Conciliation boards tend to make everything secondary to the effecting of a settlement.

Following the afternoon discussions at the sectional meetings, those attending the "Burns Nicht Supper" were addressed by the Hon. R. W. Bonner, Q.C., attorney general of British Columbia.

#### Panel on Merchandizing

During the Tuesday morning sectional sessions, the Manufacturers and Supply Section heard a talk by W. G. Leithead on "How Manufacturers and Suppliers Can Be of Greater Assistance to Architects". He described the functions of the architect, and suggested ways in which successful collaboration between architects, structural, mechanical and electrical engineers, and contractors, manufacturers and suppliers could be achieved. This was followed by a "Panel Discussion on Merchandizing Methods", in which Past President "Bob" Drummond, R. F. Legget, director of building research, National Research Council and Mr. Leithead participated.

#### Forum on Better Transportation—Highway Transport

The luncheon meeting heard an address by G. M. Parke, president, Canadian Automotive Transport Association, one of four speakers during the convention on the question: "How Would You Spend a Billion Dollars to Improve Transportation in Canada ?"

Referring to the growth in the numbers of trucks to a total of 770,000 in 1952, of which the trucking industry's 70,000 vehicles earned $200 millions in freight haul during 1953, and another 200,000 of which were used on Canadian farms, he called attention to the flexible, personalized and specialized services that trucks can provide.

If Canada's rate of growth over the past quarter century continues at the same rate, by 1978 we would have a population of close to 21 millions and 5.7 million motor-vehicle registrations, he predicted, but only 260,000 miles of roads. This indicated we would then have over 22 vehicles per mile of road by 1978 as against 18.5 vehicles per mile today. Unless road building was stepped up, we would then find ourselves even more deeply bogged down in the traffic quagmire.

It was unlikely, he said, that the trucking industry would seek any part of that hypothetical billion dollars as a subsidy, but if other forms of transportation were to receive such aid to enhance their competitive position with the trucking industry, then the latter might in self-defence be forced to seek its share.

#### What Water Transportation Needs

Tuesday's dinner meeting was addressed by J. R. McLagan, O.B.E., president, Canada Steamship Lines. Outlining the history and development of water transport in Canada, and particularly through the Great Lakes, he showed how it had stimulated Canada's growth. Tonnage carried by American and Canadian inland fleets combined had approached 200 million tons in 1953, he said, while of this a record 129 million tons passed through St. Mary's River canals, exceeding the tonnage through Suez and Panama combined. Combined inland fleets comprised 696 ships with capacity of nearly five million tons. The Canadian fleet comprised 264 ships with total capacity of 1,222,000 tons.

Foreign ships could use our canals, he explained, but cannot carry cargo from one Canadian port to another. British ships, however, can engage in this coastwise trade, which places Canadian ships at a great disadvantage. A British sailor earns $80.00 a month, while a Canadian sailor receives more than $200.00

Completion of the Seaway would create a huge international trade movement between Quebec ports and United States ports on Lake Erie. Does it seem good business to spend our money, he asked, and then hand over the trade to those who don't pay our taxes and who pay only a fraction of what we pay in wages ?

He advocated the signing of a proposed treaty between Canada and the United States, restricting this trade between our two countries to American- and Canadian-built and registered ships. Canadian shipbuilders also wanted our Pacific and Atlantic coasts restricted to Canadian built ships. Canadian shipbuilding wage rates are three to four times the wage rates paid on the Clyde. This, he said, was part of the price of being a Canadian.

At this moment our Canadian ships are being transferred to the British flag, and that meant repair work would be done in the U.K. We hope, he added, that our government will relent and take remedial measures to protect Canadian deep-sea vessels. The "Lifeline of Industry" can disappear very quickly if not protected. We cannot depend on foreign shipping. In time of war it will be withdrawn.

#### The Railroad Viewpoint

At the Wednesday morning session, the speaker was J. Hugh Campbell, director of personnel relations, Canadian Pacific Railway. In spite of the very high level of Canada's economic activity, he pointed out, the railways had shown a serious decline in net earnings. Carloadings for 1953 were lower than those of the previous year by 24 million tons. There had been a steady spiral climb in operating costs, material prices and wage rates, while on the other hand freight rate increases had been "too little and too late". It was a constant struggle to achieve net earnings which would even approach the amount needed to keep the plant in operation.

Regulations, he said, define all phases of responsibilities, regardless of cost, and control the rates the railways may charge, many of them obsolete. The railway business was in a "strait jacket" of regulations and controls and was unable to adjust its rates to meet the conditions of the times.

The two great wars had demonstrated the nation's dependence on rail transport, which was called upon to move bulk commodities at the lowest commodity rates. Highway competitors could select the better paying traffic, thereby taking the cream and leaving the railways the skim milk. This was the reason, he explained, why the railroads advocate removal of the controls that prevent them from bidding successfully for the kind of traffic that would pay their way and provide funds for improvements.

#### Air Transport's Requirements

R. A. Keitts, assistant to the president, Canadian Pacific Air Lines, addressed the final luncheon meeting, on behalf of aviation, as the fourth speaker of the "Forum on Better Transportation".

Briefly reviewing the rapid growth of air transportation, he observed that while the industry merited a substantial investment in its future, the value of a transportation service could not be measured in dollars only, and this was particularly true of the role of aircraft in developing our northern resources.

Giving examples of the tremendous strides made in the movement of air freight, he emphasized that northern airports and navigation equipment warranted top priority in any program of this nature. A few million dollars wisely invested in airstrips could benefit the Canadian economy beyond calculation.

He also advocated the improvement of passenger terminals at our major airports, particularly the international terminals at Montreal and Vancouver, which were sadly out of harmony with other phases of airway development.

#### C.C.A. Policy and Resolutions

A statement of C.C.A. policy reaffirmed the Association's belief that free enterprise will operate to the greatest advantage and in the best interest of our country, and advocated:

(1) Fullest co-operation by management, labour, and government to improve efficiency and reduce costs; increased apprenticeship and immigration; and participation of labour organizations in a National Joint Conference Board; negotiation of labour agreements for periods of not less that two years.

(2) Acceleration of the flow of construction materials; emphasis on processing Canadian raw materials; quotation of firm prices; standards, methods and techniques leading to economies in material usage.

(3) Unrestricted C.C.A. co-operation with National Defence, Defence Production, the I.D.B. and Civil Defence Authorities.

(4) Maintenance of the National Housing Act to serve the essential housing market.

(5) Use of Trans-Canada Highway experience in establishing a Dominion Provincial Highways Commission for long term planning and construction of resource, tourist and strategic highways; replacement of level crossings with grade separations, and standard traffic signs and signals.

(6) Centralized control of projects under a general contractor; security deposits only on public projects; unit prices on lump-sum building projects limited to excavation, concrete, forms and reinforcement only; wider use of C.C.A.-R.A.I.C.-E.I.C. standard contract and tender forms.

(7) Continued support of N.R.C. and other technical building research; wider use of the 1954 National Building Code; complete utilization of Canada's forest resources through assistance under the Federal Forest Conservation Act; and continued support of the Community Planning Association towards achieving reasonable standards of housing and community development.

Resolutions adopted at the Convention were as follows:

(1) Appreciation of proposed federal amendments to housing legislation; advocation of an annual program of 125,000 dwelling units; extension of the 90 per cent provision beyond $8,000 value limit; consideration of age and future prospects of borrowers; co-operation by provinces and municipalities in N.H.A. land assembly schemes; open-end mortgages; an advisory committee under Section 34 of Bill 102; improved inspection services; and limitation of subsidized low rental housing to only the aged and underprivileged.

(2) Fullest use of the Canadian-owned and -controlled construction industry on the St. Lawrence Seaway; and disallowance of Department of National Revenue regulations which permit entry of construction equipment on a monthly proportionate tariff basis.

(3) Amendment of existing labour relations legislation by Federal and Provincial Governments, so as to require the use of secret ballots under supervision when trade unions vote on strike action, and enforcement of strict compliance with Canadian laws during strikes.

(4) Extension of the scope of Federal Sales Tax exemption to include all construction materials.

(5) Necessary subsoil information based on tests, and equitable adjustments with the contractor where conditions vary from the conditions described; and discontinuance of retention of holdbacks past the limits set by mechanics requirements.

(6) Contractors moving to a new area to recognize and respect principles set down by local Builders Exchanges.

The Convention closed with a joint meeting of the 1953 and 1954 executive committees, and election of officers for the coming year. Raymond Brunet, O.B.E., of Hull, Quebec was installed as president, with John Flood of Saint John as Immediate past-president, and W. G. Malcom of Winnipeg and Alan Turner Bone of Montreal as national vice-presidents.

# Sixty Years of the Faculty of Applied Science at Queen's

By Dean D. S. Ellis, M.E.I.C., *Queen's University*

**An address given at the Queen's University Convocation, October 1953, which marked the Diamond Jubilee of the Faculty of Applied Science.**

Sixty years ago in October 1893, the first classes in applied science were held by the newly formed School of Mining and Agriculture in the buildings of Queen's University. The School was not a part of Queen's University but was organized under its own Board of Governors representing those who had subscribed toward the formation of the new institution.

The members of this first board were: C. F. Gildersleeve, M. H. Folger, J. B. Carruthers, G. M. Grant, G. M. Macdonnell, Wm. Harty, Jas. Swift, J. L. Whiting, Hiram Calvin, E. W. Rathbun Jas. Haydon.

It is right to note their names because through their efforts engineering education was undertaken here.

Classes were held either in the Arts Building or Carruthers Hall. To the west of them lay an area of waste land extending to Gordon St. (University Ave.). In the southwesterly part of this area was laid out a rather rough football field. The team whose home field it was were champions of Canada that fall.

The initial subjects for the engineering course were mathematics, science and English, which were taught by the Queen's staff, while for the elementary drafting and surveying, special part time instructors were used for a few years. The appointment of W. G. Miller to the chair of geology brought to Queen's a truly great geologist who, unfortunately, left to be Provincial geologist. But he was the founder and first of a long line of distinguished geologists at Queen's.

We can picture a handful of perhaps six or eight students waiting uneasily that October morning sixty years ago for the opening lectures of the new course. They would be garbed in the rather unimaginative style of the early nineties—tight trousers with no crease or cuff, tight coats with waistcoats buttoned very high, stiff straight collars with murderous points and with hard felt hats, now rarely seen but then universally worn, and known facetiously as kaydees or christy stiffs.

From among the early graduates a surprisingly large number attained prominence in their profession, showing that when the basic training in mathematics, science and English is good, it becomes a determining factor in a man's progress in his profession. To mention only a few—T. S. Scott was an outstanding civil engineer and contractor. S. N. Graham later was professor of mining here. Charles Fortescue, a graduate in electrical engineering, rose to a position of eminence with the Westinghouse Company and made a world wide reputation as a designer of electrical machinery. He is still regarded as having been a leader in his profession. Another electrical graduate, H. S. Baker, also with Westinghouse and later with Hydro, became one of the outstanding authorities on electrical measurement. He had a great number of fundamental patents in relation to this work. Another man was M. B. Baker who for many years was professor of geology at Queen's.

Moving on now to the year 1905, we find 156 students attending the classes given by a staff of 17. This staff was a really outstanding one as the names of some will show. Among the Queen's staff were N. F. Dupuis, W. L. Goodwin, Wm. Nicol, R. W. Brock, M. B. Baker and W. C. Baker. On the engineering side were A. K. Kirkpatrick and four young McGill graduates who did so much to form the tone of the School, Gwillim, Stafford Kirkpatrick, Gill and Macphail. They made a very strong faculty, one of which the students were proud and also very fond.

Necessary new buildings appeared The mill for mining and metallurgy was erected about 1897. And in 1902 were built Ontario Hall for physics, mining, metallurgy, geology and mineralogy, and Fleming Hall for civil, electrical and mechanical and also botany. Thus the new school was provided with relatively adequate and comfortable quarters.

Going forward another ten years to 1914, we find the attendance had risen to 281 and the number of the staff was 28. That year A. K. Kirkpatrick died and W. P. Wilgar, a graduate of 1903 and an outstanding civil engineer, was appointed to the civil staff and Alexander Macphail became head of the department. However he did not assume this position till after the war, which flared up so quickly in August. He had organized a militia unit, the Fifth Field Company, among the engineering students in 1909. It trained faithfully. So when war came there was a marked movement of the staff and students into the Engineer units of the Army. Contrary to the impression gained from the local press, the Queen's engineers were not responsible for all the advances in the campaign but they did their part.

In the midst of this anxious time the negotiations to release the University from its formal ties to the Presbyterian Church were completed. Under its independent status, Queen's was eligible for government assistance which it could not receive as a church-affiliated institution. The result was that the School of Mining was reorganized as the Faculty of Applied Science of the University. Dr. W. L. Goodwin acted as dean for a few months and on his retirement Dr. A. L. Clark HON.M.E.I.C. was appointed to the post which he held with great distinction and greatly to our advantage for almost twenty-five years.

In the autumn of 1919 after four rather meagre years in educational circles from the point of view of supply of students, a surge of nearly 250 freshmen appeared for registration. Most of them were freshly demobilized soldiers, with all that that implies. However the new dean and his staff were equal to the task and showed themselves masters of improvisation in class rooms, teachers and timetables. Soon everything was running smoothly and much as in the old days, except for the practice of playing crown and anchor between classes.

There were a number of staff changes. Jemmett became head of electrical, Arkley of mechanical and MacKay took over metallurgy. N. L. Bowen, perhaps our most distinguished graduate in science, returned for a brief while as professor of mineralogy but we couldn't keep him and that department passed into another classmate's hands, E. L. Bruce, who later held the research chair in geology.

All departments were expanding their work and the student body continued to grow. The financial slump of 1929 and early thirties seemed to indicate to us that enrolment must drop. Strangely the opposite occurred, and during the bad economic years of the thirties, our enrolment rose more steeply than before, and by 1939 we had a staff of 46 and 646 students in the Faculty. In 1937 Lindsay Malcolm, for 30 years on our staff, was made director of the Civil Engineering College at Cornell—a marked recognition for Queen's.

Then came another great war. There were insufficient engineers for the now highly mechanized service units. However the decision was made to compel those students in engineering to finish their training before joining the forces. This proved a wise though unpopular decision. There were some suspicious-looking failures. Numbers dropped slightly and younger staff members went with the units of the technical services.

The surge of returned men experienced after the first war was recalled vividly by most of our staff, and preparations were made to deal with increased numbers. Our estimates, while not precise, were helpful and our preparations were adequate. For several years it was necessary to carry alternate groups through the summers. It allowed us to handle greatly increased numbers without enlarging materially the classes and still use adequate and customary classrooms. The result was, we think, excellent and it is with happiest memories that we look back to these days. The support we received from these men, and indirectly from their wives, made no effort on our part seem too great. It was a great privilege to have worked with them.

Now we are back to the high school graduate whose average age is say 19 on entrance and who has not much experience working with men, or sometimes perhaps of working. That is not his fault. However they are, as you can see, a promising looking lot. Their numbers are again increasing and this fall we have 794 undergraduates and 23 graduates.

Our class room space and laboratories are crowded but we can manage. The technical equipment in the various departments is expanding every year. Some recent additions are new hydraulic equipment in our laboratory and improvements in the Sanitary laboratory and improved testing equipment for highways materials: new transmitter in electrical and extended facilities in chemistry and chemical engineering; synchrotron in physics, X-ray and relay analytical equipment in geology; and last, but certainly not least, the truly magnificent mechanical building, McLaughlin Hall. All this equipment is actively used for research either at the master's level or by work the staff members are doing themselves.

Undergraduate instruction is our principal task but we believe that research is one of the best ways to improve this instruction and widen the horizon of both the teacher and the student. So our aim in graduate work is to have a relatively small body of good men who can be given adequate attention. The standards have purposely been made high. The results of this policy are shown in the uniformly good reports we receive of these men, most of whom go on for higher degrees elsewhere. Another confirmation of this policy is in the number who come here from other universities. Such work is done to a great extent in the sciences—chemistry, physics and geology and chemical engineering, where it has been found necessary to have a doctor's degree for advancement. Now even against the attraction of relatively high salaries in industry, graduate work is increasing in the professional departments.

About three years ago through the suggestion of Dr. N. F. Tisdale, an Advisory Council for Engineering was set up. It consists of three outside engineers for each engineering department. Of the three, one must be a graduate of another university, and the other two are Queen's graduates. The purpose of this Council is to study critically our work and to suggest changes to faculty. The general idea back of it is to get a truly impartial opinion on our work. Frankly we went into this with some misgivings, which have been swept away by the warm response we received when we asked men to serve on the Council, but when they met and went to work, we were somewhat lost in admiration and amazement. Subsequent meetings strengthened this feeling. We are very grateful to these men who have given so freely of their time and labor. And especially we thank here those men of other universities whose help has been so generously given. Apart from this, we the staff do enjoy talking once a year to someone who can listen sympathetically to our problems and doubts. Dr. Tisdale did better for us than we knew.

Some of you may think that staff and officials run the faculty. This is anything but true, for a large number of problems concerning students—and there are few which do not—are dealt with by consultation between staff and the Engineering and Year Societies. I wish now to pay tribute to the wise way in which the students carry on their affairs. They have always been a real help to us. A very tangible result of the Engineering Society's efforts is the modern book store which we now have.

So now we face the future with good advisers, good equipment, a strong student body and a staff which by tradition and inclination works as a good team should. We think that we have a good chance of progressing to even better things.

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# Engineering Education Statistics

In the academic year ending June 30, 1953, 21,612 Baccalaureate degrees were awarded to men and 30 to women by the engineering schools having E.C.P.D. accredited curricula. These schools awarded Masters degrees in the same period to 3,603 to men and 15 to women and Ph.D. degrees to 588 men and 4 women.

These schools have currently 18,000 persons enrolled for Master degree work (10,000 of these are evening students) and 3,000 are studying for their Ph.D. degrees.

The number of Baccalaureate degrees awarded by these same schools this year (ending June 30, 1954) will drop to about 17,000. Growing graduate school enrollments indicate, however, that more Masters and Ph.D. degrees will be awarded in 1954 than 1953. The variables in individual programs make numerical estimates impossible.

The figures quoted above were obtained from the U.S. Department of Health, Education and Welfare.

# The ASME Boiler Code

### Interpretations

The Boiler Code Committee meets monthly to consider "Cases" where users have found difficulty in interpreting the Code. These pass through the following procedure: (1) Inquiries are submitted by letter to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.; (2) Copies are distributed to Committee members for study; (3) At the next Committee meeting interpretations are formulated to be submitted to the ASME Board on Codes and Standards, authorized by the Council of the Society to pass upon them; (4) They are submitted to the Board for action; (5) Those which are approved are sent to the inquirers and are published in Mechanical Engineering.

The following Case Interpretations were formulated at the Committee meeting December 11, 1953.

**Case No. 1180**

Special Ruling

***Inquiry:*** The 1952 Edition of Section VIII, Table UCS-23 lists stress values for carbon-steel bar stock material furnished in accordance with Specification SA-306. May bar stock complying with Specification SA-7 be used in the construction of unfired pressure vessels?

***Reply:*** It is the opinion of the Committee that, pending the time when bar stock complying with Specification SA-306 becomes generally available, it is permissible to use bar stock furnished in accordance with Specification SA-7, in the construction of unfired pressure vessels under Section VIII of the Code, provided that:

(1) The steel is manufactured by the electric furnace or the open-hearth process.

(2) The design temperature at which the material is used is between 20 and 650° F.

(3) The stress value used in design is 12,650 p.s.i.

(4) The procedure classification for this material in Table Q-11.1 in Section IX of Welding Qualifications is P No. 1.

**Case No. 1170-1**

(Reopened)

Special Ruling

In the Inquiry, revise the first line of the tabulation to read: "0.095 in. for tubes 1¼ in. O.D. and smaller"

**Case No. 1091**

Covered by Specification SB-247 and revised footnote 5, Table UNF-23 1952 Section VIII.

**Case No. 1133**

Case Annulled

Covered by Table UNF-23 1952 Section VIII.

### Proposed Revisions and Addenda to Boiler and Pressure Vessel Code

As need arises, the Boiler Code Committee entertains suggestions for revising its Codes. Revisions approved by the Committee are published here as proposed addenda to the Code to invite criticism.

In the following the paragraph numbers indicate where the proposed revisions would apply in the various sections of the Code.

Comments should be addressed to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.

#### Unfired Pressure Vessels, 1952

***Table UNF-23.*** Footnote 5 revise to read:
The stress values given for this material are not applicable when either welding or thermal cutting are employed.

***Table UNF-23.*** Copper-Silicon, A, C, D, SB-96 Plates and Sheet (1), revise to read under "Subzero to 150" to "12,000" instead of "10,000".

***Par. UA-280.*** Example 1 insert the words "ring type joint" between the word "pound" and "welding neck".

#### Editorial

***Table UCS.-23*** Footnote (1). Change to "(1). See Par. UCS-6(b)".

***Par. UG-45(2).*** Add the reference "See Par. UG-31(c) (3) )."

***Par. UG-41(b).*** First and second lines, change "Par. UG-40(c)" to "Par. UG-40(a)".

***Example 1.*** Pages 148 and 149. In the first line on page 149 change "400F" to "150F".

***Par. UG-37(b).*** In (1), last line, change "M-1" to "E-1 and M-1"; in (2), second line, insert "seamless" before "cone"; in (3), seventh line, insert "seamless" before "sphere".

#### Non-editorial

***Table UCS-23*** and also to ***Table UHA-23:***—Add the following notes: "All stress values in shear are 0.80 times the values in the above table."

"All stress values in bearing are 1.60 times the values in the above table".

***Par. UG-44.***—Fifth line, change "ASA B-16e –1939" to "ASA B16.5–1953"; in the 6th and 7th lines, change "MSS 150 and 300 lb. Bronze flange and Flanged Fittings Standard, MSS SP-2-1946 (R-1949)" to "ASA B16.24-1953 Brass or Bronze Flanges and Flanged Fittings 150 and 300 lbs."; in 10th line, change "MSS SP-42-1951" to "MSS SP-42-1953"; in 13th line, change "B16e-1939" to "B16.5-1953".

***Table UA-450, Appendix O.*** Change the parenthetical note in the heading, from "(Table from ASA B16e-1939)" to "(Table from ASA B16.5-1953".

***Table UA-451.*** Change Footnote 5, page 159 from " . . . as given in ASA B36.10-1935, Schedule 4" to " . . . as given in ASA B36.10-1950 Schedule 40".

***Table UA-451.*** Change Footnote 6, page 159, from " . . . of the ASA B16e-1939" to " . . . of the ASA B16.5-1953".

Replace the tables on pages 160 and 161 with new B16.5-1953, Table 2 through 15 inclusive.

***Par. UG-41(c).*** Add the following sentence: "For obrotund openings, consideration shall also be given to the strength of the attachment joint on one side of the plane passing through the intersection of a semicircular end with the parallel sides of the opening".

***Par. UG-39.*** Reletter Pars. (a), (b), and (c) to (b), (c) and (d), respectively, and add a new paragraph reading:—

"(a) General. The rules in this paragraph apply to all openings other than small opening covered by Par. UG-36(c) (3).

***Par. UG-36(c) (a).*** Change "3 in. pipe size in vessel walls 3/8 in. or less" to "3 in. pipe size in vessel shells or heads 3/8 in. or less" and "2 in. pipe size in vessel walls over 3-8 in." to "2 in. pipe size in vessel shells or heads over 3/8 in".

***Par. VW-14.*** Reletter present (b) and (c) to (c) and (d) respectively. In present (c) (new (d), change last line of reference from "(a) (2)" to "(b)".

Replace present (a) with the following (a) and (b):

"(a) Any type of opening that meets the requirements for reinforcement given in Par. UG-37 may be located in a welded joint.

(b) Openings within the limits given in Par. UG-36(c) (*3*) that do not fully meet the requirements for reinforcement in Par. UG-37 may be located in head-to-shell and other circumferential joints, provided the weld meets the radiographic requirements in Par. UW-51(m) for a length equal to three times the diameter of the opening with the center of the hole at midlength. Defects that are completely removed in cutting the hole shall not be considered in judging the acceptability of the weld.

***Par. UW-11(b).*** Revise to:

"(b) Butt welds joining the flange or saddle of an inserted type nozzle as shown in Fig. UW-16.1(q) (1) and (q) (2) shall be radiographed when the vessel or vessel section to which the nozzle is attached is required to be radiographed. Nozzles attached by fillet or corner welds, or both, need not be radiographed. Delete Fig. UW-11.

***Fig. UW-16.1(q) (1).*** Note—Now UW-16.1(q), change this figure to show the acceptance of attaching an inserted type nozzle to a shell of thinner wall thickness by use of a 1:3 taper beginning at the shell side of the attaching butt weld. (Fig. UW-16.1(q) (1) attached as Appendix V.)

***Fig. UW-16.1(q) (2).*** Add this figure showing the attachment of inserted type nozzle to the shell and employing the compound taper recommended by the AWS and adopted by the ASA for joining thick body welds to relatively thinner pipe shells. This permits a 30 deg. maximum taper beginning at the inserted side of the attachment weld, and extending 1½ times the pipe shell thickness. From there to the nozzle neck, a taper of 45 deg. maximum is permitted. (Fig. UW-16.1(q) (2) attached as Appendix V).

Delete the present Fig. UW-16.1(q) and use the above two figures in its place.

***Par. UG-38.*** Revise as follows:

"UG-38 Flued Openings in Formed Heads (a) Flued openings in formed heads made by inward or outward forming of the head plate shall meet the requirements for reinforcement in Paragraph UG-37.

(b) The minimum depth of flange of a flued opening exceeding 6 in. in any inside dimension, when not stayed by an attached pipe or flue, shall equal 3t or (t+3) inches, whichever is less, where t is the required head thickness. The depth of flange shall be determined by placing a straightedge across the side opposite the flued

opening along the major axis and measuring from the straightedge to the edge of the flanged opening.
(c) The minimum width of bearing surface for a gasket on a self-sealing flued opening shall be in accordance with Par. UG-46(j). (Figure required for the revision of Par. UG-38 is attached as Appendix V).

*Par. UG-37.* Revise (a) to:
(a) General. The rules in this paragraph apply to all openings other than small openings covered by Par. UG-36(c), large head openings covered by Par. UG-36(b) (2), and openings in flat heads covered by Par. UG-39.

*Par. U-1(d) (2).* Revise to:
(2) Vessels for containing water under pressure for domestic supply including those containing air, the compression of which serves only as a cushion.
(3) A domestic hot-water supply storage tank heated by steam or any other indirect means when none of the following limitations is exceeded:
(a) a heat input of 100,000 BTU per hour,
(b) a water temperature of 200° F.,
(c) a nominal water containing capacity of 120 gallons.
Renumber present (3) and (4) to (4) and (5) respectively.

### Welding Qualifications, 1952

*Table Q-11.1.*—Delete SA-203, Grade D and Grade F from Table P-5 and insert in Table P-9. At the same time change Grade F to Grade E.

### Announcement

The 1952 edition of ASME Suggested Rules, Care of Power Boilers is now available through the Order Department, ASME, 29 West 39 Street, New York 18, N.Y.

## Thirty-five Years Ago

### Comment on the *JOURNAL* of March 1919

The annual meeting was held in Ottawa on February 11, 12 and 13, 1919. This was counted as the thirty-third, dating from the foundation of the old Canadian Society of Civil Engineers. The March *Journal* is devoted almost entirely to the doings at this meeting; most of the papers were printed in the February *Journal.*

Perhaps the most important step taken at the meeting was the appointment of a special committee composed of one member from each branch, to meet at Headquarters before April 15, 1919, "draw up such sample legislation as it may deem necessary and advisable in order that members of the Institute throughout the different provinces may ask for legislation on the same uniform basis," and report to Council before May 1, 1919. Council was ordered to "ask by letter ballot, before June 1, 1919, the opinion of all the members of the Institute regarding the adoption of the legislation proposed by the said committee of the Institute."

The Finance Committee got a pat on the back because its report showed that the first year of the *Journal* ended with a surplus, this in spite of the fact that "full postage" had been paid on all issues "owing to opposition from existing technical papers." President Vaughan thought that when the *Journal* reached a "certain point" it would "really be an index to the manufacturing concerns of the country," but, like any cautious engineer, he did not say where that point was.

The Canadian Engineering Standards Association, now the Canadian Standards Association, is mentioned for the first time as an incorporated body. Its main committee was made up of three members from the Institution of Civil Engineers, three from the Institute, three from the Canadian Institute of Mining and Metallurgy, three from the Canadian Manufacturers' Association, three each from the universities — Laval, McGill and Toronto — and three from government departments. Though the Association may be "of comparatively little value in Canada, there is quite a prospect that we shall find an important and useful work to do."

The Honour Roll Committee reported 960 on its list, of whom 943 were officers, including three generals; 110 decorations were noted, including two Victoria Crosses.

Some remarks by branch representatives bring back old times. For example, the Ottawa Branch spent $116 for "expenses in connection with branch contribution of exhibit beavers to main Institute rooms, Montreal." The epidemic of Spanish influenza "adversely affected" the activities of the Toronto Branch. The Halifax Branch was busy absorbing the former Nova Scotia Society of Engineers. One speaker thought that the possibility of publication in the *Journal* would improve the quality of branch papers.

The Governor General, the Duke of Devonshire, was the speaker at one luncheon. At another time, Alfred D. Flinn, secretary of the United Engineering Council, New York, told of the efforts of engineers of all kinds in the United States to get together, something which did not bother Canadians, for the Institute was a home for all. Another luncheon speaker was Dr. Ira N. Hollis, representing the American Society of Mechanical Engineers. Dr. Hollis congratulated the Institute on the succinct statement of its aims — "To facilitate the acquirement and interchange of professional knowledge . . . " — which in those days appeared on the *Journal's* cover, and now will be found just over the table of contents on the page preceding the text. American engineers had not succeeded in developing a similar statement, though they had tried to many times.

Hon. F. B. Carvell, Dominion Minister of Public Works, spoke at another luncheon, delivering a "somewhat lengthy address filled with optimism regarding the future of Canada." He did not see how the country could get along on a budget smaller than $300 to $350 million for the next few years. Look at 1953's budget.

The Parliament Buildings, burned in 1916, were under reconstruction, so the Institute members and their friends were treated to a tour of them personally conducted by John A. Pearson, chief architect, and J. B. Hunter, Deputy Minister of Public Works.

The principal paper in this March *Journal* of 1919 was M. R. Riddell's "Development and Future of Aviation in Canada." His first craft was the "Canada", a Curtiss flying boat with 76-foot wing spread and two 170 hp. Curtiss engines. With two 90-hp. motors temporarily installed, she made 87 m.p.h. and climbed to more than 3,500 feet in less than seven minutes. She was shipped to England in late 1915 or early 1916, where, with her regular engines, she touched 102 m.p.h. She carried 1,000 pounds of pay load and had a flying radius of 500 to 600 miles at full power.

Other early planes, nearly all military were described by Mr. Riddell, but the most interesting part of his paper to today's reader is his thoughts on the future of aviation. According to him, aviation would have to overcome "the aversion that many have to leaving the safety of terra firma." For reasons as valid today as they were in 1919, he thought that "for short distances . . . it would seem that aerial transport is not likely to be commercially possible". Of course, he counted without the helicopter.

"Passenger service will probably begin by the use of single machines for rapid journeys in any direction, but later it will become possible to institute regular services along settled routes on scheduled time . . . Some form of comfortable enclosed cabin will have to be supplied and the method of entrance will have to involve less of an acrobatic performance than at present . . . The class of freight that can be commercially handled . . . will be limited to articles of high intrinsic value and small weight.

"(For) regular aerial service over the Atlantic . . . the airplane will not be the type of air vessel generally employed . . . The lighter-than-air ship . . . appears to offer superior advantages in the way of comfort and safety.

"As commercial aerial service extends, new uses for the aeroplane will be continually found and in a comparatively small number of years, instead of considering it an interesting but somewhat impractical toy, flying will have become a matter of everyday life and we will wonder how we ever got along without it."

George K. McDougall's paper on "Industrial Illumination" takes up six pages, an excellent primer of principles which have not changed much to this day.

Someone, perhaps a bored member at the Ottawa meeting, amused himself by making thumbnail silhouettes of the more prominent participants. About 50 are published as page-wide spreads. Most of the subjects long ago passed to their rewards, but a few are happily still with us — F. S. Keith, J. B. Challies and J. L. Busfield, among others.

The diving-bell controversy was still going on, with no decision in sight. Both Mr. Taylor and Mr. Macdonald stuck to their guns and each one needled the other, in a nice way, of course. This month Mr. Macdonald was the attacker.

"Sapper" writes in with a grouse about salaries. He quotes a Civil Service notice:

| | *Salary* |
|---|---|
| Reporter for the House of Commons | $2,200 |
| Fruit inspector | $2,000 |
| HYDROMETRIC ENGINEER. | $1,500 |
| Legal clerk | $1,500 |
| Storekeeper | $1,500 |

And he says, "C'est à rire!"

Two Council meetings held in February and reported in this issue do not seem to have dealt with any very important matters. The committee engaged in trying to raise salaries of engineers in the Civil Service reported "progress"; this frequently means "no progress".

The employment bureau had twelve jobs listed, five of them in the Civil Service, including a commissioner of immigration, perhaps a tribute to the adaptability of engineers. An electrical engineer who could "design the layout of a power plant" was wanted at $3,000 and a city engineer at $2,400 to $3,000.

## News of Other Societies

The annual meeting of the **Canadian Institute of Mining and Metallurgy**, 906 Drummond Bldg., Montreal, Que., is scheduled for April 26-28, 1954, at the Mount Royal Hotel, Montreal.

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The 1954 annual assembly of the **Royal Architectural Institute of Canada,** 57 Queen St. W., Toronto 1, Ont., will be held in Montreal, May 11 to 15.

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The **Canadian Good Roads Association,** 270 MacLaren Street, Ottawa 4, Ont., will award this year a scholarship valued at $1,800 to a Canadian engineer. The recipient will take special advanced studies in field of highway transportation, probably following courses in the United States which are not available in Canada.

Applications for the academic year 1954-55 must be submitted by May 1, 1954. Information can be obtained from the C.G.R.A. Office.

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The 1954 annual convention of **Canadian Electrical Association,** Room 704, Tramways Bldg., Montreal, will be at Murray Bay, Que., June 24-26.

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The **Society for Experimental Stress Analysis** will hold the spring meeting and the educational lecture and exhibit on April 14, 15, 16, 1954, at the Netherlands Plaza Hotel, Cincinnati, Ohio. Information may be obtained from Harry LaTour, chairman of the spring meeting, 134 Kensington Street, Middletown, Ohio.

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The second welding and allied industry exposition in the Memorial Auditorium, Buffalo, N.Y., has been arranged to coincide with the **American Welding Society's** spring technical meeting at the Hotel Statler, Buffalo, May 4-7, 1954.

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The calendar of the **American Institute of Chemical Engineers,** 120, East 41st Street, New York 17, N.Y., lists for May 16-19, 1954, a meeting at Springfield, Mass.; June 20-25, a special meeting on nuclear energy, at University of Michigan, Ann Arbor; September 12-16, a meeting at Glenwood Springs, Colorado, and December 12-15, the annual meeting in New York City.

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The **American Association of Spectrographers** is presenting a symposium on Direct Reading Emission Spectroscopy, in Chicago, May 7, 1954. The subject will be treated under the following subtitles: iron and steel, non-ferrous metals, and metal in non-metallic materials, and contributed papers are welcome. Please address all inquiries to: M. E. Slagel, chairman, U.S. Reduction Co., Box 30, East Chicago, Indiana.

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The **American Society for Engineering Education** will hold its 62nd annual meeting, June 14-18, with the University of Illinois, Urbana, as host institution. The Society's headquarters are at Midwestern University, Evanston, Ill.

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Meetings of the **Institute of the Aeronautical Sciences,** 2, East 64th Street, New York 21, N.Y., June 21-24, IAS annual summer meeting, IAS Building, Los Angeles, Calif.; August 9-11, Turbine-Powered Air Transportation meeting, Seattle, Washington.

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The Oregon Section of the **American Institute of Mining and Metallurgical Engineers** will be host for the AIME Pacific Northwest Metals and Minerals Conference to be held in Portland, Oregon, April 29 through May 1, 1954.

The technical program, which will be open to the public, will cover metals technology of iron and steel, extractive and physical metallurgy, industrial minerals, engineering geology, groundwater and mineral industries education. Information can be obtained from A. O. Bartell, 308 Woodlark Bldg., Portland 5, Ore.

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A conference on oxidation will take place at the Hague, Netherlands, on May 6 and 7, 1954, under the auspices of the Institution of Chemical Engineers, the Society of the Chemical Industry, the Royal

Institution of Engineers (Netherlands) and the Netherlands Chemical Society.

Information can be obtained from the secretary of the British Organizing Committee, the Institution of Chemical Engineers, 56 Victoria Street, London, S.W. 1.

### Officers of Other Societies

The Journal has received news, during the past few months, of the election of officers to the following professional societies:

**The Engineers Joint Council.** Dr. Thorndike Saville, dean of the College of Engineering, New York University, is president for 1954.

**The Community Planning Association of Canada.** Sir Brian Dunfield is president. He is a judge in the Supreme Court of Newfoundland. C. E. Campeau, M.E.I.C., Montreal and P. R. U. Stratton, Vancouver, are vice-presidents.

**National Association of Corrosion Engineers.** Aaron Wachter, is president. F. L. Whitney, Jr., is vice-president, and Russell A. Brannon, treasurer.

**American Society of Refrigeration Engineers.** Four new directors are George K. Iwashita, Schenectady, N.Y.; T. P. Neff, Chicago; R. H. Lock, Toronto; A. L. Hesselschwerdt.

**British Standards Institution.** Sir Roger Duncalfe was elected president, to succeed Viscount Waverley. Sir Roger Duncalfe is chairman of British Glues and Chemicals Ltd., a vice-president of the Federation of British Industries.

**Institute of the Aeronautical Sciences.** John Leland Atwood, president and director of North American Aviation, is president. Four vice-presidents are: William A. M. Burden, E. S. Thompson, Edmund T. Price, John W. Larson. Treasurer is Elmer A. Sperry, Jr.

**Society of Automotive Engineers, Inc.** William Littlewood of Washington, D.C., the new president, is vice-president of American Airlines, Inc. Vice-presidents are: R. W. Rummel, F. W. Fink, G. W. Newton, G. M. Buehrig, John Dickson, A. L. Boegehold, Kenneth Boldt, Harold Nutt, E. D. Kemble, H. L. Brock, H. L. Willett, Jr., R. C. Wallace.

**American Institute of Chemical Engineers.** Chalmer G. Kirkbride, president and director of Houdry Process Corporation, Philadelphia, Pa., is president for 1954. Barnett F. Dodge, of Yale University, is vice-president; George Granger Brown, of University of Michigan is treasurer, and Stephen L. Tyler has been re-elected secretary.

**Canadian Radio Technical Planning Board.** R. A. Hackbusch of Toronto, president of Hackbusch Electronics Ltd., was re-elected president at the ninth annual meeting. C. W. Boadway, Toronto, is vice-president and Stuart D. Brownlee is secretary-treasurer of the Board.

# Elections and Transfers

At the meeting of Council held in Regina, Sask., on Friday, February 5, 1954, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

*Members:*

M. E. Almstrom, *Whitehorse*
W. L. Anderson, *Edmonton*
E. Beck, *Montreal*
F. R. Denham, *Quebec*
F. G. East, *Toronto*
H. Farah, *Toronto*
L. Fieldman, *Malton*
K. Hulmdorf, *Toronto*
E. W. Jupp, *Georgtown, B.G.*
T. Kraulis, *Montreal*
E. L. Lyons, *Hamilton*
O. Margison, *Toronto*
A. Rose, *Toronto*
O. Rudzitis, *Montreal*
J. L. Shirley, *Toronto*
A. H. R. Thomas, *Toronto*
A. Valter, *Toronto*
E. Visan, *Montreal*
E. M. Warnes, *Montreal*
L. Warycha, *Montreal*
J. P. Wright, *Toronto*

*Juniors:*

K. Czerwinski, *Montreal*
P. M. Dimitroff, *Fort Erie*
A. E. J. Dubois, *Ste. Dorothee*
A. Favilla, *Shawinigan Falls*
D. H. Giddy, *Johannesburg*
F. G. Holroyd, *Montreal*
N. E. Katsicadamas, *Montreal*
M. S. P. Reszetnik, *Kitchener*
H. S. Siré, *Montreal*

*Transferred from the class of Junior to that of Member:*

M. B. Allan, *Montreal*
G. Babineau, *Quebec*
C. Belanger, *Three Rivers*
J. M. Bennett, *Toronto*
R. P. Boucley, *Montreal*
J. Brissette, *Montreal*
D. N. Brown, *Winnipeg*
P. M. Butler, *Edmonton*
L. G. Crutchlow, *Ottawa*
W. R. Denford, *Guelph*
A. T. Farmer, *Three Rivers*
J. M. Ferguson, *Cochrane*
W. J. Gall, *Arvida*
T. S. Gamble, *Weston*
C. E. E. Gelinas, *Montreal*
D. R. Graham, *Kingston*
A. W. Greenberg, *Winnipeg*
H. J. Harding, *Winnipeg*
J. H. Hearn, *Summerside*
S. B. Howlett, *Merritt*
I. C. Johnson, *Toronto*
R. S. Kittlitz, *Edmonton*
W. Lemiski, *Sault Ste. Marie*
A. N. Oldfield, *Montreal*
C. E. Paget, *Terrace Bay*
E. R. Renouf, *Toronto*
R. J. Schneider, *Toronto*
T. A. Sissons, *Medicine Hat*
A. W. S. Tite, *Hamilton*
H. L. Topham, *Kamloops*

The following Students were admitted:

*McGill University*

| | |
|---|---|
| P. M. Arsenault, | N. J. Bergman |
| H. Benjamin | P. Biron |
| J. G. Biggs | G. V. Cox |
| D. N. Carlaw | H. C. L. d'Auriol |
| J. R. Darling | J. F. Dobranski, Jr. |
| F. J. Deegan | G. B. Earle |
| K. G. Drake | R. Fancott |
| D. C. Ellis | J. M. Forde |
| D. B. Floreani | G. R. Garby |
| M. Galler | E. C. Goodier |
| J. F. Gillies | J. E. Hacker |
| I. R. A. Gregory | R. H. Hauver |
| P. V. Hale | R. D. Hewson |
| G. R. Heckman | D. G. Hislop |
| L. Karl Hinds | J. W. Knubley |
| H. A. Jackson | P. J. Lamontagne |
| E. D. Kobernick | B. Leichtag |
| D. A. Leger | F. O. McConney |
| J. J. Leinwand | M. E. Markanen |
| R. Marcus | M. Orlander |
| B. C. Neill | A. Popescu |
| D. Petrov | F. H. Rasmussen |
| I. Putsep | J. St. Clair Ross |
| H. A. Rios | E. Sperlich |
| D. E. Rudberg | A. D. Strelsnik |
| R. P. Stewart | J. D. Thompson |
| R. B. Thomas | G. J. Tous |
| B. R. Titcomb | L. von Staa |
| J. A. Turner | S. W. Young |
| W. P. Winser | L. J. Zakaib |
| O. Bellemare | |

*Nova Scotia Technical College*

| | |
|---|---|
| G. R. Curran | D. C. Haggarty |
| K. R. Holt | E. K. Myers |
| G. E. Nelson | G. M. Webb |

*University of New Brunswick*

| | |
|---|---|
| G. J. Davidson | M. S. McInnis |
| R. J. Vaughan | |

*University of Manitoba*

| | |
|---|---|
| R. E. Gottfred | C. L. Reid |
| S. A. Mayman | L. A. Wasilewski |
| A. Moen | |

*Carleton College*

W. D. Smythe    J. N. Shoosmith

*University of Alberta*

J. G. Clark

*Royal Military College*

J. P. Cheevers

*Laval University*

B. E. J. Dupont
P. Vilim, B.Sc.(Mech.) Manitoba 1953
S. J. Bober, Student, C.P.E.Q.

**Applications through Associations:**

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

Alberta

*Members:*

E. G. Cameron    K. C. Williams

*Junior to Member:*

W. A. Wolley-Dod

Quebec

*Members:*

C. T. Dupont    D. J. McParland

# Personals

## News of the Personal Activities of Members of the Institute

**Dr. R. S. Stephen Jane,** M.E.I.C., vice-president and director of Shawinigan Chemicals Limited, in charge of research, since 1946, has been appointed executive vice-president of the company.

**Dr. R. S. Jane, M.E.I.C.**

Dr. Jane received his B.Sc. degree from the University of British Columbia in 1922. He obtained his M.Sc. degree from McGill University in 1923 and his Ph.D. degree from that university in 1925. His work there won him a Wembley scholarship for two years' study at the University of London.

Upon his return to Canada in 1927, Dr. Jane became chief chemist of the Canada Carbide Company at Shawinigan Falls. When that company became the carbide division of Shawinigan Chemicals Limited a few months later, he took charge of plant research for the division. He moved to head office at Montreal in 1936, and in 1943 was transferred to the parent Shawinigan Water and Power Company to take charge of the industrial research department which was formed at that time.

In 1946 Dr. Jane returned to Shawinigan Chemicals Limited as a director and vice-president in charge of research and development. He is also a director and vice-president of Canadian Resins and Chemicals Limited, and a director of B.A.-Shawinigan Limited, Montreal; of Shawinigan Resins Corporation, Springfield, Mass.; and of Gelvatex Coatings Corporation, Pasadena, Cal.

President of the Chemical Institute of Canada in 1952-53, Dr. Jane is a fellow of that organization, and a member of the Society of Chemical Industry and of other professional bodies.

**A. B. Hunt,** M.E.I.C., general manager of the communications equipment division of Northern Electric Company Ltd., has been appointed director of the electronics division of the federal Department of Defence Production.

Mr. Hunt, who will be on loan to the Canadian government, has been actively associated with the communications field since graduating from the University of Toronto in 1928 with the degree of B.Sc. He also earned the medal given by the British Association for the Advancement of Science, the highest engineering award the university has to offer.

A native of London, Ont., he received his early education in that city and, after graduation from university, joined Northern Electric in 1928 as a manufacturing methods engineer in connec-

**A. B. Hunt, M.E.I.C.**

tion with theatre sound systems and vacuum tube production. In 1933 he was appointed special products manufacturing superintendent, and in 1935, took over the added duties of radio receiver engineer. Two years later he was made special products superintendent in charge of manufacturing, engineering and installation, and the following year he became manager of a separate division of the company established to handle expanding electronics business.

In 1948 he moved with the electronics division to Belleville, Ont., where he stayed until 1950 at which time he returned to Montreal to accept the position of assistant manager of Northern's telephone division. With the amalgamation of the telephone and electronics division into the communications equipment division three months later, Mr. Hunt became general manager of the communications equipment division.

Mr. Hunt was a winner of the R. A. Ross Medal in 1946 for his paper "The Future of Radio Communications in Canada". He is a former president of the Radio-Television Manufacturers Association (1952-53), and a member of the Corporation of Professional Engineers of Quebec, the Institute of Radio Engineers, Canadian Manufacturers Association, and the Canadian Industrial Preparedness Association. He also holds the rank of lieutenant-colonel in the reserve army having served as commanding officer of the 2nd Corps H.Q. Signals Regiment.

**C. A. Peachey, M.E.I.C.**

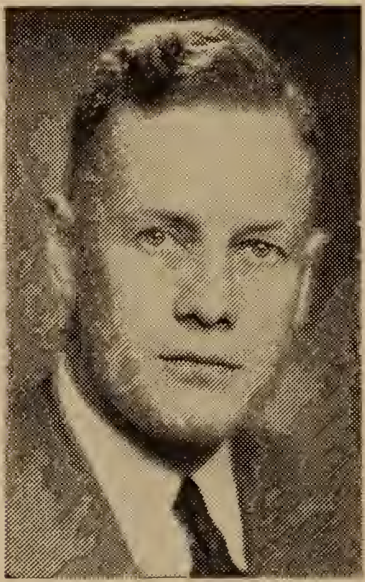
**C. A. Peachey,** M.E.I.C., has been appointed general manager of the communications equipment division of Northern Electric Co. Ltd., succeeding A. B. Hunt, M.E.I.C., who has been named director of the electronics division of the Department of Defence Production.

Mr. Peachey, who is a graduate of the University of Toronto, has been with Northern Electric since 1927, joining as an engineer in connection with vacuum tube production. In 1930 he was made a supervisor with the engineering group, and three years later was put in charge of shop methods. He assumed the title of technical engineer in 1936, shop superintendent in 1939, and works manager of the electronics division in 1942. In 1945 Mr. Peachey became works manager of the telephone division, and retained the title of works manager with the formation of the communications equipment division in 1950.

Mr. Peachey is a member of the Corporation of Professional Engineers of Quebec. He is president of the Canadian Management Council, Canadian representative on the International Committee of Scientific Management, a past chairman of the Institute of Administration and, in 1951, was metropolitan chairman of the Canadian Red Cross Society Campaign for funds.

**D. D. Panabaker,** M.E.I.C., **has been** elected director and secretary-treasurer of Otis Elevator Company Limited.

Mr. Panabaker graduated with a B.A.Sc. degree from the University of Toronto in 1933. He was for a time assistant professor at the university, and since then has had varied and extensive experience in many branches of the Otis organization including production, cost control, construction, sales and management.



D. D. Panabaker, M.E.I.C.

He recently relinquished the Toronto district managership to become administrative assistant to the president.

Mr. Panabaker will discharge his new responsibilities, covering all fiscal aspects of company business in Canada, from the company's head office in Hamilton, Ont.

**Franklin E. Holland,** M.E.I.C., **formerly** vice-president of the Murphy Paint Company, has been appointed vice-president of Canadian Pittsburgh Industries Ltd. The new organization is composed of three parts: The Murphy Paint division, Pennvernon division and Hobbs Glass division.

Mr. Holland is a civil engineering graduate of Cornell University, class of 1912.

**J. H. Wallis,** M.E.I.C., vice-president and manager of Dominion Hoist & Shovel Company Limited, has been named a vice-president of Dominion Engineering Works Limited and manager of the Power, Crane and Shovel Division, the new name given to the former company to conform with recent developments in the operations of Dominion Engineering Works Limited.

J. H. Wallis, M.E.I.C.

For the past 23 years the Dominion Hoist and Shovel Company has been a wholly-owned subsidiary of Dominion Engineering Works Limited and was comprised of five divisions: paper making machinery, hydraulic, industrial, diesel and manufacturing. Recently a plan was put into effect to streamline the operations and integrate still further the functions of Dominion Hoist and Shovel with those of the parent organization. The new name — Power, Crane and Shovel Division — confirms the accomplishment of this plan. However, the name change does not in any way affect personnel or sales and service policies.

**H. M. Black,** M.E.I.C., has been appointed a vice-president of Dominion Engineering Works Limited.

Mr. Black is manager of the company's industrial division and has been associated with Dominion Engineering Works Limited since 1940, having served as manager of the Longueuil Plant during the war and later as manager of the Ontario division.

H. M. Black, M.E.I.C.

Mr. Black graduated from McGill University in 1923 with the degree of B.Sc. in mechanical engineering and subsequently joined the staff of the Allis-Chalmers Company in Milwaukee. In 1927 he became associated with English Electric Company of Canada Limited and remained with that company for 13 years before joining Dominion Engineering Works Limited as manager of the Longueuil Ordnance Plant.

**I. S. Patterson,** M.E.I.C., has been appointed sales manager of Canadian Controllers Limited.

Until his recent appointment Mr. Patterson was sales manager of the English Electric Company of Canada.

Mr. Patterson is an electrical engineering graduate of the Nova Scotia Technical College, class of 1928. Upon graduation he joined the Canadian General Electric Company at Peterborough, Ont., and after a period of training there, in Toronto, and in Schenectady, N.Y., he was appointed a sales engineer in the company's Montreal office in 1930.

I. S. Patterson, M.E.I.C.

In 1942 Mr. Patterson, then industrial control specialist with the company in Montreal, was loaned to the Wartime Bureau of Technical Personnel at Ottawa. Four years later he accepted the position of sales manager of the Winnipeg district office of the English Electric Company of Canada Limited.

**F. W. Gray,** M.E.I.C., of Victoria, B.C., represented the Dominion Steel and Coal Corporation as an employer-delegate at the fifth meeting of the Coal Mines Committee of the International Labour Organization held at Dusseldorf from November 30 to December 12, 1953. His fellow employer-delegate was Norman Avard of Joggins Mines and the Canada Electric Company, of Amherst, N.S.

The hosts of the Coal Mines Committee were the German Government of the Rhenish-Westfalische Lande. Eighty-seven countries were represented by tripartite delegates—Chili and Mexico for the first time, and Germany and Japan for the first time since the cessation of hostilities. The committee has been invited to meet in Turkey in 1955.

**Harold M. Finlayson,** M.E.I.C., has been named manager of the hydraulic resources department of The Shawinigan Water and Power Company.

A student at Montreal High School when World War I broke out, Mr. Finlayson interrupted his education to join the forces, and served with the Royal Flying Corps at that time. He returned to Montreal and attended McGill University, graduating in civil engi-

H. M. Finlayson, M.E.I.C.

neering in 1923. Upon graduation he joined the St. Lawrence Deep Waterway Commission.

In 1928 he entered The Shawinigan Engineering Company Limited, and for two years led a hydrographic survey party in measuring the flow of the St. Maurice River at sites which have since been developed or planned for hydroelectric power generation. He was then transferred to the generation and transmission department of the parent power company to undertake studies of water-storage and potential power-sites on many rivers in Quebec and elsewhere.

Mr. Finlayson is vice-president of the international Eastern Snow Conference, and a member of the Arctic Institute of North America, the American Geophysical Union, the American Society of Photogrammetry, the American Institute of Electrical Engineers and the Corporation of Professional Engineers of the Province of Quebec.

**Matthew Balls,** M.E.I.C., a life member of the Engineering Institute of Canada, has recently retired as manager of the hydraulic resources department of The Shawinigan Water and Power Company, a post which he has occupied since 1941. He has also served as an assistant vice-president of the company since 1948.

Mr. Balls joined The Shawinigan Water and Power Company in 1928. He was previously engaged for 20 years in survey, construction and hydraulic engineering work in western Canada, the United States and Alaska. For several years he was a member of the National Research Council's sub-committee on ice and snow research.

**Raymond A. Frigon,** M.E.I.C., program officer in the division of planning and co-ordination of technical assistance administration of United Nations in New York, has recently returned to New York after accompanying, as technical secretary, a three-man mission to Central American republics. The purpose of the mission was to make recommendations on the establishment of a central technological research institute for the five countries of Costa Rica, Guatemala, Honduras, Nicaragua, and El Salvador. One of the members of the mission was Dr. W. H. Cook of the National Research Council.

Mr. Frigon spent about two months in Central America during which time necessary information on which to base recommendations was gathered for a report now being prepared.

**Fraser F. Fulton,** O.B.E., M.E.I.C., has been appointed general manager of the sales division of Northern Electric Company Limited.

Mr. Fulton was born in Saint John, N.B. He received his engineering certificate from Mount Allison University in 1926, and his B.Sc. degree in electrical engineering from McGill University in 1928.

He joined Northern Electric in Montreal in 1928, devoting the early part of his career to the field of electronics. At the outbreak of war in 1939 he joined the Army as a lieutenant in the Royal Canadian Corps of Signals and proceeded overseas the following year.

His military career included tours of duty in England, North Africa, Italy and North-West Europe, and culminated in his appointment as chief technical officer for the Canadian Army overseas with the rank of brigadier. In 1943 he was awarded an O.B.E. in the King's first Honours List for the Canadian Army.

F. F. Fulton, M.E.I.C.

Upon his return to Northern Electric in 1946, Mr. Fulton was appointed chief engineer of the company's electronics division and three years later, government contracts manager. In 1950 he became manager of Northern Electric's electronics plant at Belleville, Ont., and the following year was named assistant to the vice-president and managing director of the company.

In 1952 he was appointed general sales manager reporting to the head of the division, a position he held until his recent appointment.

**Group Captain E. C. Luke,** O.B.E., R.C.A.F., M.E.I.C., has assumed the position of director of construction in the North Atlantic Treaty Organization under a recent reorganization of the Allied Air Forces Central Europe Headquarters at Camp Guynemer, Fontainebleau, France.

The international cost of the airfield construction program for which Group Captain Luke's staff is the responsible NATO military agency will exceed $700,000,000.

Group Captain Luke's tour of duty in France has been extended another year.

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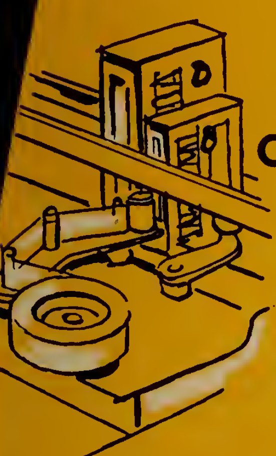

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☐ "SCOTCH" Cellulose Tapes

NAME ........................................

POSITION ........................................

COMPANY ........................................

ADDRESS ........................................

**L. G. Grimble,** M.E.I.C., has resigned his position as chief bridge engineer for the Alberta Department of Highways to enter private practice.

Mr. Grimble entered the department in 1946 as assistant bridge engineer. Three years later he was appointed chief bridge engineer.

Mr. Grimble graduated from the University of Alberta in civil engineering in 1942 after which he joined the Royal Navy Fleet Air Arm and saw service in the Pacific. He received his M.Sc. degree from the University of Illinois in 1948.

**Leslie H. McManus,** M.E.I.C., has been appointed chief bridge engineer of the department of highways of Alberta. He previously occupied the position of assistant chief construction engineer.

Mr. McManus, a 1934 civil engineering graduate of the University of Alberta, joined the highways department in 1938 as assistant chief engineer. Since that time he has worked in the department's laboratory and has done considerable field work in connection with the testing of road-building materials.

**C. H. Allen,** M.E.I.C., former manager of industrial sales, has been named central stations sales manager of Canadian Westinghouse Company Limited in Hamilton, Ont.

Mr. Allen joined Westinghouse in 1924 and graduated from the company's four-year student training course.

He spent ten years in the service department during which time he was responsible for the erection of switchgear and control equipment at many large power projects such as Queenston, Chats Falls, Masson and Rapide Blanc. He was appointed industrial sales manager in January, 1952.

**Robert H. Stevenson,** M.E.I.C., formerly district sales manager in the Halifax apparatus sales office of Canadian Westinghouse Co. Ltd., has been named assistant to E. E. Orlando, M.E.I.C., general manager of the District Apparatus Division. He will make his headquarters in Hamilton.

R. H. Stevenson, M.E.I.C.

Mr. Stevenson completed the two-year Westinghouse graduate student training course in 1938 following graduation from the University of New Brunswick. He was in the Montreal apparatus office before wartime service, and from 1946 to 1951 was branch manager of the Westinghouse office in Moncton before moving to Halifax.

He is a member of the Association of Professional Engineers of Nova Scotia.

W. O. Sorby, M.E.I.C.

**Walter O. Sorby,** M.E.I.C., manager of central station sales in Montreal for Canadian Westinghouse Company Limited during the past two years, has been appointed district sales manager for the Halifax district.

Mr. Sorby joined the company in 1925 from the University of Toronto. For 12 years he was a sales engineer in Winnipeg and in 1946 was transferred to the Montreal office. He was appointed manager of central station sales in 1951.

During World War II Mr. Sorby served with the Royal Canadian Artillery.

He is a member of the Association of Professional Engineers of Quebec.

**Adam W. S. Smith,** M.E.I.C., consumer service engineer for the western region of the Hydro-Electric Power Commission of Ontario, has been appointed manager of the Toronto region.

Mr. Smith has been associated with the Hydro-Electric Power Commission of Ontario for 30 years having served first as rural superintendent in Brantford.

He was appointed assistant engineer-municipal in 1929, and consumer service engineer of the western region in 1947.

He is an electrical engineering graduate of McGill University, class of 1923.

**Stanley H. Frame,** M.E.I.C., retired hydraulic engineer with the water rights branch of the government of British Columbia, has been honoured with a life membership in the American Society of Civil Engineers.

Mr. Frame, who lives in Victoria, B.C., worked for the Canadian Pacific Railway on irrigation projects in the prairie provinces before coming to British Columbia in 1928. His work with the government required surveys in the Kitimat and Kemano regions where Aluminum Company of Canada Limited's development is now being installed. He retired in 1947 after completing 44 years of engineering service.

**MacKenzie McMurray,** M.E.I.C., divisional welding engineer with Dominion Bridge Company Limited, has been elected chairman of the Toronto Branch of the Engineering Institute.

M. McMurray, M.E.I.C.

Mr. McMurray received his B.A.Sc. degree in metallurgical engineering from the University of Toronto in 1939, and spent some time as a demonstrator in mining engineering at that university before joining Dominion Bridge Company Limited in 1940 as metallurgist and chief inspector at the Sorauren Avenue munitions division. He occupied that position until 1945 when plant operations were brought to a close. He

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This is due mostly to the wonderful machines which produce the good things of life at great speeds and in huge quantities thus lowering costs and raising the standard of living of all Canadians. And this fact gives you a real interest in Canadian Vickers Limited because Canadian Vickers designs and builds the machines that manufacturers use to make the things that help you live the good life.

Mining machinery that processes raw ore into the metal of which so many good things are made; Chemical Process Equipment needed to produce plastics or nylon and other fabulous fabrics; Industrial Boilers, Paper Machinery . . . machinery and equipment of every kind to make the good things that you enjoy. And more, Canadian Vickers builds ships and ships' engines that enrich Canada by carrying Canadian goods throughout the world. Yes, you live a better life because of the machinery, equipment and ships made by . . .

CANADIAN VICKERS LIMITED MONTREAL

IF INDUSTRY NEEDS IT . . . CANADIAN VICKERS BUILDS IT . . . BETTER then became engaged in design work both in Toronto and at the boiler division of the company's head office in Lachine, Que.

In 1948 Mr. McMurray was appointed as sales engineer in the boiler division of the company, and a year later, as welding engineer of the Ontario division.

**D. D. Morris,** M.E.I.C., manager of the research and development division of Consolidated Mining and Smelting Co. Ltd., has been appointed administrative assistant.

**D. D. Morris, M.E.I.C.**

Mr. Morris was born in Edmonton, Alta., and attended the University of Alberta where he received his chemical engineering degree in 1928.

He first joined the company's staff as an assayer in 1928. Ten years later he was transferred to research work in the chemicals and fertilizer department. In 1940 he was named assistant general foreman of the ammonia group.

Mr. Morris served as superintendent of the ammonia plant at the Alberta nitrogen department in Calgary from 1941 until 1943. In that year he was appointed general superintendent of the Calgary department, continuing in that position until coming to Trail as general superintendent of the research and development division in 1949. He became manager of this division in 1951.

He is a fellow of the Chemical Institute of Canada and a member of the Association of Professional Engineers of Alberta.

**A. D. Turnbull,** M.E.I.C., assistant manager of the metallurgical division, has been appointed manager of the research and development division of Consolidated Mining and Smelting Company of Canada Ltd.

Mr. Turnbull was born in St. Mary's, Ont. He received his B.A.Sc. degree in metallurgical engineering from the University of Toronto in 1925 and joined Consolidated Mining and Smelting Company of Canada Ltd. as a chemist at Trail that same year.

He served for a number of years in the refining department and in 1936 was appointed assistant superintendent of refineries. Four years later he became assistant chief metallurgist, and in 1948 was named assistant manager of the metallurgical division.

In 1949 Mr. Turnbull was elected member of the legislative assembly for the Rossland-Trail riding. The following

**A. D. Turnbull, M.E.I.C.**

year he was appointed minister of health and welfare for British Columbia. He rejoined Consolidated Mining and Smelting Company of Canada Ltd. in 1952 in his former capacity.

Mr. Turnbull is a member of the Canadian Institute of Mining and Metallurgy, the American Institute of Mining and Metallurgical Engineers and the Association of Professional Engineers of British Columbia.

He has served as reeve of Tadanac, was chairman of the Trail-Tadanac hospital board, and has been active in chamber of commerce work.

**T. H. Weldon, M.E.I.C.**

**T. H. Weldon,** M.E.I.C., superintendent of the zinc department of Consolidated Mining and Smelting Company of Canada Ltd. has been appointed general superintendent of the metallurgical division.

Mr. Weldon was born in Montreal. He graduated from McGill University in 1922 with a B.Sc. degree in mining. He was awarded the Douglas Fellowship and the following year received an M.Sc. degree in ore dressing and metallurgy. He won the British Association medal in mining in 1922.

His service with Consolidated Mining and Smelting Company of Canada Ltd. started as an assayer in 1923. He was appointed superintendent of the Tadanac concentrator in 1928. In 1929 he became superintendent of the leaching plant.

In 1940 Mr. Weldon was appointed assistant chief metallurgist and, three years later, was named assistant superintendent of the zinc department, subsequently becoming superintendent, the position he held until his present appointment, in 1948.

Mr. Weldon is a member of the Canadian Institute of Mining and Metallurgy, the American Institute of Mining and Metallurgical Engineers and the Association of Professional Engineers of British Columbia. He is a member of the Trail chamber of commerce and served on the Trail district school board for eight years, two of which as chairman.

**A. F. White,** M.E.I.C., has retired as chief engineer of the Toronto, Hamilton and Buffalo Railway Company having completed 41 years' service with the company.

Mr. White joined the engineering department of T. H. & B. Railway Company in January, 1913, after being employed by the Michigan Central Railroad at St. Thomas since 1906.

In 1938 he succeeded the late R. L. Latham as chief engineer.

Mr. White is a member of the Association of Professional Engineers of Ontario, and has served as a member of the engineering committee of the Railway Association of Canada.

**George F. West,** M.E.I.C., has been appointed deputy commissioner of works for the City of Halifax.

He was previously a divisional engineer in the Halifax works department.

Mr. West is a 1942 electrical engineering graduate of the Nova Scotia Technical College.

**Stanley Morton,** M.E.I.C., has formed a new company, Morton Engineering Limited, in Vancouver, B.C. The new firm of which Mr. Morton is president is a distributor in British Columbia for Browning Manufacturing Company of Maysville, Kentucky, makers of mechanical power transmission equipment. In addition the new company handles other parts and equipment allied to mechanical power transmission requirements.

Mr. Morton was formerly B.C. manager of Ronald Coventry Ltd. and R. & M. Bearings Canada Ltd. in Vancouver.

**J. W. McCarthy,** M.E.I.C., formerly a resident engineer with Angus, Butler & Associates Ltd. in Edmonton, Alta., has joined the staff of Stewart & Phillips (Alta.) Ltd. in Calgary.

Before joining the Edmonton firm, Mr. McCarthy was associated with the Steel Company of Canada in Hamilton, Ont.

He is a graduate of the University of Alberta in electrical engineering, class of 1950.

**G. W. C. Lake,** M.E.I.C., recently resigned his position as hydraulic engineer in the water rights branch of the B.C. Department of Lands in Victoria to accept the position of municipal engineer for the Township of Richmond in Vancouver, B.C.

In his present position Mr. Lake is responsible for the township's drainage and dyking system in addition to the municipal engineering department.

**Donald McN. Lowe,** M.E.I.C., formerly manager of civil engineering and maintenance at H.M.C. Dockyard in Hali-

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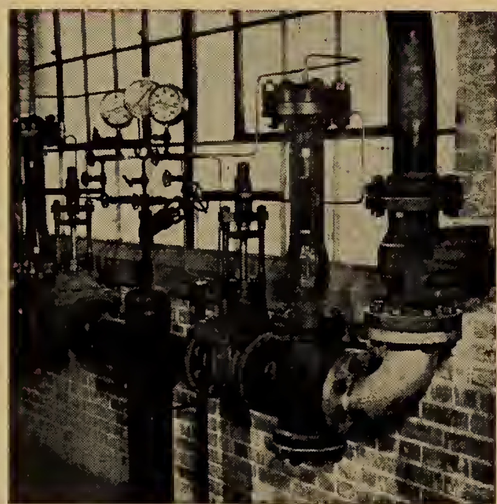

Three 6" Hopkinson steam stop valves in process steam lines in the boiler room of the Cornwall Division of Howard Smith Paper Mills Ltd.

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SYDNEY · TORONTO · SUDBURY · WINNIPEG · CALGARY · VANCOUVER fax, N.S., is now office engineer for Defence Construction Ltd. at Camp Gagetown, Oromocto, N.B.

**Dennis P. Herring,** M.E.I.C., former chairman of the Sarnia Hydro-Electric Commission and president of District 8, Ontario Municipal Electric Association, has entered into private consulting engineering practice in Hamilton, Ont.

A graduate of the University of Saskatchewan in mechanical engineering, class of 1942, Mr. Herring is now associated with Edgar G. Brown, Hamilton consulting engineer.

Mr. Herring was associated with Polymer Corporation as senior project engineer for six years.

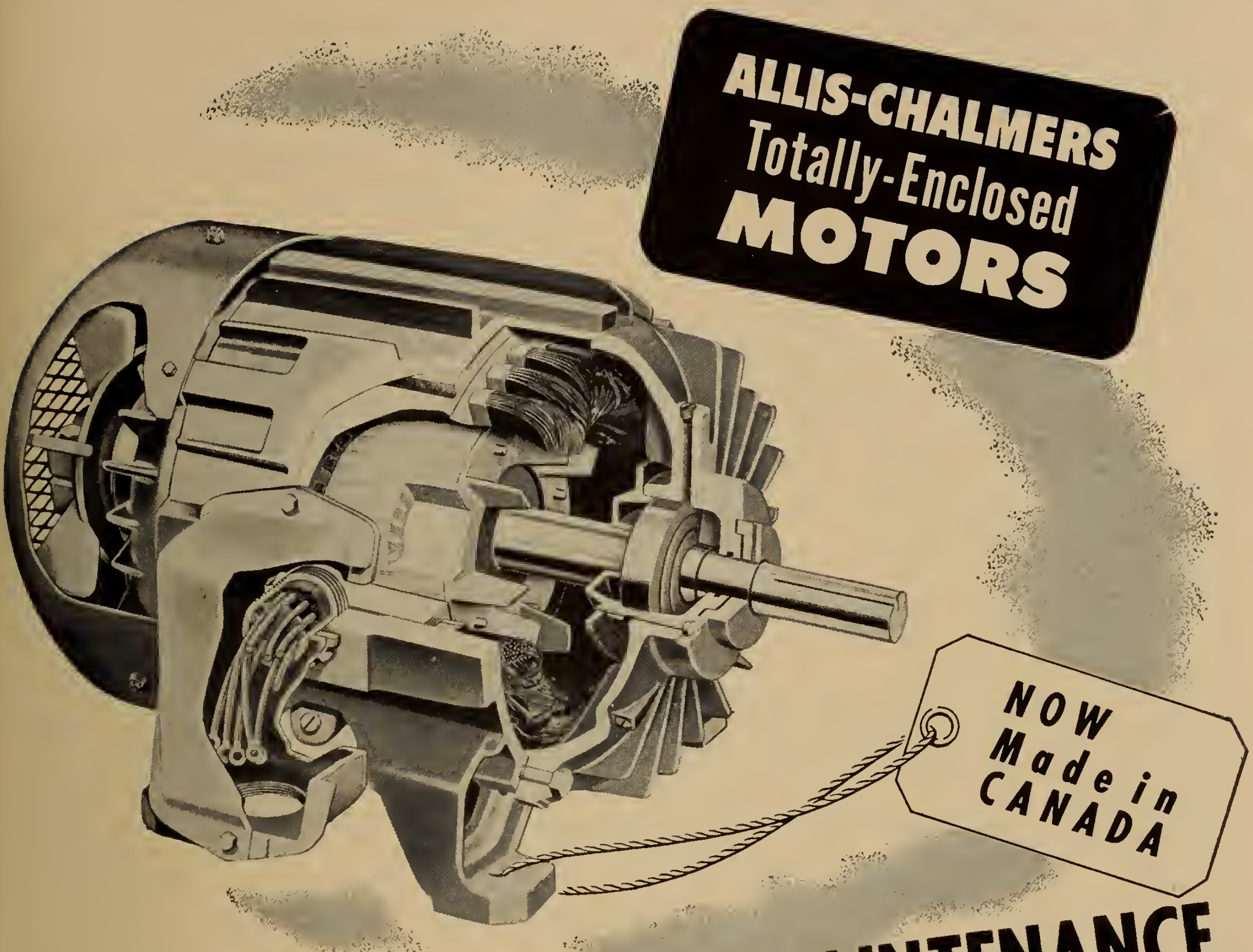
D. P. Herring, M.E.I.C.

**G. R. McMillin,** M.E.I.C., has been appointed superintendent of Imperoyal refinery at Halifax, N.S.

Mr. McMillin joined Imperial Oil Limited at Sarnia, Ont., in 1933 as a laboratory assistant after graduating in chemical engineering from the University of Toronto. He subsequently became senior chemist there, and in 1938 was loaned as assistant chemist to International Petroleum Company at Talara, Peru.

G. R. McMillin, M.E.I.C.

Upon his return to Canada he was appointed chief chemist at Imperoyal, and in 1944 was named assistant superintendent.

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Mr. McMillin was appointed group supervisor in the engineering and development division at Sarnia in 1948, and two years later was named assistant superintendent of the Sarnia refinery. Since October, 1952, he has occupied the position of superintendent.

Mr. McMillin served as chairman of the Sarnia Branch of the Engineering Institute last year.

**Roy Stenberg,** M.E.I.C., has been promoted by The Shawinigan Engineering Company Limited at Shawinigan Falls to the position of mechanical superintendent with general supervision over all construction yard operations.

Mr. Stenberg was born at Starbuck, Man. He served with the Royal Canadian Air Force as an aero-engine mechanic from 1939 until 1945, after which he entered the University of British Columbia where he received his mechanical engineering degree in 1951.

He was employed by The Shawinigan Engineering Company Limited during the summers of 1949 and 1950 at Trenche, and on June 1, 1951, he joined the permanent staff.

Since that time he has served at Trenche, Rapide Blanc, Clova and Shawinigan Falls.

**P. R. Woodfield,** M.E.I.C., is at present chief staff engineer of the gas turbine engineering department of A. V. Roe Canada Limited.

He was formerly head of the gas turbine mechanical testing laboratories of this company.

Mr. Woodfield graduated from the University of Manitoba as an electrical engineer in 1939.

**F. W. Barnhouse,** M.E.I.C., has been appointed general sales manager of Phillips Electrical Co. (1953) Ltd.

He was formerly manager of the wire and cable section of Canadian General Electric Co. Ltd., and has more than 18 years experience in this field.

Mr. Barnhouse is a 1934 graduate in electrical engineering of the University of Alberta.

**A. Sandilands,** M.E.I.C., has been appointed manager of the western region of Phillips Electric Company (1953) Ltd.

Mr. Sandilands, who has been specializing in the wire and cable field for the past 15 years, was formerly district manager in Winnipeg for Automatic Electric (Canada) Ltd.

He is a graduate in electrical engineering of the University of Manitoba, class of 1934.

**Michael Broadbent,** M.E.I.C., has been appointed equipment design engineer in charge of equipment design and modification for the Montreal and Brockville factories of Phillips Electrical Co. (1953) Ltd.

**F. H. Chapman,** M.E.I.C., has recently been appointed consulting metallurgist by Anglo American Corporation of South Africa Ltd. in Kitwe, Northern Rhodesia. He will be concerned principally with the metallurgical developments and problems of the Rhokana Corporation Ltd., Nchanga Consolidated Copper Mines Ltd., Rhodesia Copper Refineries Ltd., Rhodesia Broken Hill Development Co. Ltd., and Bancroft Mines Ltd.

Before his new appointment Mr. Chapman was assistant consulting metallurgist of the Anglo American Corporation which he joined in 1949 after resigning his position as executive secretary of the Association of Professional Engineers of British Columbia. He was previously associated with Consolidated Mining and Smelting Co. of Canada, Ltd. in Trail, B.C.

**Robert Black,** M.E.I.C., is general manager of the Davie Shipbuilding & Repairing Company at Lauzon, Que. Mr. Black joined this company in 1944 as a draughtsman.

He is a member of the Institute of Naval Architects in both Britain and the United States.

**J. J. Waller,** M.E.I.C., has been named chief material and process engineer responsible for administration of material and process engineering laboratory functions for Canadair Limited.

He is a graduate in chemical engineering of McGill University, class of 1936.

**R. D. Richmond,** M.E.I.C., has been appointed chief development engineer responsible for the administration of special weapons, experimental, aerodynamics and preliminary function for Canadair Limited.

He was previously aerodynamic section chief.

Mr. Richmond is a 1942 graduate in aero-engineering of the University of Manitoba.

**A. L. van den Brandeler,** M.E.I.C., of British Columbia International Engineering, has joined T. O. Lazarides, Lount and Partners, as chief engineer in charge of the Vancouver office.

Mr. van den Brandeler is a graduate of Delft and Grenoble universities.

**A. P. Benoit,** M.E.I.C., has been appointed commodity manager of hose products of Dominion Rubber Company Limited in Montreal.

A. P. Benoit, M.E.I.C.

Mr. Benoit, who has been associated with the Dominion Rubber Company for the past 18 years, served as sales engineer prior to his recent appointment.

He is a civil engineering graduate of McGill University, class of 1934.

**William Tkacs,** M.E.I.C., formerly cost reduction engineer with the International Register Company, is now chief industrial engineer of Omar Incorporated of Omaha, Nebraska. The firm is a multi-plant baking company and retail selling organization covering the states of Nebraska, Iowa, Wisconsin, Illinois, Indiana and Ohio.

Mr. Tkacs received his B.Sc. degree in mechanical engineering from Queen's University in 1941. After service with the Royal Canadian Navy, he entered the University of Michigan where he received his M.Sc. degree in mechanical engineering in 1947.

**J. D. Williams,** M.E.I.C., has been transferred by his company, Alberta Salt Co. Ltd., from Lindbergh, Alta., to La Salle, Ont. He is production and engineering supervisor.

Mr. Williams is a graduate chemical engineer of the University of Alberta, class of 1946.

**John J. Rowan,** M.E.I.C., has been transferred by Imperial Oil Limited from Sarnia, Ont., to Montreal.

Mr. Rowan joined the Imperial Oil Company in 1936. He received his civil engineering degree from Ecole Polytechnique in 1935, and his mechanical engineering degree from the Massachusetts Institute of Technology in 1936.

**A. I. Wotherspoon,** M.E.I.C., of the structural design department of Dominion Bridge Co. Ltd., Lachine, Que., has been transferred to The Sault Structural Steel Co. Ltd. in Sault Ste. Marie, Ont.

He is a 1949 graduate in civil engineering of Glasgow University.

**Alex Glassman,** M.E.I.C., has resigned his position as technical superintendent at the St. Lawrence Corporation in Three Rivers, Que., and is now on the staff of R. R. Donnelly and Sons Company, Chicago, Ill.

He graduated in chemical engineering from McGill University in 1946.

**R. F. Hawkins,** M.E.I.C., formerly with the Montreal Road Laboratories of the National Research Council in Ottawa, Ont., has been appointed chief engineer with Guardian Assurance Co. Ltd. in Montreal, Que.

Prior to joining the National Research Council staff, Mr. Hawkins was marine engineer with Imperial Oil Limited.

He is a mechanical engineering graduate of the College of Technology in Belfast.

**S. G. Jones,** M.E.I.C., is now supervisor of Industrial and Commercial Sales for the Province of British Columbia.

He was previously industrial engineer with Imperial Oil Limited in Toronto.

Mr. Jones is a 1941 chemical engineerig graduate of Queen's University.

**R. T. Bogle,** M.E.I.C., is manager of the manufacturing services department of Canadian General Electric Co. Ltd. in Toronto.

He was formerly works manager in this same department.

Mr. Bogle is a graduate in mechanical engineering of the University of British Columbia, class of 1940.

**Ernest J. Ollerton,** M.E.I.C., formerly in the employ of the Lee Wilson Contracting Company of Cleveland, Ohio, is now senior methods engineer with

the general products planning group of the Westinghouse Air Brake Company in Swissvale, Penn.

Before joining the Lee Wilson Contracting Company, Mr. Ollerton served as mechanical engineer in charge of design in the engineering department of Dominion Foundries and Steel Limited in Toronto, Ont.

## Errata

**Marian Pona,** M.E.I.C., was referred to in error as "Miss Pona" in the January issue of the *Journal.*

Mr. Pona, who is a 1951 civil engineering graduate of the Polish University College, is a designing engineer with the Hydro-Electric Power Commission of Ontario in Toronto.

Information presented in the February "Personals" about **William B. Scott,** Jr.E.I.C., of Consolidated Paper Corporation Ltd., Grand'Mere, Que., was not completely correct. This resulted from confusion of his name with that of Walter B. Scott, M.E.I.C., engineer on transmission line construction, Shawinigan Engineering Co. Ltd., Shawinigan Falls, Que.

William B. Scott, before joining Consolidated Paper Corporation Ltd. in Grand'Mere, was assistant to the mechanical superintendent of the Canada Paper Company in Windsor Mills, Que.

He is a 1951 mechanical engineering graduate of the Nova Scotia Technical College.

**John Douglas Barber,** Jr.E.I.C., is an instructor on the staff of the civil engineering department of the University of Toronto. At the same time he is undertaking post-graduate study at the university.

Mr. Barber was formerly a structural draughtsman with Stone & Webster Engineering Corporation in Boston, Mass.

He received his B.A.Sc. degree from the University of Toronto in 1951.

**I. R. Hudson,** Jr.E.I.C., of Sandwell and Company Limited in Vancouver, B.C., has been transferred to Auckland, New Zealand, for a period of two years during which time he will be employed on the construction of a pulp mill, newsprint mill and sawmill for Tasman Pulp and Paper Company Limited.

Mr. Hudson is a graduate mechanical engineer of the University of British Columbia, class of 1951.

**W. D. Goodings,** Jr.E.I.C., has joined the staff of Sidney Wood, provincial land surveyor in Hamilton, Ont.

He was formerly associated with L. P. Stidwell in Cornwall, Ont.

Mr. Goodings is a 1951 civil engineering graduate of Queen's University.

**Gordon W. Oliver,** Jr.E.I.C., is presently employed as industrial salesman with British American Oil Co. Ltd. in Edmonton, Alta.

He was previously associated with the Department of Natural Resources in Regina, Sask.

Mr. Oliver is a graduate in mechanical engineering of the University of Saskatchewan, class of 1949.

**W. Nesplak,** Jr.E.I.C., is at present employed as resident engineer for Defence Construction Limited at the new Army development at the Fort Osborne Barracks in Winnipeg, Man.

He was formerly assistant resident engineer with Central Mortgage and Housing Corporation, Winnipeg.

Mr. Nesplak graduated in civil engineering from the University of Manitoba, class of 1950.

**Robert J. Hollingshead,** Jr.E.I.C., has been appointed assistant chief construction engineer for the Alberta Department of Highways.

Previously materials engineer, Mr. Hollingshead has been with the department since 1946. He has made a specialty of soil mechanics.

Mr. Hollingshead received his B.Sc. degree in civil engineering from the University of Alberta in 1946 and his M.Sc. degree from the same university in 1948.

**J. C. Platt,** Jr.E.I.C., is assistant engineer in the structural research department of the Hydro-Electric Power Commission of Ontario.

Mr. Platt is a graduate in mechanical engineering of the University of Toronto, class of 1952.

**James Radford,** Jr.E.I.C., is now employed by the Polymer Corporation in Sarnia, Ont.

He was formerly civil engineer for Montreal Engineering Co., Montreal.

Mr. Radford graduated in 1952 in civil engineering from the University of Belfast.

**G. Campagnola,** JR.E.I.C., is an electrical engineer in the plant engineering department of the tire factory of Dominion Rubber Co. Ltd. in Kitchener, Ont.

He was previously connected with Walker & Associates Ltd. in Hamilton, Ont.

Mr. Campagnola graduated in electrical engineering from Queen's University in 1950.

**T. J. Hall,** JR.E.I.C., has recently joined the staff of the Seaboard Oil Company of Delaware in Calgary, Alta.

He was previously associated with Husky Oil & Refining Ltd., Sask., as production engineer.

Mr. Hall graduated in chemical engineering from the University of Alberta in 1950.

**S. B. Howlett,** JR.E.I.C., has been transferred as district manager of the B.C. Power Commission from Merrit, B.C. to Sechelt, B.C.

Mr. Howlett joined the B.C. Power Commission after his graduation in electrical engineering from the University of British Columbia in 1946.

**Samuel Rabin,** JR.E.I.C., has joined the staff of Mofax Electric Limited in Montreal, Quebec.

He was previously associated with Stadler Hurter & Co. in Montreal.

Mr. Rabin graduated in electrical engineering from McGill University in 1946.

**C. S. White,** JR.E.I.C., formerly with the industrial products division of Canadian General Electric Company Limited, has been transferred to the Company's apparatus division at the Montreal district office.

A 1950 mechanical engineering graduate of the University of British Columbia, Mr. White entered the Canadian General Electric Company as an engineer in training in Toronto. Since 1952 he has been associated as sales engineer with the company's aircraft equipment division in both Ottawa and Montreal.

**E. Edward MacPhail,** JR.E.I.C., is in the divisional engineers' office of Canadian National Railways in Belleville, Ont.

He was formerly associated with Demerara Bauxite Co. Ltd., British Guiana.

Mr. MacPhail graduated in civil engineering from Queen's University in 1949.

**Hugh Coleopy,** JR.E.I.C., formerly associated with Vancouver Iron Works Ltd., Vancouver, has returned to Vivian Diesels and Munitions, Ltd. in Vancouver, as assistant engineer.

Mr. Coleopy is a graduate mechanical engineer of the University of British Columbia, class of 1951.

**Lieut. H. T. McCall,** R.C.E.M.E., JR.E.I.C., has been transferred by the Department of National Defence from No. 2 Works Company, R.C.E., in Toronto, to No. 17 Works Company, R.C.E. at Whitehorse, Y.T.

Lieut. McColl graduated from the University of Manitoba in civil engineering in 1949.

**Jack C. Morris,** JR.E.I.C, is now field engineer with Carter Construction Co. Ltd. in Toronto, Ont.

Prior to accepting this appointment he was briefly associated with Canadian Copco Company Limited in Toronto.

He was formerly on the sales staff of Sandrik Canadian Limited and Bailey Meter Company Limited.

Mr. Morris is a graduate engineer of the University of Toronto, class of 1951.

**M. A. Nelson,** JR.E.I.C., is presently employed as an engineer in the mechanical department of Stock, Ramsay & Associates, Regina architects and consulting engineers.

Mr. Nelson was previously associated with the Saskatchewan Department of Highways, and with the Swift Current Collegiate as an instructor.

Mr. Nelson is a graduate in mechanical engineering of the University of Saskatchewan, class of 1947.

**H. E. Cole,** JR.E.I.C., is project engineer for Defence Construction (1951) Ltd. at Wolsley Barracks, London, Ont.

He was previously on the staff of Central Mortgage and Housing Corporation in Centralia, Ont., and was plan examiner in the building department of the City of Toronto.

Mr. Cole is a 1948 civil engineering graduate of the University of Toronto.

**Fred I. Morton,** JR.E.I.C., until recently associated with the Shawinigan Water and Power Company, has joined the special projects branch of the Department of Transport.

Mr. Morton is an engineering physics graduate of the University of Saskatchewan, class of 1949.

**James H. Toms,** Jr.E.I.C., has recently been transferred from Trail, B.C. to Toronto, Ont., by Stone & Webster Canada Limited.

Mr. Toms is a graduate civil engineer of the University of British Columbia, class of 1951.

**R. Waterfall,** Jr.E.I.C., is designer draughtsman in the engineering department of Mathews Conveyer Company Limited in Port Hope, Ont.

He was formerly associated with Dominion Hoist & Shovel Co. Ltd. in Lachine, Que.

**S. Okumura,** Jr.E.I.C., is presently employed as superintendent of the Perth Laundry and Cleaners in Winnipeg, Man.

Mr. Okumura graduated in mechanical engineering from the University of Manitoba, class of 1949.

**Jacques Perreault,** Jr.E.I.C., is now construction supervisor at the Beloeil works of Canadian Industries Limited in McMasterville, Que.

Mr. Perreault received his engineering degree from Ecole Polytechnique in 1952.

**Michael Staryk,** Jr.E.I.C., is presently employed in the special products department of the Electronics Division of Canadian Westinghouse Company Limited in Hamilton, Ont.

He was previously associated with the City of Winnipeg Hydro-Electric System.

Mr. Staryk is a 1950 graduate in electrical engineering of the University of Manitoba.

**Zane Bakun,** Jr.E.I.C., is presently employed as a community planning engineer in the Department of Municipal Affairs of the Saskatchewan government.

Zane Bakun, Jr.E.I.C.

A 1952 civil engineering graduate of the University of Manitoba, Mr. Bakun was one of the nine students in Canada in 1952 to be awarded the $1,200 fellowship in community planning by Central Mortgage and Housing Corporation. He received his master's degree in December, 1953. Mr. Bakun's thesis for his degree was entitled "The Design of an Area for Light Industry in the City of Winnipeg (with emphasis on the survey of utility facilities available)".

**J. Ghanime,** Jr.E.I.C., has completed the Canadian General Electric Company training course and is now employed as meter engineer in the Company's Quebec works.

Mr. Ghanime is a graduate of Ecole Polytechnique in mechanical and electrical engineering, class of 1952.

**J. N. Robertson,** Jr.E.I.C., is presently employed as a mechanical engineer in the maintenance and power branch of Atomic Energy of Canada Limited in Chalk River, Ont.

He was previously associated with Canadian Industries Limited in McMasterville.

Mr. Robertson is a mechanical engineering graduate of Queen's University, class of 1950.

**David H. Kennedy,** Jr.E.I.C., is now in the structural design department of Dominion Bridge Company Limited in Lachine, Que.

Mr. Kennedy is a civil engineering graduate of McGill University, class of 1952.

**T. B. J. Kruselnicki,** Jr.E.I.C., is at present on the staff of North Star Oil

Limited as refinery engineer in St. Boniface, Man.

He was previously connected with the Algoma Steel Company in Sault Ste. Marie, Ont.

Mr. Kruselnicki is a mechanical engineering graduate of the University of Manitoba, class of 1950.

**Samuel S. Lazier,** jr.e.i.c., is now in Kingston, Ont., following the move of the hydraulic laboratory of the Pulp and Paper Research Institute of Canada from the National Research Council in Ottawa to Kingston where facilities at Queen's University have been made available.

Mr. Lazier is continuing in Kingston a project begun in Ottawa and entitled "The Economical Construction of Safe Pulpwood Holding Grounds". This project is under the supervision of Professor R. J. Kennedy, m.e.i.c., of Queen's University.

Mr. Lazier received his B.A.Sc. degree in mechanical engineering from the University of Toronto in 1949, and his M.A.Sc. degree in 1951.

**R. Matte,** jr.e.i.c., is now purchasing agent with Lynn, MacLeod Engineering Supplies in Montreal, Que.

He was formerly director of the rates department of A. Belanger Industrial Engineering Ltd., Montmagny, Que.

Mr. Matte is a 1950 civil engineering graduate of Ecole Polytechnique.

**Marc St. Jacques,** jr.e.i.c., has been recently appointed superintendent of operations at the Thor Mills in Granby, Que.

Mr. St. Jacques was previously industrial engineer.

He is a mechanical engineering graduate of Ecole Polytechnique, class of 1952.

**J. Ross Moore,** jr.e.i.c., is now located at the new Guelph works of Canadian General Electric Company Limited. In his present position he is supervisor of works facilities and is in charge of maintenance and related services.

He is a graduate in mechanical engineering from the University of Toronto, class of 1946.

**D. R. Snider,** jr.e.i.c., formerly with the Steel Company of Canada in Hamilton, Ont., has joined Dominion Electrohome Industries Ltd. in Kitchener, Ont.

Mr. Snider graduated in mechanical engineering from the University of Toronto, class of 1950.

**Walter Bloch,** jr.e.i.c., has been recently appointed chief engineer of El-Met-Parts, Limited in Dundas, Ont.

He is a 1952 electrical engineering graduate of the University of Toronto.

**W. H. Nord,** jr.e.i.c., has been transferred as assistant equipment superintendent of Canada Wire & Cable Company, Limited to Toronto, Ont., from Montreal, Que.

Mr. Nord graduated with a B.A.Sc. degree in mechanical engineering in 1948.

**E. C. Walton,** jr.e.i.c., has resigned his position with Stone & Webster Engineering Corporation, and has joined Timber Structures of Canada Limited in Peterborough, Ont.

He is a graduate in civil engineering of the University of London, class of 1949.

**G. A. Eby,** jr.e.i.c., is chief engineer in the fuel cell division of the Dominion Rubber Company in Kitchener, Ont.

He was formerly associated with the E. B. Magee Ltd., in Port Colborne, Ont.

Mr. Eby is a graduate in chemical engineering of McGill University, class of 1949.

**Walter J. Francl,** jr.e.i.c., is now inspecting engineer for Associated Engineering Services Ltd. in Vegreville, Alta.

He was formerly field engineer with Engineering & Construction, Edmonton, Alberta.

He received his diploma in agricultural engineering at the University of Hochschule, Vienna, in 1948.

**Major W. A. McDill,** r.c.e., jr.e.i.c., Canadian engineer liaison officer at the War Office at Whitehall, London, has been recently promoted from the rank of captain.

Major McDill received his B.A.Sc. degree in mechanical engineering from the University of British Columbia in 1948, and his B.E. and M.E. degrees from Colorado A & M College in 1938 and 1948, respectively.

**J. M. Matthew,** jr.e.i.c., is engineer and manager of Schumacher-MacKenzie (Alberta) Ltd. in Edmonton, Alta.

Mr. Matthew is a 1951 electrical engineering graduate of McGill University.

**D. I. Ourom,** jr.e.i.c., is now a metallurgist with Aluminum Company of

Canada Ltd. in Kingston, Ont. He has been associated for the past two years with the Demerara Bauxite Company at MacKenzie, British Guiana.

Mr. Ourom graduated in civil engineering from the University of Saskatchewan in 1949.

**Harry E. Thiessen,** S.E.I.C., is now a transitman in the engineers' office of the Canadian Pacific Railway Vancouver Division.

Mr. Thiessen is a 1953 graduate in civil engineering of the University of British Columbia.

**Albert R. Towell,** S.E.I.C., has joined the staff of the Co-Op Refinery in Regina, Sask.

Mr. Towell is a graduate in mechanical engineering of the University of Saskatchewan, class of 1953.

## Visitors to Headquarters

**Philip H. Morgan,** M.E.I.C., Shooters Hill, Jamaica, B.W.I., February 11, 1954.

**W. A. Herron,** M.E.I.C., Montreal, Quebec, February 11, 1954.

**P. C. Kirkpatrick,** M.E.I.C., and **Mrs. P. C. Kirkpatrick,** Ste. Anne de Bellevue, Quebec, February 11, 1954.

**M. J. Green,** Montreal, Quebec, February 12, 1954.

**R. A. Watt,** Montreal, Quebec, February 12, 1954.

**Mrs. R. J. Simpson,** Valois, Quebec, February 12, 1954.

**G. Vogel,** Lachine, Quebec, February 12, 1954.

**Mr. and Mrs. R. Simms,** Montreal, Quebec, February 12, 1954.

**H. Boardman,** M.E.I.C., Altringham, Cheshire, England, February 16, 1954.

**A. C. Northover,** M.E.I.C., Corner Brook, Newfoundland, February 18, 1954.

**A. B. Whelan,** A.M.I.C.E., Bedford, England, March 10, 1954.

**G. G. Meyerhof,** M.E.I.C., Montreal, Quebec, March 10, 1954.

**O. N. Mann,** M.E.I.C., Halifax, Nova Scotia, March 3, 1954.

# Obituaries

*The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.*

**John Taylor Farmer,** M.E.I.C., who had been associated with Montreal Engineering Company Limited for the past 25 years, died suddenly at Ste. Anne de Bellevue on February 2, 1954.

Mr. Farmer was born in Liverpool, England, on December 14, 1874. He received his B.Sc. and M.Sc. degrees from the University of Liverpool in 1894, standing first in his class. In 1897 he was awarded a "1851 Exhibition Scholarship" for study abroad. He came to Montreal for research work in hydraulics at McGill University. His work was of such merit that the scholarship was renewed for a second year.

Mr. Farmer joined the Canada Patent Office as an assistant examiner in 1897. A year later he became associated with the Crosby Steam Gage & Valve Company in Boston, Massachusetts, and a year afterwards with the Ball & Wood Company in Elizabeth, New Jersey, where he was employed for a brief time before entering the Watts-Campbell Company in Newark, New Jersey, in 1901.

He was for three years assistant to the mechanical engineer and sales engineer of the Green Fuel Economizer Company in New York, and from 1905 until 1925 he served as a consultant in mechanical and hydraulic engineering in Montreal. At the same time he was district manager of Green's Economizer Limited of Canada, and represented Glenfield & Kennedy Limited of Kilmarnock, Scotland; Drysdale & Company Limited of Glasgow, Scotland; and the Uehling Instrument Company and Combustion Engineering Corporation, both of New York.

In 1925 he was appointed chief engineer of the newly-formed Combustion Engineering Corporation, Ltd. of Toronto.

Mr. Farmer joined Montreal Engineering Company Limited in 1928 as an expert in steam generating plants, auxiliary to hydro-electric developments. During his 25 years with this company he was in charge of hydraulic projects across Canada as well as in Mexico and Venezuela. During the past year he had been working on a project in Medicine Hat, Alberta.

For more than 30 years Mr. Farmer was a member of the Protestant School Board of Ste. Anne de Bellevue. Upon the formation of the Macdonald Protestant Central School Board four years ago, he represented Ste. Anne de Bellevue on that board also.

Mr. Farmer was a member of the St. James Literary Society of Montreal. It was while returning from a meeting of this society that he met his death.

Mr. Farmer joined the Engineering Institute of Canada as a Student in 1897, transferring to Associate Member in 1905 and to Member in 1919. Always keenly interested in Institute activities, Mr. Farmer served as chairman of the Montreal Branch in 1923. On January 1, 1947, he attained Life Membership in the Institute.

**Albert Ernest Sharpe,** M.E.I.C., former assistant engineer on construction with the Canadian Pacific Railway, died in Vancouver, British Columbia, on February 20, 1954.

Mr. Sharpe was born in Palmerston, Ontario, in January 28, 1877. After receiving his general education in public schools and through private instruction, he began his career with the Canadian Pacific Railway in 1897 as rodman and timekeeper. In the years following 1901 he served as transitman, reconnaissance engineer and resident engineer until 1918 when he was appointed assistant engineer in charge of construction work throughout the prairie provinces and British Columbia. After 46 years with the company, Mr. Sharpe retired in 1943.


A. E. Sharpe, M.E.I.C.

He joined the Engineering Institute of Canada as an Associate Member in 1909, transferring to Member in 1922. In 1941 he was granted Life Membership in the Institute.

**Albert Holland,** M.E.I.C., former civilian garrison engineer with the Royal Engineers, died at Old Cleve, Watchet, Somerset, England, on January 24, 1954.

Mr. Holland was born at Nerguis, North Wales, on September 23, 1879. He received his formal education at Chester College and the Technical Engineering School, at the same time serving in the county district surveyor's office and with Thomas Foster, a civil engineer in Hoylake, Cheshire, for four years.

In 1900 Mr. Holland became assistant to the municipal engineer and surveyor at Hoylake West Kirby, and in 1903, a civil engineer with Watrous Limited, contractors on the construction of docks and a breakwater on the west coast of Ireland. In 1905 he served as resident engineer to the Rt. Hon. Lord Stanley of Alderley on the construction of a sea wall at Hoylake.

Mr. Holland came to Canada in 1906 and became assistant superintendent of the Canadian White Company on the construction of the power house for the Montreal Street Railway. Within five months he was appointed superintendent on the construction of a cement plant at Longue Pointe, Quebec. In 1908 Mr. Holland was appointed civil engineer with Vulcan Portland Cement Co. Ltd. in Montreal. The following year he joined the engineering department of Canada Cement Co. Ltd. in Montreal and continued his association with this firm until his enlistment in the Army as a lieutenant in 1916. After service in France with the Royal Canadian Engineers, he was discharged in 1919.

Upon his return to England he was appointed executive engineer in the Public Works Department at Accra, West Africa, and subsequently at Puerto Cruz in the Canary Islands.

In 1937 Mr. Holland was named colonial engineer and surveyor general in the Public Works Department at Roseau, Dominica, B.W.I. At the outbreak of World War II he was appointed civilian garrison engineer and personal assistant to the deputy commander of the Royal Engineers at Dover, England. In 1946 he was transferred as civilian garrison engineer for the Royal Engineers to Liddymore Camp, Watchet, Somerset, England, and subsequently retired from active work.

Mr. Holland joined the Engineering Institute of Canada as a Student in 1908, transferring to Associate Member in 1915, and to Member in 1940. On January 1, 1950, he was granted Life Membership in the Institute.

**John Leslie Rannie,** M.E.I.C., former dominion geodesist and international boundary commissioner, died suddenly in Ottawa on February 8, 1954.

**J. L. Rannie, M.E.I.C.**

Mr. Rannie was born in Newmarket, Ontario, on May 27, 1886. He received his B.A.Sc. degree in civil engineering from the University of Toronto in 1909, and held certificates of Dominion Land Surveyor, Quebec Land Surveyor, and Dominion Topographical Surveyor. The holding of the last certificate required his passing one of the most difficult surveying examinations in the British Commonwealth.

During his summer holidays as a university student, Mr. Rannie was employed as a chainman and rodman on Canadian Northern Railway construction and location work; as an engineer's assistant on Canadian Northern Railway bridge construction over the South Saskatchewan River; and as a leveller on a Canadian Northern Railway location party.

From May, 1907, until January, 1913, Mr. Rannie served as an observer on geodetic survey parties and international boundary survey parties. He was next placed in charge of survey work on Lake of the Woods for the International Joint Commission, and in 1915 he was made responsible for survey parties on the New Brunswick-Maine boundary for the International Boundary Commission. Two years later he was appointed supervisor of triangulation for the Geodetic Survey of Canada.

In 1943, Mr. Rannie was appointed assistant dominion geodesist. Four years later he was named dominion geodesist and international boundary commissioner and continued as such until his retirement in May, 1951.

Mr. Rannie was internationally known for his interest in instrument design, and his ideas contributed in a marked degree to increased precision in present-day theodolites.

He attended as Canadian delegate the Oslo (1948) and Brussels (1951) conferences of the International Union of Geodesy and Geophysics. He was also author of numerous technical papers.

Mr. Rannie's grandfather, John Thomas Stokes, a prominent architect, engineer and surveyor in York and the neighbouring counties of Ontario, was one of the first members of the (then) Canadian Society of Civil Engineers, being elected on January 20, 1887, on the same date as such well known figures as Dean John Galbraith, Sir Casimir Gzowski, W. T. Jennings and Professor C. H. McLeod.

Like his grandfather, Mr. Rannie took a very active interest in technical organizations of particular interest to engineers and surveyors. He was a past-president of the Canadian Institute of Surveyors and a past vice-president of the Professional Institute of the Civil Service of Canada. He also served as chairman of the Ottawa Branch of the Engineering Institute of Canada in 1924, and as councillor representing the Ottawa Branch in 1926-27.

He joined the Engineering Institute of Canada as an Associate Member in 1918, transferring to Member in 1922. On January 1, 1953, he attained Life Membership in the Institute.

**Leroy Francis Harza,** M.E.I.C., president of Harza Engineering Company Limited of Chicago, Illinois, died at his home in Highland Park, Illinois, on November 22, 1953.

Mr. Harza was born in Brookings County, South Dakota on February 6, 1882. He received his B.S. degree in mechanical engineering from the South Dakota State College in 1901, and his B.S. degree in civil engineering from the University of Wisconsin in 1906. Two years later he obtained his C.E. from the latter university.

Mr. Harza was employed in various field engineering, surveying, construction and draughting jobs from 1901 until 1912 at which time he opened his private consulting practice in Chicago. His company has been concerned with investigation, design, and construction of dams, hydraulic works, hydro-electric projects and bridges in the United States, Canada, Uruguay, Argentina, India, the Philippines, El Salvador, Nicaragua, Iraq, Egypt, Greece, Turkey and France.

Mr. Harza was a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the Western Society of Engineers. He was also a member of the Water Resources Board. In 1930 he served as United States delegate at the World Power Conference in Berlin, and in 1951 he was United States representative at the Fourth Conference on Large Dams in Bombay.

In 1949 he received a citation from the University of Wisconsin, and the following year was awarded the degree of doctor of engineering from the South Dakota State College. He was the recipient of the John Cross Medal awarded by the American Society of Civil Engineers in 1950.

Mr. Harza joined the Engineering Institute of Canada as a Member in 1928.

**J. Alide Trahan,** M.E.I.C., former consulting engineer with Mag'oire Cauchon Limited of Quebec City, died on June 6, 1953.

Mr. Trahan was born at Yamachiche, Quebec, on July 6, 1901. He received his general education at the Three Rivers Seminary, and in 1923 entered Ecole Polytechnique in Montreal, graduating with a B.A.Sc. degree in 1928.

Upon graduation Mr. Trahan joined the Truscon Steel Company where he remained until 1931 when he entered the bridge and tunnel department of the City of Montreal.

In 1934 he joined the Department of Roads of the Province of Quebec and was placed in charge of survey, design and road construction for the eastern part of the province. He continued in this position until 1942 at which time he entered the general construction firm of A. Deslauriers & Sons in Quebec City. During his association with this firm he was in charge of the construction at Princess Louise Basin, Quebec.

Mr. Trahan joined the engineering and contracting firm of Magloire Cauchon Limited as consutling engineer in 1944.

He was a member of the Corporation of Professional Engineers of Quebec.

Mr. Trahan joined the Engineering Institute of Canada as a Member in 1945.

**Joseph Edward McPherson,** M.E.I.C., district engineer for the Department of Highways of the Province of Alberta in Grande Prairie, died in September, 1953.

Mr. McPherson was born in Cochrane, Alberta, in 1894. He received his general education at Western Canada College in Calgary, Alberta. He joined the Department of Public Works of Alberta in 1926, serving for his first three years as rodman, gravel checker, instrumentman, and inspector on gravel research. In 1929 he was appointed junior engineer and served in this capacity until 1941 when he joined the Royal Canadian Engineers with the rank of lieutenant. The following year he was promoted to the rank of major.

After his discharge in 1947, he returned as resident engineer to the Department of Public Works of Alberta and was placed in charge of asphalt and gravel surfacing and drainage work at Edmonton and Newbrook. Three years later he was appointed district engineer at Grande Prairie, the position he held at the time of his death.

Mr. McPherson was a member of the American Association of Engineers, the Military Engineers Association of Canada, and the Association of Professional Engineers of Alberta.

He joined the Engineering Institute of Canada as a Member in 1948.

# Employment Service

**THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.**

**NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.**

**REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.**

**INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.**

## SITUATIONS VACANT

### CHEMICAL

KEY POSITIONS in a new expanding, research lab. are open to competent scientists. Must have sound theoretical background, and at least five years practical experience in (a) natural and synthetic fibers—paper (b) high polymers—adhesives. Applicant should have a M.Sc. or Ph.D. degree in chemical engineering or physical chemistry. Must be qualified to organize, plan and supervise the work of a group of men. In reply please submit personal resume education and experience which will be held confidential. Remuneration to be negotiated. File No. 4725-V.

CHEMIST OR CHEMICAL engineer with experience in the pulp and paper industry, to supervise control work in a section of the technical department. Applications will be held confidential. File No. 4729-V.

CHEMICAL ENGINEER with rubber experience to sell rubber chemicals and compounds for Canadian manufacturer in Eastern Ontario and Quebec. Salary and profit sharing. Opportunity for an aggressive sales minded man. File No. 4764-V.

CHEMICAL GRADUATE with experience, preferably sales, in metal cleaning, electroplating and/or painting. This is a salaried position plus expenses, commission and annual bonus. Firm also provides a liberal retirement insurance and hospitalization program. Location working out of Toronto. File No. 4783-V.

### CIVIL

CIVIL GRADUATES, 1954 required by paving company in Province of Quebec. Applicants should be preferably bilingual. File No. 4726-V.

FULLY EXPERIENCED structural steel checker required in middle west organization. Applicant should have about fifteen years or more experience in structural steel and have previous checking experience. File No. 4727-V.

YOUNG GRADUATE ENGINEER PREFERABLY CIVIL or mining, required by manufacturer of drainage and all kinds of metal products. Applicant should not have more than two years experience and have a definite interest in sales work. Location Ontario. File No. 4733-V.

APPLICATIONS ARE INVITED and will be received by the undersigned for the position of a planning engineer. Applicants should have university graduation in civil engineering or architecture or related field preferably including or supplemented by courses in municipal planning. Considerable professional experience in municipal planning desirable, including some supervisory responsibility or an equivalent combination of training and experience. Applicants to state age, marital status, education qualifications and experience history. File No. 4736-V.

CIVIL ENGINEER with good experience in field layout and draughting required by pulp and paper company in the Maritimes. File No. 4743-V.

CIVIL ENGINEER, university graduate and registered Professional Engineer required for sales promotion work by large company with Canada-wide interests. Applicants should have at least 5 years' experience in reinforced concrete structural design, should be in the twenty-five to thirty-five age group and should be prepared to do considerable travelling. Please apply giving full details of academic training and professional experience, references and salary requirements. File No. 4749-V.

APPLICATIONS WILL BE received for the position of Township Engineer and road superintendent for the Township of Sandwich West, Ont., population now 13,000. Applicants must be qualified civil engineers and should be prepared to handle all problems in connection with roads, water works, etc., in a growing municipality. We employ a work supervisor. Applicants should state age, qualifications, past experience, references and salary expected. File No. 4751-V.

UTILITIES ENGINEER required salary $6,120 to $6,840 plus Fort Churchill allowance by Department of National Defence, Fort Churchill, Manitoba. Details and application forms at nearest Civil Service Commission office and National Employment Office. Quote No. 53-1205. File No. 4753-V.

CIVIL ENGINEER, graduate of a Canadian University and registered professional engineer with at least 10 years practical experience in a supervisory capacity specializing in design of structural steel and reinforced concrete building to supervise group of engineers and draughtsmen in consulting engineers office in Windsor, Ontario. Salary range $7,500 to $9,000 depending on qualifications. Please write giving full details including experience, age, reference, etc. File No. 4769-V.

CONSTRUCTION ENGINEER required by company located in P.Q. engaged in the construction of small houses as well as commercial and industrial. The responsibilities would include the preparation of estimates and the complete charge of execution. File No. 4779-V.

CHIEF ENGINEER and director required by structural engineers Toronto. Applicants must be structural engineers specialized in design and full control of drawing office for many years in position of entire responsibility for the design of work of great magnitude in both reinforced concrete and structural steel. Suitable age between 35 and 45. File No. 4785-V.

CIVIL ENGINEER required by private consultant located in Ontario. Requirements are at least five years experience engineering. Preference will be given to applicant having commission as land surveyor. Salary $4500.00. Please state age, education and experience to fullest extent and ability. File No. 4786-V.

ENGINEER REQUIRED with experience in structural steel for design and sales work, by steel fabricator in Montreal. Salary open depending upon qualifications. File No. 4790-V.

RECENT GRADUATES in civil engineering for employment in Southern Ontario as sales representatives of national manufacturer and erector of steel construction products. Preparatory training course provided. File No. 4793-V.

REQUIRED GRADUATE civil engineers for specialized work in soil mechanics and foundation engineering. Graduate soils work desirable. Locations: Montreal and Toronto with some travelling. File No. 4794-V.

### ELECTRICAL

APPLICATIONS ARE INVITED for the position of assistant professor dept. of electrical engineering University of British Columbia, Vancouver, Canada. Candidates should have post-graduate training preferably at the Doctor's level in electronics and servo-mechanisms. Duties include teaching under graduate courses in electrical engineering, post graduate studies in some phase of servo-mechanisms or electronics. Starting salary $4,500 to $5,000 per year. Date of appointment July 1, 1954. Further information may be obtained by writing to the head of the department. File No. 4720-V.

GRADUATE ENGINEER preferably electrical with one to four years experience and a desire for sales engineering is required by small nationally recognized electrical manufacturer. Six months to one year orientation at Toronto factory then sales engineering work in Montreal office on salary plus commission basis. File No. 4721-V.

ELECTRICAL ENGINEER for system planning division. Should have at least ten years' experience in the designing and operation of hydro and/or thermal generating plants and transmission systems, with particular qualifications as follows: Application of the method of symmetrical component to the solution of unbalanced conditions on A.C. systems, experience in the use of the A.C. net work analyser on load flow studies, relay problems and stability studies, both transient and steady state. Familiarity with problems associated with the operation of a power system, such as fluctuating loads, and methods used to mitigate the effect of some; also some knowledge of the operation problems associated with the inter-connection of two or more systems. Experience also desirable in A.C. system operation with particular regard to the maintenance of voltage levels, reactive and real power flow and speed covering problems. Address all applications giving full details of qualifications and experience and salary required. File No. 4723-V.

REPRESENTATIVE REQUIRED for Quebec and Ontario areas by electrical manufacturers to contact architects, consulting engineers and electrical contractors covering lighting equipment and wiring devices. Reply in handwriting stating qualifications and experience. File No. 4724-V.

ELECTRICAL ENGINEER required to design and develop rectifiers and communication equipment. Applicant should have better than two years experience in this field. Starting salary depends on qualifications. File No. 4728-V.

THREE GRADUATE ELECTRICAL engineers interested in design development, technical control or application engineering. The duties include; learning and preparing specifications for internal use of electrical conductors, the study of insulants and dielectric behaviour, the preparation of calculations and line design, asesssement of the quality of raw materials, designing cables developing new products, and writing technical brochures and catalogue sections. Location Ontario. File No. 4738-V.

YOUNG GRADUATE ELECTRICAL engineer bilingual required by manufacturer of vacuum tubes and fluorescent and incandescent lamps. The plant of this company is located at 60 miles from Montreal. The position offered would involve work in production engineering quality control, testing. Please state salary expected and full details of qualifications and experience. File No. 4740-V.

FIELD ENGINEERS preferably with electrical background by oil well service company operating in Western Canada. Five months training period. Comprehensive employee benefits. Work is substantially in the field for initial years with irregular hours. Age limit of 28 preferred. Engineers will be based in active oil exploration area of Western Canada. Well established company active throughout world. Inquiries welcomed. File No. 4754-V.

ELECTRICAL ENGINEER required to fill positions as Senior product engineer with long established and expanding company manufacturing rectifiers and distribution equipment for public utilities. Must have proven technical and administrative ability to assume responsibility for all design, development and product engineering and supervision of engineers, technicians and draughting staff. File No. 4756-V.

ASSISTANT PROFESSOR required in the department of electrical engineering of University located in Maritime Provinces. Preferably Canadian, under 35, and with at least two years experience. The course involves D.C. machinery A.C. circuits and introductory electronics. File No. 4760-V.

ELECTRICAL ENGINEER bilingual, required for system planning studies of rapidly expanding utility located in P.Q. Duties will involve problems of distribution, transmission and hydraulic generation. Educational requirements: graduation in electrical engineering from a recognized university and from 3 to 7 years experience preferably in a utility or allied field. Employee benefits include: pension, group insurance, and hospitalization plan. In reply please give age, marital status, summary of experience and salary required. File No. 4781-V.

GRADUATE ELECTRICAL ENGINEER required for new plant in Ontario. Applicants should have experience in the telephonic communications field. Company is engaged in the manufacture of telephone dial switching equipment and associated apparatus such as telephone relays etc. The work involves the following detailed engineerings. The preparation of specifications detailing each item of equipment to be supplied for a particular installation. The preparation of exchange drawings to be used by installers in the installation of equipment. File No. 4684-V.

ELECTRICAL ENGINEER required by paper company located in Eastern Canada. Young graduate with some experience not necessarily in paper mill. File No. 4799-V.

ELECTRICAL ENGINEER required by hydro commission in Ottawa. Should have at least 4 years experience in urban electrical distribution, and to act as an assistant to the distribution engineer. File No. 4801-V.

## MECHANICAL

GRADUATE MECHANICAL ENGINEER wanted, experience in heater coil manufacture or design required. To assist also in technical sales. Salary commensurate with qualifications and experience. Location Montreal. File No. 4732-V.

SALES ENGINEER REQUIRED by large manufacturer of industrial equipment for sales and service of pulp and paper mills on west coast. Previous mill experience desirable. Excellent opportunity. File No. 4735-V.

GRADUATE MECHANICAL ENGINEER required to take over the preventative maintenance program of a fleet of transport vehicles operating interprovincially in Western Canada. Applicant should be prepared to spend some two or three months in the U.S.A. then put into operation a preventative maintenance program for this organization. File No. 4739-V.

PROCESS OR PRODUCTION ENGINEER required by locomotive firm. Excellent opportunity for progressive engineer who can initiate and follow through on cost reduction, machine and process improvement, and scrap reduction programs. Should have three or more years experience in modern machine shop and steel fabrication practice. This job offers splendid opportunity for advancement. Salary commensurate with ability and experience. File No. 4761-V.

INDUSTRIAL ENGINEER required by large organization. Applicants should be preferably graduate engineers in mechanical. The age range could be from 25 to 40 and the duties involved will be engineering studies of manufacturing operations for the purpose of improving operating methods, equipment material handling, etc. Experience in time study for the establishment of production standards for large incentives, would be a decided advantage. Due to rapid expansion opportunities for advancement are excellent. Starting salary range from $4,000 to $6,500 depending on qualifications and experience. File No. 4762-V.

TWO RECENT ENGINEERING graduates, preferably mechanical required by large beverage company for plant work in Toronto and Montreal. File No. 4766-V.

MECHANICAL ENGINEER required by air conditioning and ventilating contractor in Montreal. Duties to include field supervision and estimating. Man must be familiar with sheet metal work and installation of air-conditioning equipment. Must be bilingual. File No. 4767-V.

MECHANICAL ENGINEER graduate of a Canadian college and registered professional engineer with 15 years experience in design of pressure vessels, pressure piping, for work in Windsor, Ontario. Salary ranges between $8,000 and $10,000 depending on qualifications Please write giving full details including experience, age, references, etc. An interview will be arranged. File No. 4769-V.

GRADUATE MECHANICAL ENGINEER 23 to 28, interested in sales to work as assistant in general engineering and sales department of growing engineering company. Company specializes in aircraft parts and industrial work. Location Montreal. Please write giving full details. File No. 4772-V.

MECHANICAL ENGINEER with about three to eight years experience required by manufacturer and distributor of a comprehensive line of plumbing and heating products consisting mainly of cast iron soil pipe and fittings, cast iron and convector radiation, cast iron domestic and commercial size boilers, steel furnaces, tank fabrication and allied lines. Duties would be plant engineering in plant located in Ontario Applicant should be above average ability as it is the intention to move him into the field of general supervision of service department as soon as ability is indicated. File No. 4775-V.

PROFESSOR OF MECHANICAL and head of mechanical engineering department required by the University of Roorkee founded in 1949 as the first technical university in India. Roorkee is about 100 miles north of Delhi. Applicant should be a mechanical engineer with a sound background of modern mechanical science. He should have a high academic qualification preferably Ph.d. or D.Sc. The direction of specialization is not important. Age preferably not under 38-40 years. Duration of appointment minimum two years preferably three. Living accommodation provided and free medical attention. File No. 4780-V.

MECHANICAL ENGINEER required to work with electronic engineer in the design of commercial and government military equipment. This includes wave guide and cavity design and layout. At least one or two years' mechanical design experience required not necessarily with electronic equipment. Location Ontario. File No. 4788-V.

SALES ENGINEER required in the diesel engine department, Montreal Branch of large manufacturer. Recent graduate, preferably bilingual, professional training should not be too specialized, as work is of a general mechanical type that requires a preparation of estimates on diesel engines for stationary service generating sets, marine propulsion and marine auxiliaries, etc., in the early stages, travelling would not be necessary, but the potential of the job includes the complete coverage of all diesel engine contracts of this territory. Salary depending upon qualifications and experience. File No. 4789-V.

INSTRUCTOR OF MECHANICAL engineering to teach mechanical drawing and assist in mechanical engineering laboratory courses. Preference will be given to an applicant with experience in the field of machine shop practice and industrial engineering, who would have an opportunity to develop courses in this field. Location University of B.C., Vancouver. File No. 4791-V.

MECHANICAL ENGINEER required by plant engineering branch of large research organization at Ottawa. Applicants should be B.Sc. graduates in mechanical engineering with at least three years' experience in the design of heating and ventilating of offices and industrial buildings. Duties include the preparation of drawings and specifications for heating and ventilating, and the assistance in the design, layout, and adjustment of refrigeration and air conditioning equipment. Initial salary up to $5,750, depending on qualifications. Apply by letter giving full details of education and experience. File No. 4798-V.

SALES ENGINEER for field work to represent manufacturers agency selling original and maintenance equipment used in mines, paper mills and heavy industry. Company operating in Northern and Northwestern Ontario, also Northwestern Quebec. Progressive training for suitable applicant. Technical, mechanical maintenace or mill experience desirable. Submit record of education, experience, references and photograph, to File No. 4803-V.

### MISCELLANEOUS

LONG ESTABLISHED company located in Toronto area has interesting vacancies for sales engineers preferably experienced on pumps and compressors or would consider men with a good knowledge of heavy machinery or power plant equipment. All replies in strictest confidence. File No. 4714-V.

AN ASSISTANT CHIEF water resources division, at Ottawa. Salary $7,500 to $8,100. Details and application forms at your nearest Civil Service Commission Office, National Employment Office and Post Office. File No. 4716-V.

YOUNG MECHANICAL (or civil engineer), bilingual, with sales experience in, or good knowledge of diesel engines, road-building and municipal equipment required by important company for its Montreal sales staff. This position provides an ideal opportunity for an engineer seeking a future in the heavy equipment sales field. File No. 4717-V.

APPLICATIONS ARE INVITED for the following positions: 1. research officer, to engage in theoretical and experimental studies relating to building acoustics. Duties may include supervision of standard acoustical testing, field measurements and laboratory research in acoustics. 2. Research officer, to engage in studies of soil vibrations and their effect on buildings. Duties may include theoretical and experimental studies of wave propagation in soils and design of suitable apparatus for vibration studies in both field and laboratory. General qualifications: University degree in physics or engineering and at least two years of post graduate training or pertinent industrial experience. File No. 4719-V.

STREET LIGHTING sales engineer required by a long established manufacturing company in the field of scientific illumination. Duties after a specific training program will involve the sale of light directors to municipalities and public utilities chiefly. Deligence, dependability, an agreeable personality, and determination to make a career in this field are of highest importance. File No. 4731-V.

AUTOMOTIVE INDUSTRY IN ONTARIO requires work standards men to be employed on time study and methods work. File No. 4734-V.

POSITIONS BECOMING available at Winnipeg in air line for graduate engineers having comprehensive experience in aircraft structures, mechanical, electrical and radio systems. Also senior draughtsmen with experience in aircraft structural or mechanical engineering. File No. 4741-V.



APPLICATIONS ARE INVITED for the position of assistant professor, Department of Civil Engineering, University of British Columbia, Vancouver, Canada. Candidates should have had postgraduate training preferably at the Ph.D. level in fluid mechanics. Duties include teaching fluid mechanics and other courses in the under-graduate school and teaching one post-graduate course in some phase of fluid mechanics. Starting salary from $4,500 to $5,000, depending on experience, with the possibility of augmenting income with summer work on hydraulic models or other hydraulic projects. Date of appointment is July 1, 1954. File No. 4744-V.

PLANT LAYOUT AND material handling engineer required by automotive industry in Ontario. Applicants should have either specific experience in these particular fields or with plant or maintenance engineering experience, such as construction, piping, conveyors, etc. File No. 4747-V.

PLANT LAYOUT ENGINEER — Large U.S. Manufacturer with plants located in Latin America requires capable Plant Layout Engineer for work in consulting office in New York State. Must have experience in metal working industry in plant layout work with sound knowledge of building design and manufacturing methods. Please send complete resume covering education, experience and family, including recent photograph. File No. 4752V.

MOTOR DESIGN ENGINEER — Large U.S. manufacturer with factory in South America needs experienced induction motor design engineer with sound knowledge of manufacturing methods. Motor sizes to range from small fractional horsepower through 50H.P. Please send complete resume covering education, experience and family, including recent photograph. File No. 4752-V.

SALES ENGINEER required in the Industrial division of large manufacturer of metal products for steel mills power plants and other industrial operations. Applicant should also be able to evaluate possible new business in the light of expanding manufacturing facilities, therefore a manufacturing background is essential. Good deal of travel is involved. Age range 35 years. Located in Montreal. Company has been serving Canada's railroads and industry for more than 50 years. File No. 4757-V.

GEOLOGISTS OR GEOLOGICAL engineers with a minimum of 5 years experience in geological exploration in Western Canada and/or Northwestern U.S. required by consulting firm. Must be qualified to assume complete responsibility of large exploration projects involving photogeological techniques. Occasional field work only. Top salary to qualified applicants. File No. 4758-V.

NATIONAL ORGANIZATION requires a sales engineer for the Province of Quebec. Applicants must be fluently bilingual. Engineering graduates. Those having a thorough knowledge through experience of road building and materials will receive preference. Age 30 or over. This is a well salaried position deserving consideration by qualified persons. Apply in Writing. File No. 4759-V.

UNIVERSITY GRADUATE in electronics or applied physics required to act as assistant (technical) to the sales manager of a medium sized company engaged in the development and manufacture of advanced defence apparatus prepare technical requests, edit instruction manuals, catalogues, price lists, etc. Work is concentrated in Montreal however, there is a possibility of frequent travel mainly in Quebec and Ontario. File No. 4763-V.

GRADUATE ENGINEER required immediately by the Department of Engineering at Carleton College, Ottawa. He will be required to teach in and direct the work of the present two-year engineering course and in addition to explore the possibilties of developing this into a degree course in general engineering. Qualifications a degree in engineering or its equivalent, together with some practice experience and proven ability to impart knowledge. Salary in accordance with the responsibilities of the position. File No. 4765-V.

YOUNG CIVIL OR MECHANICAL ENGINEER required by a pulp and paper company in Quebec. Applicant should have a minimum of three years experience in engineering and maintenance preferably in the pulp and paper industry. Applicant should be fluent in either French or English and should be able to get along in both. Replies should outline qualifications, experience, age and salary expected. File No. 4768-V.

SALES ENGINEER required by firm located in Montreal. Applicant should be acquainted with combustion lines, have sales experience, entries to architects, consulting engineers. This position could be either full or part time on a commission or drawing account basis or other arrangements could be made after discussion. File No 4771-V.

ASSISTANT CITY ENGINEER required in Western Canada. Duties will be general municipal engineering, including operation of the pumping and purification plant, cleansing and water delivery branch, asphalt plant, also maintenance construction of street paving, concrete curbs, sidewalks, sewer and water mains, also building inspection. Applications giving full particulars as to qualifications, experi-

THE CITY OF EDMONTON
ALBERTA, CANADA
REQUIRES AN ASSISTANT
CITY ENGINEER

DUTIES:

As first assistant of the City Engineer to assist in administration of the Department involving planning, co-ordinating and supervising of various municipal projects, including construction and maintenance of roadways, walks, bridges, sewers, sewage disposal, garbage collection and disposal, traffic control, and related work.

QUALIFICATIONS:

University graduate in Civil Engineering and preferably considerable varied administrative and supervisory municipal engineering experience in the above noted work.

Apply in writing, stating salary requested, to the City Engineer, Civic Block, Edmonton, Alberta, not later than April 30th, 1954.

NATIONAL RESEARCH COUNCIL CANADA
requires at Ottawa a
SAFETY ENGINEER

Under direction, to develop a program of safety consciousness throughout the laboratories of the Council.

The duties will include the investigation of accidents and fires, potential accident and health hazards and the recommendation of safety measures.

Graduation in Engineering or Chemistry (Chemical Engineering preferred) from a university of recognized standing is required; must be physically fit, and have several years industrial experience in technical work; safety engineering experience desirable but not essential.

Initial salary up to $5150 per annum depending on qualifications.

Apply to the Employment Officer, National Research Council, Sussex Street, Ottawa, giving full details of qualifications and experience.

# Mechanical Engineer

$6,420 — $7,200

Department of Public Works
Ottawa

Details and application forms at your nearest Civil Service Commission Office, National Employment Office, Post Office and University Placement Office.

Quote Competition No. 54-1202
CIVIL SERVICE OF CANADA

ence, salary desired etc. to be received not later than March 15/54. File No. 4773-V.

MACHINERY MANUFACTURERS' agents require sales engineer preferably bilingual to cover Quebec and S. Ontario. In applying indicate knowledge of previous sales experience and territory covered. File No. 4776-V.

THREE ENGINEERS REQUIRED by manufacturer of multiwall kraft bags and related paper products 1954 graduates to 6 years of experience. Training period in Montreal. Subsequent work in variety of locations. File No. 4777-V.

CHEMICAL OR MECHANICAL engineer required for coal preparation research. Experience in coal cleaning, especially with driesson cyclones and dense media desirable but not essential. Starting salary will depend on training and experience and will be in a bracket of $4,000 to $5,000 per annum plus cost of living bonus based on the consumer's index. The present bonus approximates $300 annually. Apply with all particulars recent photo and addresses for reference. File No. 4778-V.

THE COMMUNITY PLANNING ASSOCIATION OF Canada invites applications for the principal staff position in its national office. Applicants should have a general knowledge of community planning and municipal affairs, and must have an ability to prepare information and publications on planning subjects in non-technical language. Applicants need not possess professional qualifications as planners. The salary will be commensurate with the qualifications and experience of the person appointed. File. No. 4800-V.

ENGINEER REQUIRED by manufacturer located in Maritime Province planning to enlarge research facilities. Applicant should have been connected with the chip board companies in Europe and have sufficient technical knowledge and related experience to proceed along certain lines of development. File No. 4782-V.

SENIOR ENGINEER quality control university graduate in engineering physics, electrical engineering or mathematics and physics, majoring in electronics. 5 years experience in radio manufacturing preferably in a technical function. Knowledge of shop methods and inspection practice. Familiarity with all types of radio technical equipment. Knowledge of radar and especially in testing. File No. 4787-V.

RADAR ENGINEER required for the design of airborne and marine radar equipment. Must be familiar with government specifications. About five years experience is required, wartime experience desirable. Location Ontario. File No. 4788-V.

COMMUNICATIONS ENGINEER required in either microwave or V.H.F. design work. Must have at least five years experience in laboratory or industry and be thoroughly familiar with latest design techniques. Wartime experience desirable. Location Ontario. File No. 4788-V.

BROADCAST ENGINEER required for the production engineering of large broadcast and TV equipment. Must have previous production experience. Location Ontario. File No. 4788-V.

THE TOWNSHIP OF TORONTO requires a graduate civil engineer to act as an assistant engineer in their engineering department on design and construction work in connection with water and sewer systems. Applicants should have from 2 to 4 years experience on water and sewer work. Apply stating age, qualifications and salary expected. File No. 4792-V.

POWER PLANT ENGINEER required for large industrial concern near Montreal to take care of high pressure steam plant turbo-generators and refrigeration. Only those having both practical experience and technical knowledge need apply. State age, experience, and salary expected. File No. 4795-V.

DESIGN ENGINEERS, experienced in the engineering design of aircraft instruments and accessories or equivalent industrial products, required to join a small progressive company located in Montreal. Excellent working conditions and benefit plans. Apply outlining qualifications and salary expected. File No. 4796-V.

GRADUATE ENGINEER to fill the position of plant engineer, and should have some product design and cost estimating experience. Plant maintains press, foundry, plating, wire forming, etc. facilities. Location Province of Quebec. File No. 4797-V.

EXPERIENCED MECHANICAL ENGINEER required immediately. Must be capable of repairing complete designs and specifications for heating and plumbing systems in buildings. Thorough knowledge of steam and hot water heating, ventilation and air conditioning essential. Applicants must have had practical experience. Starting salary six thousand ($6,000) dollars. Apply by mail giving full particulars and references in first letter to File No. 4804-V.

## SITUATIONS WANTED

BILINGUAL MECHANICAL INDUSTRIAL graduate engineer, age 42, with personality and experience, presently employed. Seeks opportunity where diplomatic ability, technical knowledge could be used in supervisory capacity. All offers considered. File No. 140-W.

SANITARY ENGINEER, Civil engineer, B.Sc., Queen's 1948, M.A.Sc., U. of Toronto 1949, P.Eng., Jr.E.I.C., age 29, single. Four and a half years practical experience in municipal and sanitary engineering. Was chief municipal engineer for one and a half years responsible for design and development of waterworks and sewage projects. Also experienced in supervision of construction of various municipal projects, as well as in administration of a municipal engineering department. Presently employed as design engineer dealing with sewage treatment plants, water works projects, sewer designs, roads and pavements. Am seeking a responsible position, preferably with a firm of consulting engineers where individual initiative, hard work and proven ability will be recognized. Am a member of the Canadian Institute on sewage and sanitation and the American Waterworks Association. File No. 250-W.

CIVIL ENGINEER and land surveyor, M.E.I.C., 26 years of varied experience abroad and Canada, in: railroad, airport, road, dam, watersupply, irrigation, building, factory construction and related survey of layouts and location. In charge of survey parties and supervising and directing construction. Service with the Royal Engineers in the Middle East and East Africa. Married, bilingual. Seeks responsible position in Ontario or Quebec, where experience will be of value. File No. 489-W.

MECHANICAL ENGINEER, graduate 1944, single, age 34, with experience in mechanical and industrial engineering. Administrative and supervisory experience with responsibility at management level. Assistant plant manager, maintenance supervisor, plant engineer and industrial engineer in welding industry, heavy equipment, printing industry. Cost study, wage incentives, production control, plant layout, and time study. Seeking opportunity to join progressive firm in engineering, production or plant. File No. 2920-W.

PHYSICO METALLURGIST M.E.I.C., P.Eng., specialized in statistical elucidation of production data toward solution of workshop problems in metallurgy, specially in quality and process control in steel making-shaping-heat treating. As a statistical analyst experience second to none in sinchronization of production factors so that optimum conditions for the lowest occurrence of pipe in steel ingot, or segregation in steel can be attained, and maintained for a predictable length of time. Also in sinchronization of factors toward highest capacity of Bl. Fce. at lowest coke rate. File No. 3521-W.

MECHANICAL ENGINEER, Queen's 1944, M.E.I.C., P.Eng., married, age 34, eight years experience as plant engineer, including planning, design, erection and maintenance on process steam, refrigeration, air conditioning systems, seeks employment in plant engineering, preferably, but not necessarily, in smaller city or town in Ontario or Western Canada, with growing company. Available on three months notice. References include present employer. File No. 3935-W.

CIVIL ENGINEER (European), graduate from McGill and Master's degree from Toronto (52) wishes to work on design and construction of buildings. Possessor of professional engineers certificate and experience on highway construction, surveys, soil borings and soil testing. Age 26, single, available in two weeks notice. File No. 3988-W.

ENERGETIC YOUNG civil engineer, M.E. I.C., P.Eng., single. Varied heavy construction experience; pulpmill, steam and diesel plants, docks, houses, barracks, hangars, runways, highways, sewer and water systems, surveying. Finishing assignment as resident engineer on $16,000,000 project. Available for responsible position, field or office. File No. 4015-W.

CIVIL ENGINEER, N.S.T.C. 1952, age 28, married. Have had some highway construction experience. Presently employed in job requiring very little engineering training. Would like to obtain experience along any line of engineering. Present location Nova Scotia. File No. 4070-W.

SENIOR MECHANICAL ENGINEER (34), M.E.I.C., A.M.I., Mech.E., seeks responsible post in Vancouver or district. 10 years experience in design and construction of medium and heavy machinery, rolling mills, chemical plant, hydraulic equipment. 3 years experience research and development in noise and vibration science. Also administrative experience, personnel and purchasing. Good knowledge French and Italian. File No. 4091-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.A. Sc., U.B.C. 1950. Age 29, married, 2 children. Two year graduate training course with large electrical manufacturer. 14 months pulp and paper experience including maintenance and new installations. Desires position with more responsibility. File No. 4153-W.

CIVIL ENGINEER, M.Sc., M.E.I.C., P.Eng. (Ont.), graduated 1947, is available. First class designer of all types of modern structures, inventive, enterprising and with flair for structures involving complex statistical problems. File No. 4173-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng., McGill 1951, power option, seeks employment in construction or manufacturing line. Maintenance and construction experience. Presently employed as resident electrical engineer on large project for a firm of consulting engineers. Location no object. File No. 4202-W.

GRADUATE ENGINEER B.Sc. Mining Engineer, University of Leeds, England 1951, Jr.E.I.C. Age 25, married one child. 18 months experience in municipal and general civil engineering, 8 months mechanical drafting. Desires change to position with a future. File No. 4207-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (Queen's 1948), veteran age 32, married, 1 child, over five years experience on layouts, steel and concrete design in a chemical plant. Ability to supervise projects and some knowledge of estimating and costs. Desires a responsible position where above experience would be an asset. Available on one month's notice. Preferable location southern Ontario. File No. 4238-W.

GRADUATE MECHANICAL ENGINEER. Married, with family, requires employment. Diversified industrial experience. Purchasing, maintenance and machinery shop practice. Sound business training. Experience includes heating, sheet metal industries and general machinery equipment. Bilingual. Has good personality, enthusiastic, keen business acumen. Desires employment on production, sales or engineering administration. Location Montreal area. Available immediately. File No. 4300-W.

MECHANICAL ENGINEER, B.Sc. University of Saskatchewan 1950. Jr.E.I.C., age 28, married. Have been doing plant engineering work since graduation. Desire position with opportunity, location not important. File No. 4328-W.

CHEMICAL ENGINEER, 1945 graduate M.E.I.C., P.Eng. (Ont.) with several years work in anodizing, lacquering, plating, plastic and metal-spraying, phosphatizing, electropolishing. Particular consideration of corrosion problems in the chemical beverage, textile industry. Has practical experience in managing as well as laboratory work in the field of analyzing and material testing. Did extensive research on chemical durability of lacquers and on adhesion of metals and paints on aluminum and steel. Desires a position in a plant or in a developing and research laboratory. File No. 4359-W.

MECHANICAL ENGINEER Jr.E.I.C., B.A.Sc. 1948, 6 years pulp and paper and heavy industrial equipment experience before graduation as project designer and 2 years after graduation. For several years engaged in the combustion engine field, mainly diesel equipment. Desires position in either field with more responsibility. File No. 4386-W.

CIVIL ENGINEER, M.Sc. Technical University Dansig 1935, D.Sc. Technical University Munich 1947, M.E.I.C., age 40, bilingual. 17 years experience in Europe and Near East in architectural and structural design of residential, industrial, hospital buildings and in town-planning. One year Canadian experience in Toronto in residential, industrial, and theatre design. Seeks responsible position with firm of engineers or architects. File No. 4387M.

MECHANICAL ENGINEER, D.I.C., G.I.M.E., 27, single, bilingual, three years experience in design office and manufacturing of fabricated steel and structural steel, 1½ years research experience, sound knowledge of shop procedure, electric and electronic bias, seeks permanent position in Montreal area but willing to travel. Presently employed below technical ability. Loyal, responsible and willing to start at junior level if opportunity for advancement is provided after ability has been shown. File No. 4388-W.

MECHANICAL ENGINEER and Chemist B.A.Sc.—1952; B.Sc. (Chemistry and Physics) 1946 M.C.I.C., Junior A.S.M.E. age 28. Married, with two years experience in all phases of instrumentation in pulp and paper industry, also one and one-half years work as junior chemist in the petroleum industry. Desires job with definite opportunity for advancement. Presently employed, but available on reasonable notice. File No. 4390-W.

CHEMICAL ENGINEER, P. Eng., B.A.Sc. (Toronto '50) Jr.E.I.C., M.C.I.C., 32, married, 1 child, veteran 3½ years R.C.N., four years general office work, four years development control and supervisory experience in chemical process industry. Working knowledge of French, some German. Desire more responsible position in technical service, development or similar work, Canadian or foreign. All replies acknowledged. Resume on request. File No. 4391-W.

ELECTRICAL ENGINEER, Canadian, M.E.I.C., B.Sc. (Alta., 1944), M.S. (Carnegie Instiute of Technology, 1952), expecting Ph.D. Carnegie Tech. 1954. Married, 1 child. 4½ years with large Canadian electrical manufacturer including test course and design experience. 3 years in electrical sales. Desires teaching position in power field, or research and development in servo-mechanism and control field. Doctoral thesis being written on fundamental study of magnetic amplifiers. File No. 4392-W.

JR. E.I.C., Graduate Polytechnique 1950—fully bilingual. Has been working for 2 years as estimator and construction engineer. Had 1 year experience in construction work in Europe. Position wanted in Montreal or surroundings, but would consider going anywhere in Canada. File No. 4398-W.

EXECUTIVE ENGINEER, M.E., M.E.I.C., P.Eng. (Ont.), twenty-three years varied design-manufacturing and management experience of which eleven years chief engineer with equipment manufacturing concern. Since 1946 practising privately and activities consisted mainly of larger engineering assignments including project development and execution, also extensive consulting with steel, pulp and paper industries as well as equipment manufacturers. Interested in an association with a really progressive organization offering appropriate opportunities preferably in connection with larger scale Canadian and/or foreign developments, or other responsible activities requiring engineering background, leadership qualities, a realistic approach to problem analysis, diplomacy, practical imagination and acknowledged design talent. Present income considerably above average but would consider reasonable compromise if proposition otherwise attractive. File No. 4399-W.

ELECTRICAL ENGINEER, B.E. (University College Dublin), Associate Member Institute of Civil Engineers of Ireland. Age 34, married, with children. Nine years experience with electricity supply organization. Experience mainly in electrical distribution design and construction overhead and underground networks. Arriving Canada March or April. Seeking interviews for position as distribution engineer. Location unimportant. File No. 4400-W.

CIVIL ENGINEER, B.E. (National University of Ireland), Jr.E.I.C. Two years experience in structural steel design; 6 months with Canadian structural firm; also worked for short time on traffic survey. Presently employed (Montreal) in job requiring very little engineering training. Desires position offering experience in various branches of municipal engineering. Taking course leading to A.M.I. Mun.E. Location of little importance; available on reasonable notice. Age 23, married. File No. 4401-W.

ELECTRICAL ENGINEER, B.Eng. (Hons.)., M.A.Sc., M.E.I.C., P.Eng., age 35, married, and presently completing eighth year as Professor of Electrical Engineering. Has taught many different courses on senior and graduate level with emphasis in power. Broad general experience in construction, public utility work and as a naval officer. Has done considerable consulting work of general nature. Seeks appointment which should offer a broad challenge in keeping with background proffered. File No. 4402-W.

DIPLOMA ENGINEER, Mechanical, P Eng., M.E.I.C., with comprehensive technical knowledge, creative ability and 18 years experience in design and manufacture of diversified machinery and devices such as power shovels, hydraulic presses, aircraft engines, pumps machine tools, electric automatic controls, welded products, as well as experience in organizing and managing plants with up to 5,000 workers, economical minded with mature judgment, at present engaged in machine tool development seeks a position with a progressive company where his past experience could be utilized best. File No. 4403-W.

PROFESSIONAL ENGINEER (Ont.), B.Sc. (E.E.), U. of Manitoba, veteran, age 28, married, 2 children. Canadian Westinghouse Training Course. Nearing completion of post-graduate work in Business Administration, consisting of evening classes leading to M.Com. Presently employed as project engineer responsible for co-ordination of all phases of manufacture of projects. Desire responsible position in administration or production. File No. 4404-W.

CIVIL ENGINEER, B.Sc., Jr.E.I.C., now employed with 3 years foreign experience, construction and structural design (reinforced concrete), and one year Canadian experience in building construction and draughting (not in structural design), is seeking a junior position with prospects in structural design, preferably in Toronto. File No. 4407-W.

CIVIL ENGINEER, B. of Sc. in Eng. M.E.I.C., P.Eng., Danish citizen, age 46, married seeks responsible position with future possibilities. Over twenty years experience in all sorts of heavy construction: roads, concrete pavings, excavation, dikes, sewers, reinforced concrete: bridges, piles, buildings, hangars, design. Fully familiar with administration and thoroughly experienced in preparation, organization and supervision of construction. Preferably in larger city. Available on approximately one month's notice. Future possibilities will be considered more than starting salary. File No. 4409-W.

ELECTRICAL ENGINEER, Jr.E.I.C., U. of Alberta, 1949, veteran, age 33, married. 1½ years in industrial and commercial construction, 3 years design and development of power plants for large communication company. Experienced in electrical controls. Prefer Alberta or B.C., but willing to locate anywhere if work is interesting and has advancement possibilities. File No. 4411-W.

CHEMICAL ENGINEER, S.E.I.C., Jr.C.I.C., B.Sc. (Queen's 1952), single, age 22, desires position with responsibility in industry or technical sales. Three years summer employment in the paper industry. Have two years municipal engineering administrative experience working with senior executives and meeting the public. Location headquarters preferred in E. Ontario. File No. 4414-W.

SANITARY ENGINEER M.A.Sc. University of Toronto as of April 1954. S.E.I.C., B.Sc. (C.E.) University of Manitoba 1952. One years experience in building construction. Desires position offering experience in sanitary or Public Health Engineering. Location immaterial Available beginning of May. File No. 4415-V.

OVERSEAS POSITION preferred by graduate chemical engineer, Jr.E.I.C., McGill 1949, war veteran. Considerable experience in mechanical work such as all phases of design fabrication and erection of heavy structural, plate and mechanical products. Also process plant experience and considerable customer contact experience. Presently employed in a supervisory capacity. File No. 4416-W.

MECHANICAL ENGINEER, B.Sc. 1st class hons. Ph.D. (Durham) G.I.Mech.E., married, age 24, recently arrived from England seeks position in development or production. Experience includes 18 months in general engineering and 3 years supervision and direction of a research project in the field of applied thermodynamics. Training includes stress analysis, gas and fluid dynamics and industrial management. Has also had experience in writing and editing reports and publications. Available immediately, location anywhere. File No. 4417-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950 graduate, Toronto. Veteran, 32, single, some research experience, over three years in chemical industry on project and design work, involving process and services equipment and piping, instrumentation and building construction, including some estimating, purchasing, expediting and inspection. Desires position of greater responsibility in similar work or in maintenance work of a general nature. File No. 4418-W.

CIVIL ENGINEER, B.Sc. C.E. U.N.B. 1950, Jr.E.I.C., age 30, married. 4 years experience as construction engineer on highways, including reinforced concrete bridges. 2 years in charge of building construction, including sewage disposal systems, water supply etc. One year as design engineer of municipal street layout, landscaping etc. Available on short notice anywhere in Canada. File No. 4419-W.

CIVIL ENGINEER, D.L.C. Hons (Civil Engineering), M.E.I.C., P.Eng., (Ont.), Grad. Inst. Struct. Eng., awaiting election to A.M.I.C.E., age 28, single, 6 years experience on construction of dry dock and deepwater quay, power station, airfields, bridges, roads and railways, survey, design of steel-piled cofferdams, track layout and construction schemes. Responsible for supervision of layout, construction, concrete inspection, pile-driving, underwater drilling, pressure grouting, test boreholes, diving operation, measurement of quantities and cost reports. Presently employed as area engineer on construction of chemical plant. Desires position of responsibility suitable to past experience. Location—anywhere in Canada. File No. 4420-W.

ADMINISTRATIVE ASSISTANT. B. Eng., Jr.E.I.C., McGill 1952, age 26. Experience includes time and methods study, job classification and plant engineering. Presently graduate student in business administration at University of Toronto. Desires position as staff assistant to an executive in a company in Toronto. Available in May. File No. 4421-W.

MECHANICAL ENGINEER (McGill-1951) Jr.E.I.C., single, age 27. At present attending Graduate School of Business Adminitsration (Western). Two years experience in engineering department of a newsprint mill, layouts, maintenance, reports, budgets, field work and 4 summers varied experience in construction, manufacturing, etc. Seeking employment with medium or small sized manufacturing concern Location preferably Ontario. Available mid-May. File No. 4423-W.

MECHANICAL ENGINEER. Bilingual, M.E.I.C., P.Eng., age 41, M.Sc. 1938, veteran, presently employed. 16 years diversified technical experience in Air Force and industry, including 6 years Canadian experience in design and maintenance of steel mill equipment, structural steel, piping, handling equipment, transmissions, plant layouts, reinforced concrete, building etc. — desires position requiring initiative, organizing and supervisory ability. File No. 4425-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng. Nova Scotia Technical College 1952. Age 28, married, one child. Presently engaged as electrical inspector with corps of engineers, U.S. Army on defence projects in Labrador. Duties include diesel and steam power plants, power transmission and distribution facilities and the installation of electrical equipment in connection with extensive P.O.L. distribution Have open mind regarding position offered. Foreign location preferred. Available upon reasonable notice to present employer. File No. 4428-W.

CIVIL ENGINEERING GRADUATE (B.Sc. St. Andrews University, Scotland) 1953, with some field experience, desires position anywhere in Canada. File No. 4429-W.

ENGINEERING PHYSICIST M.Sc. (Physics) Delft U. (Netherlands) 1950, B.Sc. (Electrical Engineering) 1936, 7 years service and sales engineering of medical X-ray equipment, 2 years development of X-ray tubes, 3 years electrical and electronic instrumentation in university lab. 4 years representation of large European manufacturer of radio and electronic equipment, electron tubes and electronic components in national and international electro technical standardization committees. Experienced secretary of international technical conference, good specification writer, fluent English and German, working knowledge of French. Married, three daughters. Detailed resume on request. Interview preferably in first week of April. Location Western Canada or Southern Ontario. File No. 4430-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.A.Sc. University of British Columbia 1951, single, age 35. Seeks position in communications in British Columbia. Two years experience in meteorology and marine and aviation radio communications prior to graduation. Post graduate experience; 1¾ years of development, production, and maintenance engineering in quartz crystals manufacture; 1 year development work on microwave equipment. File No. 4431-W.

MECHANICAL ENGINEER, P.Eng., G.I.Mech.E., single, age 27. Experience: 2 years general workshop practice including overhaul of steam and diesel engines and factory machinery repair. 18 months machine and structural design and draughting. Desires work on production or plant maintenance in Montreal or B.C. File No. 4436-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng. Age 32, married, bilingual. Seven years varied experience in electric generation and distribution. Some familiarity with relays. Good mathematical background. Desires opportunity to train as relay engineer with large utility. Would consider attending G.E. or Westinghouse relay course and willing to sacrifice for this opportunity. Location no object. File No. 4437-W.

# Attention, Employers

**• Available to you in June 1954 will be seventeen Canadians with engineering degrees and who have also graduated in Business Administration from Harvard University.**

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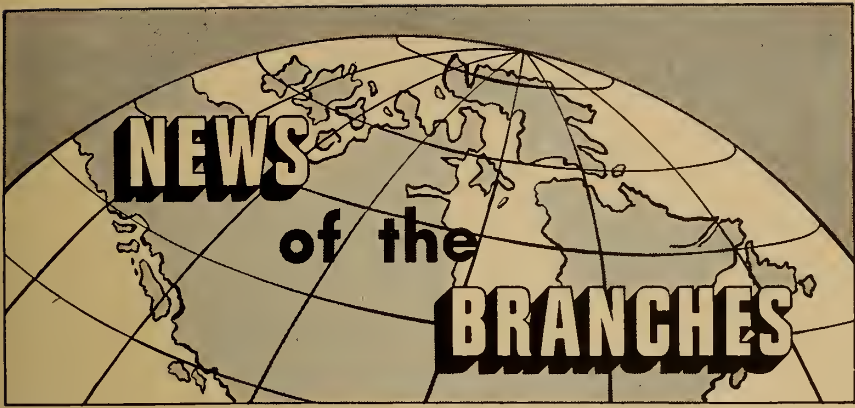
**Canadian Club**

**Harvard Business School** **Boston 63, Mass.**




**Activities of the Forty-seven Branches of the Institute and abstracts of papers presented at their meetings**

## Belleville

C. H. Lusk, Jr.E.I.C.,
*Secretary-Treasurer*

***Isotopes in Industry***

The Belleville Branch of the Engineering Institute of Canada held its regular meeting at the Masonic Temple in Belleville on January 11 with 46 members present.

As there was no general business to bring before the meeting, C. R. Whittemore, chairman, called on J. H. Legate to introduce the speaker.

C. H. Hetherington, a representative of the Commercial Products Division of Atomic Energy of Canada Limited, addressed the Branch on the subject, "Isotopes in Industry". In his introduction, the speaker briefly traced the history of Atomic Energy of Canada Limited and, in particular, the growth of the Commercial Products Division.

Mr. Hetherington then showed slides and gave a brief description of the atomic reactor NRX at Chalk River. NRX is a heavy water pile which is considered to have certain advantages over the graphite pile. There are three main types of product obtained from an atomic reactor, namely, fission products, irradiated products and separated isotopes. The industrial use of isotopes can be broken down into two main categories. These are a source of ionizing radiation and a tracer.

The speaker then outlined the various ways in which isotopes are used as a source of ionizing radiation. These include the science of radiography by which metal castings are tested and examined, the control of liquid levels and densities in tanks, the detection of leaks in pipes, the elimination of static, and the determination of soil moisture. It was also explained how the use of isotopes is applied to thickness gauges in paper mills and sheet metal mills.

Mr. Hetherington also explained briefly, the application of isotopes in chemical analyses and in the sterilization of meats and various types of food. He also noted that in the future, atomic energy would undoubtedly be used to generate electricity in steam plants. In this regard, he remarked that if it could be completely burned, one pound of nuclear fuel would produce the equivalent heat energy of 1,300 tons of coal.

In conclusion, the speaker showed some slides and explained the application of cobalt 60 in the treatment of cancer.

The appreciation of the Branch was expressed to Mr. Hetherington by J. C. R. Punchard.

## Calgary

W. E. Hawkins, M.E.I.C.,
*Secretary-Treasurer*

R. F. Bailey, M.E.I.C.,
*Branch News Editor*

***January 7 Meeting***

The speaker of the evening was Harold W. Riley, Q.C., who spoke on the subject "What Makes a Substance a Mineral in Law as Distinct from the the Engineering World."

For his talk, Mr. Riley discussed the now famous "Sand and Gravel" case and the more recent "Borys" case both of which centered around the Edmonton area.

In the case of the former, the Alberta Courts applied an English rule which ruled that a mineral is a substance which is:

1. Taken from under the surface for profit.
2. Rare and exceptional to the area.
3. Valuable in the vernacular sense of mining and commercial men and landowners at the time of the reservation.

The Province of Alberta then passed an Act saying that sand and gravel were not minerals. The Supreme Court then upheld the Act by ruling that sand and gravel were not minerals since they represented a stage in the geologic development of agricultural soil.

In the "Borys" case, petroleum, coal, and valuable stone were reserved and the court had to decide if the word "petroleum" included the natural gas in its original meaning in 1906. It was argued that in 1906 gas was considered as a waste product only. Finally, the Privy Council ruled that petroleum included oil and natural gas in solution but not the gas cap. However, Mr. Riley pointed out that this ruling has very limited application since most reservations since 1912 were for all mines and minerals.

***Building Research***

R. F. Legget, director, Division of Building Research, National Research Council, Ottawa, spoke to the Calgary Section on January 21 on "Building Research and the New National Building Code."

For his introductory remarks the speaker traced the historical background of building codes from the earliest times.

Building research in Canada had its beginnings in 1933 but progress was hindered due to the depression. The need for a uniform building code was realized more fully in 1936-37 when the National Housing Act was instituted. By 1947 the Building Research Division of the National Research Council was formed with its basic policy being the study of problems which are peculiar to Canada only.

The basic problems being studied by the Building Research Division are as follows:

1. Building Materials
2. Climate
3. Fire Research
4. Cold Weather
5. Northern Building
6. Snow and Ice Research

Canada's first National Building Code was published in 1941 as an advisory document and was adopted by 120 Canadian cities, towns, and municipalities. While considered an excellent work both in national and international circles, the original code had many confusing and sometimes contradictory references. As a result, a twenty man committee was set up to bring the code up to date and to eliminate the faults of the old code.

The speaker stated that the new code was now in the printer's hands and would be published in separate sections each in pamphlet form. These sections are:

1. Administration
2. Climate
3. Use and Occupancy
4. Design
5. Materials
6. General Services
7. Plumbing
8. Construction Safety Measures

It was the speaker's hope that the new building code would find ready acceptance by all cities and municipalities across Canada.

## Central British Columbia

H. L. Topham, Jr.E.I.C.,
*Secretary-Treasurer*

***Joint Meeting***

The meeting of the joint executives of the Central British Columbia Branch and the British Columbia Engineering Society was held in Kelowna, B.C., on January 8, 1954, at the Water Rights Office, 435 Bernard Avenue. The meeting convened at 7:30 p.m.

The following executive members were in attendance:

M. L. Zirul, chairman of the E.I.C.; W. A. Ker, vice-chairman, E.I.C.; R. L. Bigg, immediate past chairman, E.I.C.; H. DeBeck, committeeman; E.I.C.; H. Topham, secretary-treasurer, E.I.C.; A Dimock, committeeman, E.I.C. and B.C.E.S.; R. G. Harris, chairman, B.C.E.S.; T. S. Hughes, secretary-treasurer, B.C.E.S.

The minutes of the last executive meeting held at Penticton on July 10 were read and adopted.

It was moved by Mr. Bigg and seconded by Mr. Dimock that the secretary-treasurer acknowledge the selection of Mr. Stephens as president of the Institute for the coming year.

After some discussion it was suggested that the secretary-treasurer advise Headquarters that if the annual meeting of the Engineering Institute of Canada is to be held in Zone A in 1957, that Jasper would be favored as the choice of this executive.

It was moved by Mr. Ker, seconded by Mr. Hughes, that R. L. Bigg be appointed as our Branch representative on the Nominating Committee for the year 1954.

It was moved by Mr. DeBeck and seconded by Mr. Harris that D. W. Simon, Bruce Gilmour and Gordon Jones be accepted as Branch affiliates.

The following dates and locations were selected for the dinner meetings which are to be held during 1954:

February 13, Kelowna: This meeting is to be sponsored by the E.I.C. It will be a mixed dinner meeting, as the President and Secretary from Headquarters will be present. The Kelowna convenor is to invite the local civic officials who would care to attend.

April 9, Kamloops: Sponsored by the B.C. Engineering Society.

June 11, Penticton: Sponsored by the E.I.C.

September 10, Vernon: Sponsored by the B.C. Engineering Society.

November 26, Kelowna: Sponsored by the E.I.C. It was decided that this should be a joint annual meeting of both Branches in order to ensure a maximum attendance of each Branch.

The following were appointed to the convening committee in each centre, and they were to act jointly in all the arrangements and to endeavor to ensure a good attendance of the membership located in their respective centres.

Kamloops—H. DeBeck, F. Dembiske
Vernon—F. G. DeWolfe, A. Dimock
Kelowna—G. Meckling, R. Harris
Penticton—A. F. Joplin, W. J. M. Owen.

Mr. Ker of Kelowna and Mr. Wade of Kamloops were appointed as a committee to arrange for a program at each of the meetings.

Mr. Bigg was appointed as Chairman of the By-laws Committee for the coming year.

It was moved by Mr. Dimock and seconded by Mr. Bigg that at each general meeting in 1954 the refreshments, when served, be from 6:00 to 6:30 p.m. with dinner at 6:30 sharp, instead of 7:00 o'clock approximately, as it has been heretofore.

It was suggested that during the business session of the dinner, the minutes of the previous meeting be read and all other correspondence which could be dealt with by the executive, should be referred to the next executive meeting.

It was moved by Mr. Bigg and seconded by Mr. DeBeck that Mr. Harris, the convenor of the presidential dinner, to be held in Kelowna on February 13, should be advanced $30.00 from our Branch treasury in order to make dinner arrangements.

It was requested that the secretary-treasurer contact Mr. Hatfield and Mr. Walker of Penticton about meeting the presidential party and arranging for their transportation to Kelowna for the dinner meeting.

It was moved by Mr. Bigg and seconded by Mr. DeBeck that a vote of thanks be conveyed to the present secretary-treasurer, H. L. Topham, for his services during the past two years.

It was moved by Mr. Dimock and seconded by Mr. Bigg that the meeting be adjourned. The time was 10:00 p.m.

## Edmonton

Percy M. Butler, jr.e.i.c.,
*Secretary-Treasurer*

K. Provost, m.e.i.c.,
*Branch News Editor*

***Traffic Problems***

The Edmonton Branch held its January meeting at the "Seven Seas" under the chairmanship of N. J. Allison.

The program for the evening consisted of a discussion of some of Edmonton's traffic problems by members of the Public Speaking Group. Evans Moore acted as Master of Ceremonies and introduced the speakers.

Bob Kerr, who was the first speaker in the group, presented statistics which showed that the 45,000 cars registered in Edmonton in 1953 represented a 300 percent increase over the number in 1946. During the same period the population increased 60 percent. Edmonton's per capita car density is now one car for every four people. This density is surpassed only by the city of Los Angeles.

The number of accidents in the city has increased by about the same ratio as the number of cars. The number of fatalities, however, was 16 in 1953 as compared to 12 in 1946.

Mr. Kerr described how the present day traffic problems were being answered by the extended use of traffic lights, introduction of one way streets, control of parking through the use of parking meters and no parking areas, police direction, the elimination of level railway crossings, the use of "clover leafs" and by driver education.

The second speaker was Stan Hampton. He described the difficulties encountered by the driver in travelling from Edmonton's Strathearn district to the downtown area. Mr. Hampton suggested three alternative ways in which traffic crossing the river in this area could be accelerated. These were the installation of traffic actuated signals on the approaches to the Low Level Bridge, the building of "clover leaf" approaches, or the building of a new bridge. The use of traffic actuated signals is the system being given serious consideration by city authorities at the present time.

The third speaker, Paul Buckland, described how the C.N.R. and C.P.R. trackage presented man-made barriers to the free flow of traffic out of the downtown area. He suggested how the bottlenecks could be relieved by constructing additional overpasses or subways at critical points.

After an interesting question period the group was thanked by L. F. Grimble.

## Huronia

Louis Morgante, jr.e.i.c.,
*Secretary-Treasurer*

On January 21 at the Orillia High School a very interesting meeting was held of the Huronia Branch of the Engineering Institute of Canada. Some forty Engineers and guests were present.

The highlight of the evening was an address by Orval Johnston, Project Engineer. His subject was Ontario Hydro's Sir Adam Beck Niagara generating station No. 2.

The address dealt with the complete development of this $350,000,000.00 project.

Spread across an eight mile distance, this project includes the intake structure some 2 miles above the Falls near Chippawa, twin tunnels under the City of Niagara Falls, an open cut canal following the tunnels, and a new powerhouse located at Queenston some six miles below the cataracts.

Two 500 ft. gathering tubes are like gigantic mouth organs in appearance, and from these the water proceeds down underneath the City of Niagara Falls, through twin tunnels 5½ miles long and some 45 ft. in finished inside diameter and located some 330 ft. below the ctiy. These tunnels emerge into a 2¼ mile open cut canal which in turn carries the water to a huge forebay for delivery to the penstocks.

Construction of the tunnels was a major feat of modern mining engineering. Five access shafts were sunk into the rock past the depth of the tunnels and located 6,225 ft. apart along the tunnel route. Broken rock was loaded with power shovels into 15 ton trucks and hoisted to the surface in skips.

The twin hydraulic pressure tunnels are, as far as is known, the largest of their type in the world. They have a rough diameter of 51 ft. which is reduced to a finished diameter of 45 ft. by the 3 ft. thick circular concrete linings. Approximately 1,056,000 cu. yd. of concrete was required to line the tunnels. Almost 10,000,000 tons of rock had to be excavated from the tunnels. Some 38,290 tons of structural and reinforcing steel was used in supporting the roof and sides of the tunnels.

It was pointed out in this talk that the use of models saved millions of dollars in the overall project. Models made it possible to determine how current would act and saved a tremendous amount of rock excavation that otherwise would have been necessary.

One very interesting aspect was the intersection of the power canal for the new project with the original No. 1 Sir Adam Beck power canal development.

Another very interestering aspect is that arrangements are made such that the huge tunnels can be pumped out in about one week so inspection can take place if and when found necessary. Electric pumps are located down on the bottom of these tunnels completely housed in and protected from the water, and the only connection to the surface is by means of an electric cable. Such pumps may be idle for years at a time and then it may be necessary to start them at a moment's notice. They are designed for this service.

Velocities through the tunnels are such that silt will not deposit.

The site of the powerhouse six miles below the cataracts enables 295 ft. of the 315 ft. difference in level between the intake and the powerhouse to be

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utilized for the production of electric power. This means only a 20 ft. friction head loss for the whole length of the eight mile project; 50 per cent more power can be produced than if the powerhouse were built immediately below the falls where a head of only 200 ft. could be obtained.

The project has been designed such that the scenic beauty of the falls and the gorge will not be impaired. A treaty between the Canadian Government and the United States Government specifies a minimum of 100,000 cu. ft. per second flow during daylight hours in the tourist season and 50,000 cu. ft. per second at all other times. The balance of the water available is split evenly between the United States and Canada.

As an indication of the quantity of flow, the building intake structure will divert 15,000,000 gallons of water a minute to the two tunnels. This is enough water to supply the citizens of Niagara Falls for one week.

Plans are under way to provide further power by storing water. A storage reservoir containing 650,000,000 cu. ft. of water is to be built and a pumping plant will pump the water into this storage basin at night. Then during periods in the daytime when peak power is required, this water will be used for generating power.

In answer to a question from the floor, Mr. Johnston gave it as his estimate that the capital cost of the project was approximately $190.00 per installed horsepower. This is a very low capital cost considering present construction costs.

Some forty engineers present agreed that this was one of the most interesting talks they had heard at the Huronia Branch.

## Lakehead

G. E. Cook, M.E.I.C.,
*Secretary-Treasurer*

H. Penner, Jr.E.I.C.,
*Branch News Editor*

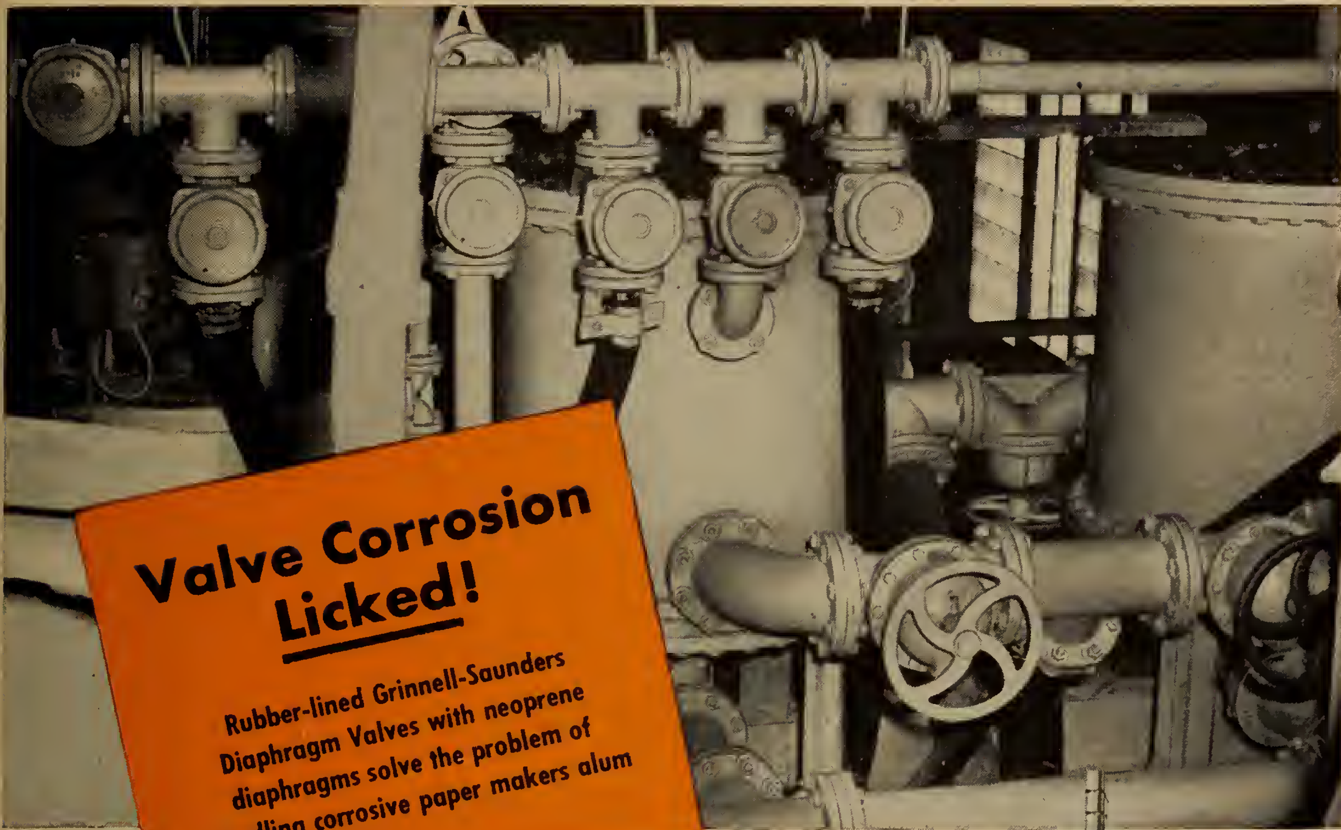
**Annual Dinner and Dance**

The annual dinner and dance of the Lakehead Branch was held on January 30 at the Royal Edward Hotel, Fort William. Since the tentative date for this affair coincided with the president's annual visit, it was decided to combine the two events in one evening. The evening as planned called for a dinner, a talk by the president, followed by a dance. The evening was very successful even though it was incomplete. Due to weather conditions, President Dobbin was marooned at Sault Ste. Marie after a visit to the branches there.

Cocktails were served at 5:30 and the dinner served at 7:00 featured roast veal on the menu.

G. S. Halter, chairman of the Lakehead Branch, called on J. M. Fleming, D. I. Nattress and J. Antonisen who were to have introduced and thanked the speaker in turn. These members outlined briefly Mr. Dobbin's previous associations and activities. Mr. Antonisen carried on a fifteen-year-old tradition in that he was again called on to move the vote of thanks to the visiting president. At close to 85 years of age Mr. Antonisen, who takes a keen interest in Institute affairs, is the oldest member of the Lakehead Branch.

After the dinner and abbreviated speeches were over, the guests danced until midnight. A crowd of about 150 were present.



## Valve Corrosion Licked!

**Rubber-lined Grinnell-Saunders Diaphragm Valves with neoprene diaphragms solve the problem of handling corrosive paper makers alum**

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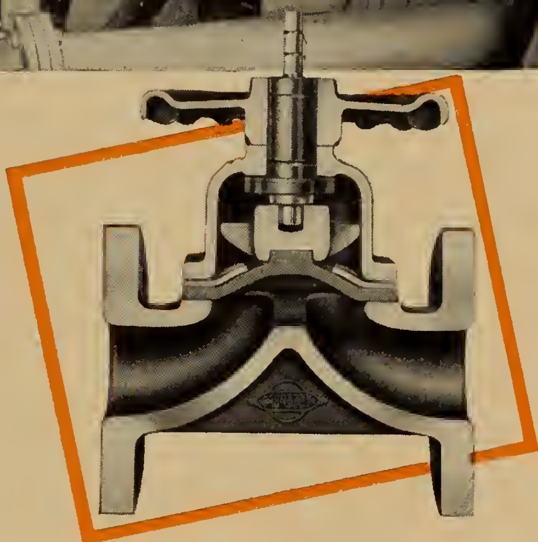
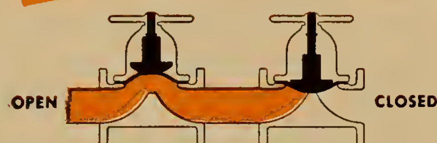


Commercial aluminum sulphate can be everlastingly troublesome, as anyone knows who has ever had to work with it. That's why in the manufacture of "paper makers alum" the preference is for Grinnell-Saunders Diaphragm Valves. In fact, the wide range of body, lining and diaphragm materials available with Grinnell-Saunders valves offers flexibility in handling a variety of corrosive fluids.

The basic design of the valve is an advantage. Working parts are completely isolated from the fluid stream which, in the case of corrosive acids, means longer valve life. Also, there is the matter of economy. With Grinnell-Saunders Diaphragm Valves, it is usually possible to go to less expensive body materials, to which special body linings can be added. Replacement and maintenance expenses, moreover, are greatly reduced.

Orginally designed and ideally suited for air and water service, Grinnell-Saunders Diaphragm Valves also are recommended for almost every regular or special service. This is backed up by the excellent performance records achieved by valves now in use.




***Features of Grinnell-Saunders Diaphragm Valve:***

- Diaphragm absolutely isolates working parts from fluid
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# The Field Secretary Visits the "Orphans"

**Col. F. L. Grant reports pictorially on his visits with engineer groups in centres where there is no E.I.C. Branch**

Moose Jaw, Sask. Standing, left to right: C. K. Buchback, R. L. Cockerell, R. Larson, J. E. Miller, Wm. Sproule, E. Dokken, H. B. Scott, Elmer Haack, S. B. Stewart, H. J. Tomlinson. Sitting: F. J. Vick, E. C. McNabb, Colonel Grant, K. C. Graham, F. R. Bouchard.

Blairmore, Alta. left to right: Rene Diamond, Syd Ward, Norman Lind, L. F. Grant, Andy Baxter, Herb Hewitt, R. L. Morrison.

Medicine Hat, Alta. Sitting, Left to right: H. O. Davis, R. Hurley, G. H. Sissons, A. N. Gunter, L. F. Grant, C. M. Moore, A. Dobson, Standing, T. Sissons, O. Wright, A. Webber, D. M. Hornby, K. J. Crawford, J. Cunliffe, J. M. Currie, A. W. Holroyd.

Lloydminster, Alta. Left to right: R. C. Legge, R. M. Coons, W. R. Staples, W. Graetzer, J. G. Wotherspoon, R. L. Green, L. F. Grant, H. C. Spaetgens, Allan Tubby, Thos. Steele, L. L. Samoil, G. E. Johnson, A. F. Johnson, W. C. Cracknell, W. H. Garland.

Yorkton, Sask. Left to right: I. B. Sveinbjornson, Ron. Matheson, H. M. Bailey, L. F. Grant, Ray Daniels, Kent Matheson, A. T. Sherrett.

Flin Flon, Man. Standing, left to right: K. McMillan, L. Giglielman, M. Kostiuck, R. S. Everall, G. H. Dash, R. T. Crawford, R. F. Pearson, A. H. Harder. Sitting: S. H. Kasperski, J. Sirys, Col. Grant, G. M. Feldman, H. Stevenson.

## Montreal

R. J. Harvey, M.E.I.C.,
*Secretary-Treasurer*

S. T. Rudkin, M.E.I.C.,
*Publicity Chairman*

#### General Semantics

On January 7, under the sponsorship of the Management Section, James T. McCay, vice-president of the consulting firm of Bois, McCay and Associates, gave a most interesting talk to a large audience on the subject "General Semantics and Executive Methods". He told how this new science can help executives acquire additional skills in analyzing situations, planning, communicating, and human relations, with particular emphasis on its application in creative thinking. The speaker made use of his audience to give practical demonstrations of some of his points. The meeting chairman was D. A. J. McDonald, and arrangements were by R. M. Lester.

#### Joint Meeting

"A Review of Protective Gear Practice in the United Kingdom" was the topic under discussion at a joint meeting of the Electrical Section and the A.I.E.E., held on January 11. The speaker, C. H. W. Lackey, is engineer-in-charge of research at A. Reyrolle & Company in England, manufacturers of electrical switchgear. He is the author of a number of papers on protective gear and of a book entitled "Fault Calculations". In his talk, the speaker gave a broad outline of British practice in providing protection for generators, transformers, busbars and transmission lines,. J. M. Crawford was meeting chairman, and J. R. Auld was in charge of arrangements.

#### Road Test

On January 14, the Transportation Section were sponsors of a meeting at which a film entitled "The Maryland Road Test 1-MD" was shown to an appreciative audience. In order to determine the relative effects of mobile loads of varying magnitudes on concrete highways, the United States Highway Research Board, in co-operation with a number of other organizations, conducted an actual operating test, lasting six months, on what was considered a typical section of concrete highway, in the State of Maryland. This operating test, in great detail, correlated with laboratory experiments on models, was documented on the above film of some ninety minutes duration, and is becoming of increasing interest to those in the engineering profession concerned with the construction of our great highway systems. E. Gohier, the meeting chairman, spoke briefly on Quebec's highways and loading regulations. J. D. Sylvester was in charge of meeting arrangements.

#### Strategic Metals

"Strategic Metals in the Canadian Defence Program" was the subject of a talk given on January 19 at the Royal Canadian Engineers Armoury by Dr. John Convey, Director of the Mines Branch of the Department of Mines and Technical Surveys. The meeting was jointly sponsored by the Chemical Section and the Military Engineers Association. The speaker stated that two world wars have shown that Canada must be prepared to solve her own mining and metallurgical problems, and an integrated and co-operative development program between private industry, government and the universities is accomplishing this. Among the strategic metals referred to were titanium, strong, light and high corrosion resistant; uranium, the key essential in the atomic energy process; columbium, essential in the production of stainless steel and steels used in high temperature parts of aircraft engines; cobalt, much used in radar equipment and high speed cutting steels; sulphur, scarce but approaching self-sufficiency thanks to extraction techniques developed. Major J. N. Davies was meeting chairman, and L. A. Phillips was in charge of meeting arrangements.

#### "Quality Acoustics in Radio Broadcasting"

On January 25, the Electrical Section, jointly with the A.I.E.E. and the I.R.E. sponsored a meeting at which Reginald E. Penton spoke on a "Popular Approach to Problems of Quality Acoustics in Radio Broadcasting". For the last seven years, the speaker has been with the C.B.C. working principally with the Transmission and Development Department of the Engineering Division, specializing in acoustics. He stated that today's growing noise problem is a forerunner of acoustic regulations in building codes and machinery construction specifications. Such regulations would have to be extremely explicit, in order to meet the recommended noise levels set by the Noise Abatement Society, which studies the problem of noise. The speaker pointed to soundproof broadcasting studios as evidence that the nuisance can be overcome, and the methods need not always be expensive. Allan B. Oxley was meeting chairman, and J. E. Hayes was in charge of meeting arrangements.

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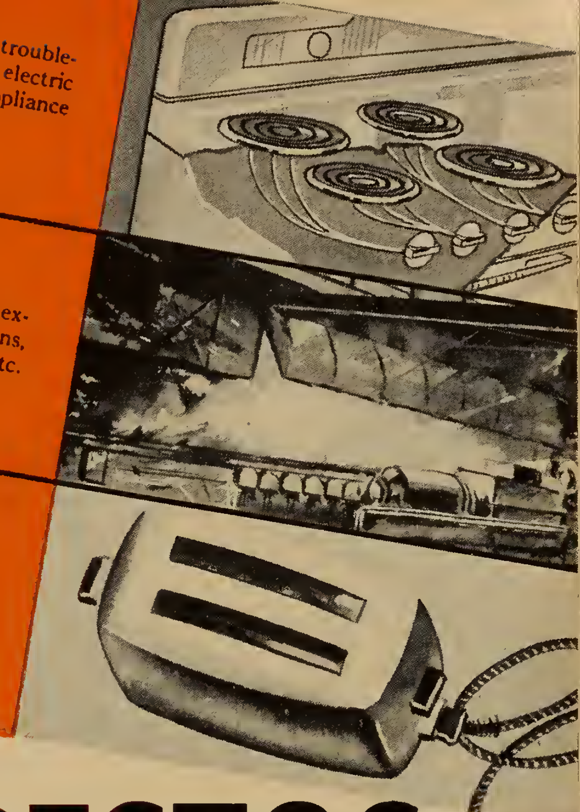

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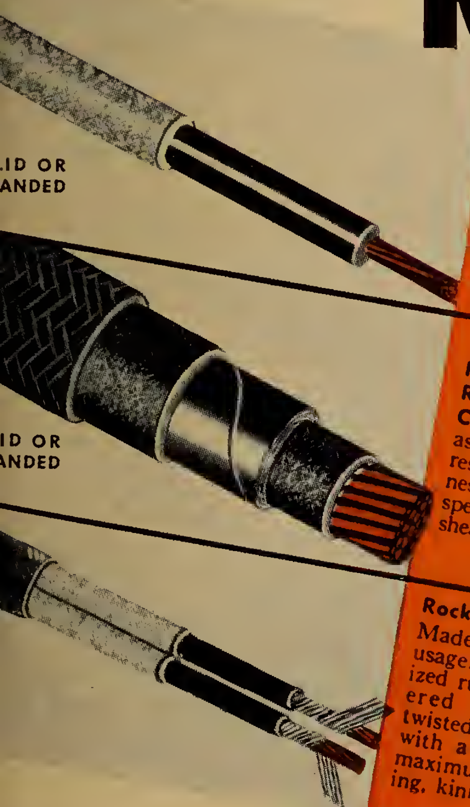


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***Foundation Behaviour***

On January 28, under the sponsorship of the Civil Section, Dr. G. G. Meyerhof, of the Foundation Company, addressed a meeting of some seventy engineers on the subject "Recent Studies of Foundation Behaviour". He outlined the practical results of research on the bearing capacities and settlements of various types of foundations, and clearly illustrated by examples of existing structures, that settlement could be reasonably predicted from field and laboratory test results. In presenting a new design approach linking wall materials and structural frame with the foundation behaviour, Dr. Meyerhof suggested that the relative stiffness of structure and soil foundation could be co-related when considering the expected behaviour of the foundation. R. F. Ogilvy was meeting chairman, and the speaker was thanked by J. Racey. W. Sefton was in charge of meeting arrangements.

***Professor Magnel Is Guest Speaker***

To an overflow crowd of over two hundred engineers and architects, at a joint meeting held on February 1 between the Civil Section and the P.Q.A.A., Professor G. Magnel spoke on "Recent Developments in Prestressed Concrete". A member of the Royal Belgium Academy, Professor of Reinforced Concrete at the University of Ghent, a Director of the Precompressed Concrete Engineering Company Limited, and author of many fundamental treatises on reinforced and prestressed concrete, the speaker is universally acknowledged as one of the outstanding authorities in that field. He suggested that the development of prestressed concrete design must be a logical step-by-step advancement of thorough research and ideas. In the last three or four years, design methods for continuous structures were being developed and tested, whereas previously only statically determinate structures were fabricated in prestressed concrete. Professor Magnel advised the use of a design based on ultimate load rather than the elastic theory, and suggested the use of an empirical formula based on experimental results. In their proper application, prestressed structures could compete economically with other types. The speaker emphatically stated that the time for writing codes or specifications for prestressed concrete had not yet arrived, as the ultimate system of design was yet to be found, and would probably be a combination of the ideas of many systems. The use of prestressing of materials, such as structural steel and stone, was shown on a number of slides. Canadian engineers and construction men were complimented on the high quality of their projects, among which was the biggest industrial prestressed roof ever built, at the Central Ordnance Depot at Cobourg, Ontario. Whereas winter construction is expensive and difficult, low temperatures actually increase the strength of prestressed structures. Dr. I. Brouillett was meeting chairman, and R. F. Shaw, P.E.Q. president, thanked the speaker. J. E. Hurtubise was responsible for meeting arrangements.

***President's Visit and Annual Meeting***

The Annual Meeting of the Montreal Branch and E.I.C. President R. L. Dobbin's official visit both took place on January 21. At noon and 4:30 p.m. respectively, the president visited student engineers at Ecole Polytechnique and McGill, and presented Jean Blouin and Stanley McGurk with the E.I.C. students' prizes for 1953. At 6:00 p.m., Mr. Dobbin was entertained at dinner at the St. Denis Club by members of the executive and committee chairman. At 8:15 p.m. the Branch Annual Meeting was held at Ecole Polytechnique, with a large gathering of members present. The business portion of the meeting consisted of the presentation of the annual report, the induction of new officers, presentation of Institute awards and an address by President Dobbin. In the course of this most interesting talk, Mr. Dobbin described his visit to the Coronation services as official E.I.C. representative and spoke most highly of British engineers as very active and up to date. He also told of a trip to Newfoundland, where he considered there were excellent opportunities for young engineers. Retiring Branch Chairman, G. N. Martin, thanked his committee for their excellent cooperation during the year. He stated that eleven branch members were presented with life memberships, and the gathering was asked to observe two minutes silence for sixteen branch members who had died during the year. Mr. Martin then turned over the chair to the new branch chairman, R. L. Dunsmore.

In recognition of services to the E.I.C. and the profession generally, President Dobbin conferred Honorary Membership certificates on F. R. Shearwood, former chief engineer of the Dominion Bridge Company, and Arthur Surveyor, promin-


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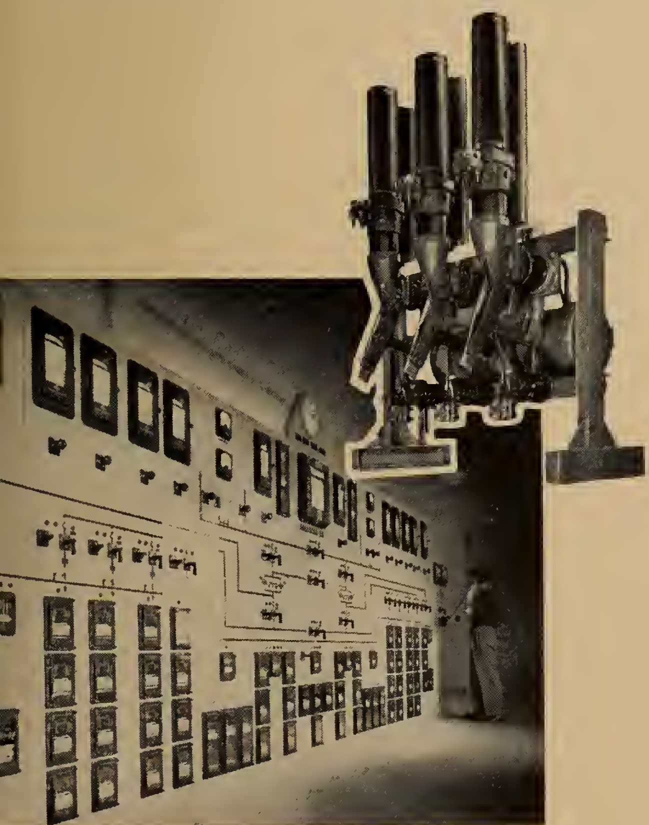

ent consulting engineer. The Ross Medal, awarded for the best paper of the year on an electrical engineering subject, was presented to John S. Kendrick, co-author with F. L. Lawton of a paper entitled "Nechako-Kemano-Kitimat Hydro-Electric Power Development and Aluminum Reduction Plant." Mr. Lawton had received his medal at the Halifax Annual Meeting. The Julian C. Smith medal, awarded for achievement in the development of Canada, was presented by Mr. Dobbin to John E. Armstrong, former chief engineer of the C.P.R. At the conclusion of the meeting, those present were taken on a conducted tour of the Ecole Polytechnique laboratories, after which refreshments were served, and enjoyed by all.

The following are the members of the 1954 Executive Committee:

Chairman, R. L. Dunsmore; Past chairman, G. N. Martin; Vice-Chairman, C. E. Frost; Secretary-Treasurer, R. J. Harvey; Committeemen: W. H. Gauvin, C. G. Kingsmill, H. A. Mullins, Jules Archambault, R. Brais, P. W. Gooch.

Committee Chairmen are: Program, R. A. Phillips; Membership, S. W. Pappius; Policy and Coordination, C. E. Frost; Publicity, S. T. Rudkin; Student Guidance, W. H. Moore; Admissions, W. H. Gauvin; Reception and attendance, E. D. Gray-Donald; Entertainment, L. Scharry; Chairman, Junior Section, L. T. Hammerschmid.

## Peterborough

D. G. C. Donaldson, M.E.I.C.,
*Secretary-Treasurer*
G. L. Davis, M.E.I.C.,
*Publicity Chairman*

***Annual Meeting***

The annual meeting of the Peterborough Branch of the Engineering Institute of Canada was held in Peterborough on January 11 at the Kawartha Golf and Country Club. The retiring chairman, Garth Wade, presided.

The meeting was honoured with the presence of Institute President Ross Dobbin. Approximately 30 members of the Branch were in attendance.

Reports of the committee chairmen during the past year were heard and the secretary's report was read. The scrutineer's report was also presented. The following members were elected to the executive for the coming year:

J. P. Watts, Chairman; J. G. Lucas, Meetings and Papers; L. H. Higgins, Membership; D. T. Bath, Property Committee; R. A. Blount, Secretary-Treasurer; G. T. Davis, Publicity; C. W. Holman, Historian; E. R. Shirley, Auditor; A. Bonney; D. G. Donaldson, Past-Secretary; G. Wade, Past-Chairman.

After the report of the scrutineer had been presented the gavel was formally turned over to Mr. Watts by Mr. Wade.

The speaker of the evening was Charles Weir of the Lindsay Division of the Ontario Department of Lands and Forests. Mr. Weir is a biologist with the department and is presently working in connection with the fish and wild life functions of this department. He presented a very interesting and informative talk on the types and geographical locations of game fish within his district. He described the work that is being done by the department towards restocking of lakes and streams and answered many questions raised by the anglers in the audience, including those of President Dobbin.

Following this, two films were shown. The first of these was a description of a fishing trip to Lake Shoshone in Wyoming and the second described a fishing expedition to South America. Following this a light lunch was served.

## Ottawa

G. A. Sutherland, M.E.I.C.,
*Secretary-Treasurer*
C. E. Howard, M.E.I.C.,
*Branch News Editor*

***Annual Meeting***

The 44th Annual Meeting of the Ottawa Branch was held on January 21, 1954, at the National Research Council Auditorium. The immediate past Chairman Dr. J. J. Green remarked on the excellent co-operation he had received

The passenger is seldom aware of door movement

from the two councillors from the Ottawa Branch, G. Ballard and T. Foulkes.

The financial report showed an operating surplus for the year of $465.42 and a bank balance as of December 31, 1953, of $1,244.59.

With regard to the Colonel By Memorial in Ottawa, negotiations have been carried out with the City of Ottawa, the Federal Government and E.I.C. Headquarters. The recommendation suggests that the memorial take the form of an ornamental fountain on a section of lawn near the National War Memorial.

Presentation of prizes to engineering students at Carleton College and University of Ottawa for $25.00 and to Ottawa Technical School and Hull Technical School for $10.00, was approved.

#### A Plan for Unity

The following motion of more than passing interest was moved by C. G. McRostie, seconded by D. E. Kennedy and passed. "Resolve that this annual meeting of the Ottawa Branch of the E.I.C. held on 21st January, 1954,

1) Express its approval of the principle that unification of the engineering profession in Canada along the lines laid down by J. H. Smith in a "Plan for Unity" is essential for the proper organization of the profession.

2) Authorize the Branch Management Committee to follow up actively through

**The Ottawa Branch management committee. Dr. J. J. Green, retiring chairman, right foreground, is shown handing over responsibilities to R. E. Hayes, the new chairman. Second row, left to right: J. K. Gordon, Hector Chaput, E. Pennock. Third row, W. E. Wakefield, T. Foulkes, G. A. Sutherland and C. E. Howard. Absent, R. F. Leggett, C. Crawford.** *Photo by Newton Associates.*

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the Branch's representative on the council of the Institute the question of unification and re-organization.

The newly elected Management Committee is as follows:

Chairman, R. E. Hayes, M.E.I.C.; Vice-Chairman, R. F. Leggett, M.E.I.C.; Secretary, G. A. Sutherland, M.E.I.C.; Treasurer, H. Chaput, M.E.I.C.; Committee: C. E. Howard, M.E.I.C., D. B. Rees, M.E.I.C., C. B. Crawford, M.E.I.C.

The meeting closed with a film "Man with a Thousand Hands", depicting operations at Kitimat, B.C.

## Sudbury

George Fleming, M.E.I.C.,
*Secretary-Treasurer*

T. C. Robertson, M.E.I.C.,
*Branch News Editor*

On January 28, 1954 the Sudbury Branch of the Institute played host to R. L. Dobbin, president of The Engineering Institute of Canada. Mr. Dobbin was accompanied on his visit by J. Ogilvy, assistant field secretary. During the afternoon W. J. Ripley, chairman of the Sudbury Branch, conducted the visitors on a short tour of some of the International Nickel Company developments. After a dinner at the Granite Club for members and visitors with their ladies, Jim Smith announced that our next meeting would be March 11 and would be members' night. He had three local and very interesting speakers lined up. The business of the evening was transacted quickly in order to have as much time as possible for the more interesting events to follow.

The speaker of the evening, Mr. Dobbin, was introduced to the gathering by Percy McAdam, who outlined Mr. Dobbin's attainments and attestations to his public popularity.

In his address Mr. Dobbin showed his versatility by digressing for a time from engineering topics to describe his trip to England to witness the coronation of Queen Elizabeth. This was a most pleasing surprise for the ladies who had visions of a purely technical discourse His personalized views on the Coronation were most interesting to both engineer and his lady. Mr. Dobbin made many new friends as well as renewing many old friendships. He was high in his praise of the hospitality of the English people and felt that they particularly liked Canadians. He described them as intensely loyal, full of respect, friendly and public spirited. In spite of himself, however, Mr. Dobbin made many references to engineering and was particularly amazed at the ingenuity of the engineers in concealing 5 cameras, including television, and 500 microphones in the sanctuary of the Abbey. He could not find any of them and was forced to ask an attendant where they were.

Before thanking the speaker, Bob Moore gave a very brief résumé of the founding of the Sudbury Branch in 1949 and the growth it has experienced since that time.

Mr. Ogilvy then spoke briefly of the Institute. The present 48 branches from Newfoundland on the east to Whitehorse in the north represented an increase in membership of 50% in the past 10 years. The library now furnished the most up-to-date information available and the employment service was functioning to the advantage of everyone. He had high hopes of further advances in the professional development field.

W. Miller presented Mr. Dobbin with a copper dish poured in the Copper Refining Division of the International Nickel Company as a memento of his visit to this mining city.

A spirited display of fencing was introduced by J. Grey of the local Y.M.C.A. The use of the epi, foil and sabre was outlined and the teams in action were very entertaining. Following this the orchestra took over and dancing was the order of the evening.

## Toronto

L. F. Bresolin, Jr.E.I.C.,
*Secretary-Treasurer*

H. Fealdman, Jr.E.I.C.,
*Branch News Editor*

**"A Plan of Unity"**

The annual meeting of the Toronto Branch of The Engineering Institute of Canada was held in the Northgate Hotel on Wednesday, January 13, 1954.

A very large turnout welcomed as guest speaker J. Herbert Smith, immediate past-president of The Association of Professional Engineers of Ontario. Mr. Smith's subject was "A Plan for Unity" which detailed a merger between The Engineering Institute of Canada and The Association of Professional Engineers of Ontario.

Mr. Smith closed his address by suggesting that a joint committee of the Dominion Council and The Engineering Institute of Canada meet to form a constitution.

Following Mr. Smith's address the meeting passed a resolution recommending that the Council of The Engineering Institute of Canada appoint a committee of the Institute as a whole, to meet a committee of the Dominion Council to discuss Mr. Smith's proposal provided that the Dominion Council will also appoint such a committee.

The following elections of the 1954 executive were announced: Chairman: M. McMurray, M.E.I.C.; Vice-Chairman: M. W. Huggins, M.E.I.C., Secretary-Treasurer: L. F. Bresolin, Jr.E.I.C.; Assistant Secretary-Treasurer: B. K. Willard, Jr.E.I.C.; Committee Men Corporate: R. H. Self, M.E.I.C., C. E. Potter, M.E.I.C., J. W. Ross, M.E.I.C., R. S. Bleackley, M.E.I.C., E. R. Davis, M.E.I.C., R. S. Segsworth, M.E.I.C.; Committee Men Junior: D. R. Burns, Jr.E.I.C., R. C. Norgrove, Jr.E.I.C., H. Fealdman, Jr.E.I.C., R. T. Worden, Jr.E.I.C.

**Joint Meeting with the R.C.I.**

On Saturday, January 30, the Branch met with the Royal Canadian Institute to hear a paper by Robert Shama, MASCE, MFFCE, MIBSE, Director Gerente, Empresas Canpenon, Bernard do Venezuela, South America, on "The World's Largest Pre-stressed Concrete Spans". The meeting, which came as a fitting climax to the Canadian Conference on Prestressed Concrete held in Toronto on the previous two days discussed the cost of three concrete arch bridges on the Caracas to LeGuaira super highway which were a magnificent and daring departure in conception and design. The meeting which was exceptionally well attended augurs well for such future joint meetings.

On February 4, F. R. Whatmough, chief engineer, Canadian Standards Approval Laboratories, addressed the Toronto Branch on "The Canadian Standards Approval Laboratories". The meeting which produced a good attendance concluded with some lively discussion.

## Winnipeg

C. S. Landon, M.E.I.C.,
*Secretary-Treasurer*

W. Victor Morris, M.E.I.C.,
*Branch News Editor*

**Professional Development Discussed**

On January 12, an informal general meeting of the Winnipeg Branch was held to discuss the possibility of instituting a course in professional development for engineers in the Winnipeg area, such a course to embrace subjects which the engineer might find useful in his profession, but which are not normally taught in university engineering courses. Those members who attended were enthusiastically favourable to the idea of such a course, though there was some minor disagreement as to exactly what subjects would be most desirable. After discussion of courses of this nature which are already in operation in Toronto and Hamilton, as well as in other centres, a committee was appointed to see to the organizing of such a course.

It was decided that the problems of organization would be such that no attempt should be made to begin the course this spring, but that two or three "sample" lectures might be arranged before June of this year, open to all members who might be interested, and that the actual course would be planned to commence in the fall of 1954.

It was also tentatively decided that each course should be limited to about 30 members, the exact details of the course to be arranged by these members; and, if more than 30 persons were desirous of taking such a course this fall, two or more classes should be formed, so that each class would be maintained to a size capable of operating reasonably as a discussion group.

The members appointed to the organizational committee were E. M. Scott. F. S. Heeley, W. J. Patton, T. E. Weber, J. S. Merrett, G. T. Haig, R. A. Jeske, and D. G. Curiston.

**Annual Meeting**

The annual meeting of the Winnipeg Branch was held on January 28. Presiding over the meeting was G. B. Williams, the new chairman of the Branch. The business of the meeting, which included the secretary-treasurer's report and the announcement of the names of the members of the Branch Management Committee by the secretary-treasurer, C. S. Landon, was quickly concluded.

**Coal-Burning Gas Turbine**

Following the business meeting, the members were privileged to hear a paper presented by Professor R. E. Chant of the University of Manitoba Mechanical Engineering Department. Professor Chant's talk was an outline of the experimental work which has been done on the coal-burning gas turbine for locomotive application. In particular it was a discussion of the research which has been carried out in the Gas Dynamics Laboratory of McGill University, on which research Prof. Chant was engaged from 1950 to 1953.

Giving a brief historical background of the reasons for attempting to develop such a power plant, the speaker indicated that similar research was being carried on in Great Britain, France,

the United States, Australia and India as well as in Canada and emphasized the point that there was extreme co-operation between all agencies involved in the way of exchange of information and also in a more tangible way such as the loaning of equipment. The main reason why the intensive research is being carried on in so many countries is that at the present rate of use the world's supply of oil is likely to be exhausted in 12 years, whereas there is a 100-years' supply of coal in present sight. The tendency to use oil is increasing whereas the use of coal is constantly decreasing, and this trend indicates that in a few years coal will be used only in a few power plants close to coal fields.

As this trend is not an entirely healthy one, the Canadian Government was anxious to co-operate in the development of a coal-burning gas turbine, which would make more efficient use of coal as a fuel, and when in 1950 Professor Mordell of McGill University put forward a planned research program in this field, a contract was negotiated between McGill University and the Department of Mines and Technical Surveys of the Canadian Government.

Professor Chant then went on to review the various gas turbine cycles which can be adapted to burn coal, pointing out the advantages and disadvantages of each cycle, in order to make clear the reasons why Canada's development program was concentrated on the particular cycle known as the exhaust-heated cycle. Other cycles have been and are being investigated by other countries. The open cycle, in which the pulverized coal is fired before the turbine, is being investigated by the Bituminous Coal Research Inc. of the United States and the English Electric Company of Britain. The closed cycle, in which compressed air is heated by an external source, and after passing through the turbine is cooled by a cooler and recirculated, was investigated by the North Scotland Hydro-Electric Board, and a 500 horsepower experimental unit was placed in service a year ago to burn peat. This cycle has the advantage that no separator is needed, as the heat source is external, rather than being a part of the cycle.

In the exhaust-heated cycle, the coal is burned in a combustion chamber placed after the turbine, so that it shares the advantage of the closed cycle in that no separation is needed. Two heat exchangers transfer the heat of combustion to the air entering the turbine. This cycle, while having the advantage of the closed cycle in requiring no separation, does not require the large amounts of cooling water needed in the closed cycle type, and therefore is considered to be more suitable for locomotive use. Another advantage of the exhaust-heated cycle is that the combustion chamber is not under pressure, and therefore the coal may be blown into the chamber instead of having to be pumped.

Professor Chant, having pointed out the general advantages of the exhaust-heated cycle, went on to describe, with slides, some of the details of the actual research project as it was carried out in McGill University's Gas Dynamics Laboratory. The engine used was an early experimental Rolls-Royce turboprop engine, the Dart, which had developed 1,000 horsepower as an aero-engine, but under the lower temperatures and lower speeds used in the locomotive experiments, the horsepower was reduced to 550. The design achieved a thermal efficiency of 16 per cent, with a compressor and turbine efficiency of 75 per cent.

Going on to describe the heat exchangers and the testing of the furnace, Professor Chant estimated that certain changes in design of the furnace, which was a Babcock-Wilcox Cyclone slagging furnace, would make 80 to 85 per cent of the heat put in by the coal available at the heat-exchanger unit. The coal was conditioned for this furnace by a hammer-mill pulverizer fitted with a ⅛-inch mesh screen.

In conclusion, the speaker mentioned several related problems which had been only cursorily considered—for instance, some improvements which could be made in the design by a more liberal use of cooling water, which in the present design had been kept to a minimum. Also the question of drive was unsolved—especially whether a direct drive or an electrical transmission would be most suitable. Direct drive, in conjunction with the speeds of the order of 10,000 rpm. attained by the turbine, would require aircraft-quality gears.

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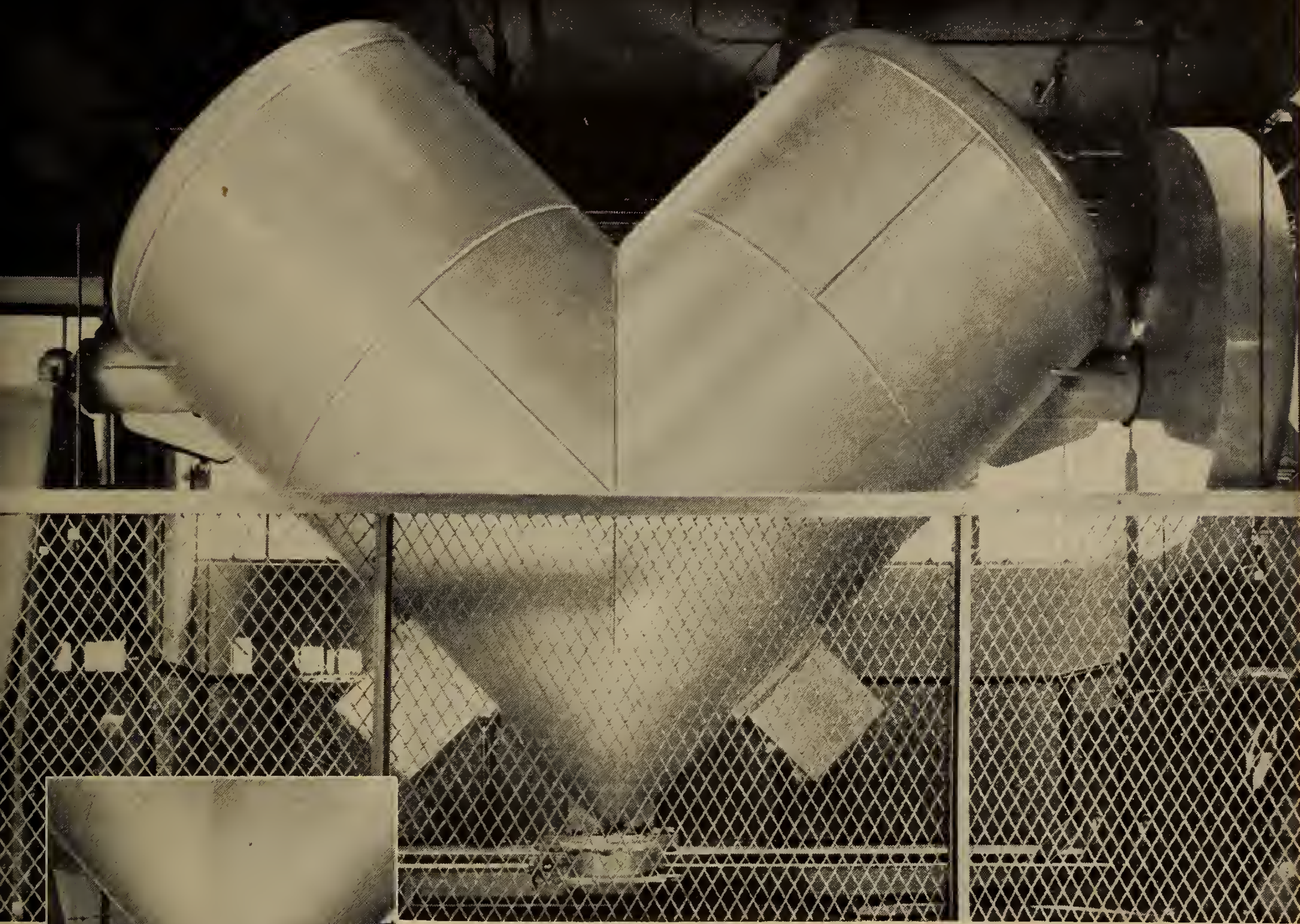
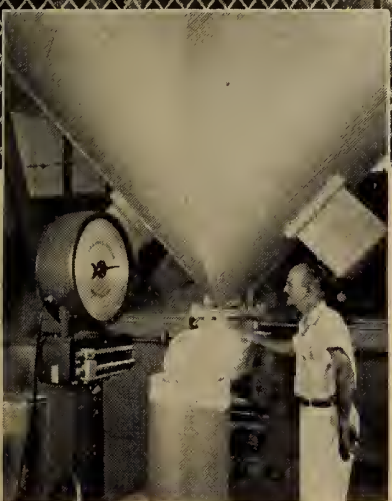
## blends a 3-ton dose of vitamins



150 cubic ft. p-k blender of stainless steel-clad construction is charged through opening in floor above.



Shown is ease of discharge of p-k blender.

Hoffmann-LaRoche, Inc., Nutley, N. J., leading pharmaceutical manufacturers, find blending a three-ton dose of vitamins in one batch an easy matter with a p-k twin shell dry blender.

And, at the same time, the patented p-k blender provides perfect dispersion of the ingredients, as uniformly as a druggist compounds a single prescription.

The 150 cubic foot p-k blender shown here is at work every day in the modern Hoffmann-LaRoche plant at Nutley, N. J. Five different particle sizes are perfectly blended in 6600-lb. batches in this p-k blender. Clinical cleaning is easy, because of the wide openings of the p-k blender.

If your blending needs a shot in the arm, write today for complete information on sizes and capacities.

**sarco**

*Canadian distributors for the Patterson-Kelley Co., inc.*

**SARCO CANADA LIMITED, 611 GERRARD STREET, E., TORONTO 8, ONT.**

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1893

Professor Chant estimated that the first coal-burning turbine locomotive to go on the rails would be the American experimental model, a direct-fired unit. Several coal-burning turbines are already in operation, the most successful being the closed cycle of John Brown Company Limited, which went into operation in November of 1952. No indication was given as to when a Canadian coal-burning gas turbine locomotive would be completed, but the prediction was made that a small unit would probably become part of a power station in the very near future.

A question period followed the speaker's talk, and the interest shown in the subject was evidenced by the spirited discussion which ensued. Professor Chant was thanked on behalf of the members by Professor N. M. Hall, chairman of the Mechanical Engineering Department of the University of Manitoba.

## Electrical Section

G. Flavell, jr.e.i.c.,
*News Editor*

**Regulators**

On Dec. 17, 1953, approximately 50 members of the Electrical Section were fortunate in hearing a paper by R. A. Harvie, manager of the Industry Application Division for Canadian Westinghouse Company at Hamilton, Ontario.

Mr. Harvie's topic was "Regulators—Superhuman in Thought and Motivation". He explained superhuman in thought, they sense or anticipate undesirable changes that are about to take place, and more quickly than humanly possible they decide what corrective action must be taken. Superhuman in motivation, they bring into play the necessary corrective forces with a faster and more unerring skill than any human operator could. Superhuman in their ability to stay on the job, alert and ready every second of the twenty-four hour day, they have become a keystone of this automatic machine age.

He discussed the fundamentals of regulators and with the aid of slides he described the examples of regulators from the simplest type to the newest magnetic amplifier. The remainder of his paper was devoted to the magnetic amplifier, its advantages and many and varied applications.

Mr. Harvie pointed out that the principle of the magnetic amplifier is not new, but recent improvements in grain oriented nickel iron core materials and in the characteristics of rectifiers have allowed manufacturers to apply them in many new ways.

After outlining the fundamental circuits, Mr. Harvie showed results of the use of a magnetic amplifier on a waterwheel generator at the Otto Holden Station of the Hydro-Electric Power Commission of Ontario. Curves taken from this experimental project showed that for a sudden reduction in voltage of 13.5%, the generator voltage would turn to within one per cent of its final value in 1.9 seconds.

Mr. Harvie provided a detailed description of typical uses for magnetic amplifiers as a steel mill regulator and a paper machine regulator.

The group was given the opportunity to view samples of magnetic amplifiers that Mr. Harvie had brought with him —one being as small as a ring on a man's finger.

Thanks was expressed on behalf of the group by E. Scott. Chairman, C. D. Osterland adjourned the meeting for the usual refreshments.

**Annual Meeting**

On January 7, the Eighth Annual Meeting of the Electrical Section was held before 120 members and guests, and the following were elected to office for 1954:

Chairman: Professor N. A. Williams; Past Chairman: C. D. Osterland; Vice-Chairman: R. T. Harland; Executive Member for one year: S. Barkwell; Executive Member for two years: P. Shane.

The meeting was held in the new C.B.C. building and the speaker for the evening was R. D. Cahoon, Prairie Regional Manager for the C.B.C. He described the new building, pointing out the facilities available for the transmission of radio and television for Manitoba listeners.

Since interest in television in Manitoba is becoming increasingly great, Mr. Cahoon dwelled mainly on this aspect of his work. Television is expected to be available in Winnipeg by May. The new station will have one camera chain to televise local plays and skits and one mobile unit for sports events and other activities around the city, but most of the programs will be Kinerecordings from the C.B.C. network shows in Eastern Canada. It is expected that there will be direct hookups with the Eastern networks by 1956.

The T.V. transmitter will operate at 7000 megacycles with an output of 10 kw. for the pictures and 5 kw. FM for sound, but due to the design of the 240 foot antenna located on the roof, the effective power output will be 53 kw. and it's expected that the station will cover most of the populated areas of Manitoba.

Mr. Cahoon warned the audience of such occupational diseases as television stoop, television squat and peculiar to children, "television jaw" which is caused by youngsters lying on their stomachs in front of their sets with their heads propped up by their hands.

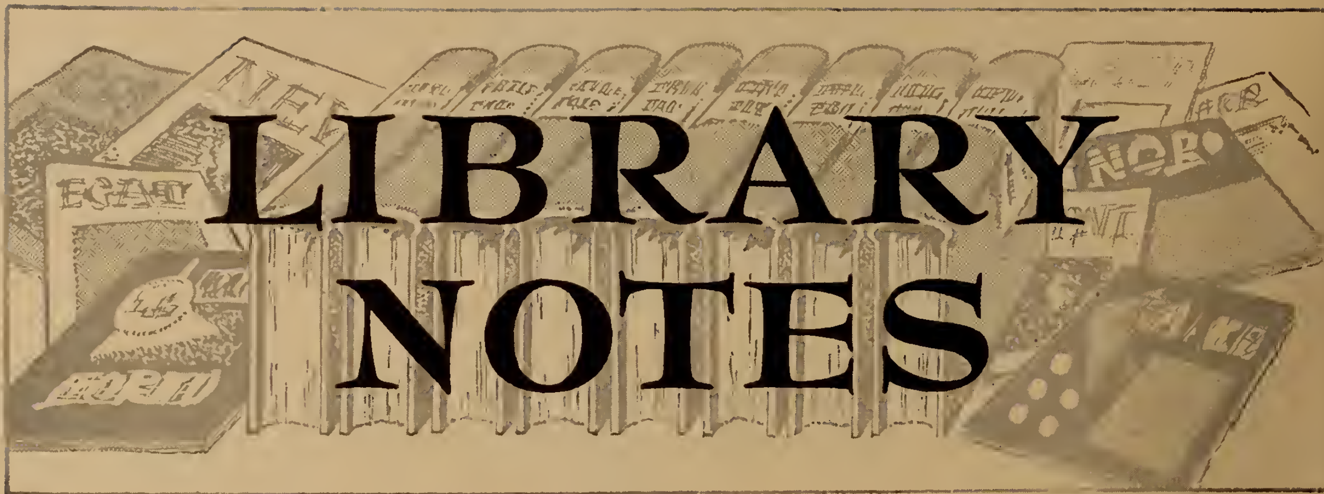
The group enjoyed a tour through the building, visiting the transmitter control room, the 7 soundproof studios, and the various recording rooms, film processing and editing rooms and offices.

Refreshments provided by C.B.C. concluded a very interesting and enjoyable evening.



## E.I.C. Annual Meeting, 1954

**May 12, 13, 14, Chateau Frontenac, Quebec**




## Additions to the Institute Library

### Reviews — Book Notes — Abstracts

## BOOK REVIEW

**Handbook of personnel management,** rev. ed. G. D. Halsey. New York, Harper, 1953. 468pp., $6.00 (U.S.).

"A major objective of personnel management is to increase the individual effectiveness of each worker . . . The difference is in how each endeavors to accomplish this objective."

The idea of continually keeping open the channel of communication between management and worker, and worker and management is now considered a major factor in personnel work, and developments in techniques of employee rating are constantly receiving consideration and attention.

Since the last edition of this handbook in nineteen hundred and forty-seven, the forementioned subjects have been revised, the chapter on pre-employment tests has been entirely re-written and a completely new chapter on Organization for personnel management has been added.

Stress is placed primarily on the problems of executives responsible for staffs of about three thousand total, and each chapter includes a selected bibliography for more detailed reading.

The author intends the book to be of use as a text for university students, and has arranged it accordingly. Basic principles and methods are discussed from a practical aspect, and the advantages or disadvantages of each are considered, with direct applications.

And the author himself states the suggestions on practices and procedures to be the result of pooled resources of many individuals and companies.

Job analysis and job description forms are reproduced, and also tables for rating of vocationally significant qualities.

Employment procedure and forms include reproductions for applications for employment, background survey, and references.

The logical and practical presentation of all possibly pertinent information follows through the volume in normal sequences. After the acquisition of staff is thoroughly covered, topics such as job evaluation, wage incentive plans, employment stabilization, employment and supervision of women, and consideration of old or physically handicapped personnel are all dealt with.

Accident prevention, employee welfare and insurance and retirement schemes are next considered, followed by collective bargaining, unionized or non-unionized plants, and records and statistics.

Bold type section and paragraph headings make use of the book easy and pleasant.

Perhaps the pièce de resistance of the book, however, is the last chapter entitled "Outline for a self-audit of personnel management", which appears to be a complete resumé of the information in the book in the form of unanswered questions, including suggested supplementary reading.

An appendix following this lists "Sources of information and help in personnel management", and a detailed index adds further to its usefulness.

The author is a graduate of the University of Cincinnati, and has been General Superintendent of Bloomingdale Brothers in New York, Store Manager of Gimbel Brothers in Milwaukee, Personnel Director of Woodward and Lothrop in Washington, and presently Personnel Director of the Farm Credit Administration in Columbia, South Carolina.

E.K.

## BOOK NOTES

**Prepared by the Library**
**The Engineering Institute of Canada**

**Automatic control of heating and air conditioning.** J. E. Haines. Toronto, McGraw-Hill, 1953. 370pp., figs., $8.10.

"To understand the operation of an automatic control system, it is necessary to understand the purpose and operating principle of every control unit used in the system."

Working on this hypothesis, and also recognizing the fact that many control units must be individually designed for

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Short subject bibliographies are compiled on request. When placing these requests, please give as much detail and background information as possible.

### Borrowing

Books, periodicals, pamphlets and films may be borrowed for two weeks at a time. All books included in the Library Notes Section of *The Engineering Journal* are available for loan. **A fine of 25c per day is charged for each day borrowed items are retained beyond the two-week period.**

A library deposit of $5.00 at par in Montreal is required, for which two items may be borrowed at a time. Temporary deposits (30 days or less) $10.00. Books are sent anywhere in Canada, and carrying charges are payable by the member concerned.

### Ordering

Any book or pamphlet may be ordered through the library. All publications of affiliated societies, whether books, pamphlets, or periodicals, should be ordered through the library, as reduced rates are applicable on these to all members. Except in the case of library deposits **please make no payments in advance.** Non-members may consult the library, but may not borrow material. Please address all requests to **The Library.**

many different situations, the author has tried to collect and deal with these varying details of construction within this volume.

Both domestic and commercial heating and automatic control are covered, including unit heaters, unit ventilators and radiant-panel heating systems; the explanation and illustration of basic problems in the above fields is the main purpose of the book, and actual control devices are not identified as to manufacturer.

Presented as an elementary textbook, rather than a technical treatise, the whole volume has been kept as simple and non-mathematical as possible, and is well indexed.

***Behavior of metals at low temperatures.** R. M. Brick, J. R. Low, Jr., and C. H. Lorig. New York American Society for Metals, 1953. 112 pp., $3.00.

Three lectures are reprinted in this volume: behavior of single crystals and of pure metals, dealing primarily with mechanical properties and basic related phenomena; the influence of mechanical variables, considering the effect of stress-state, rate of loading, etc., on strength and ductility; influence of metallurgical factors, mainly concerned with ductility and brittle fracture susceptibility.

**Communication theory.** Willis Jackson ed. Toronto, Butterworth, 1953. 544 pp., illus., $11.00.

Numerous techniques and ideas of communication theory have been produced, nurtured and cultured during the past one hundred years.

However, the newest developments, which we owe principally to Norbert Wiener and his followers, take account of the prior information which we possess, of the signals to be transmitted. In consideration of this background, the mathematicians now consider modern communications theory to be the application of probability theory to communication problems.

Studies of speech and hearing mechanisms, speech compression, television channels, recognition of speech under noisy conditions, all these vital and present day problems are included in this moderately simple heading.

The papers included in this symposium were presented and discussed in nineteen hundred and fifty, and are now available in book form.

Well known specialists in their respective fields, the writers come from Africa, Denmark, France, Germany, Great Britain, Holland, and the United States.

Eight pages of "Concluding discussion" sum up the thirty-eight papers presented.

As one examines this volume in detail, one realizes how almost limitless the field of appeal will be to a large number of our members.

**Cooling towers: with special reference to mechanical-draught systems.** Toronto, Butterworth, 1953. 104 pp., illus., $3.50.

Published in association with Imperial Chemical Industries, this handbook is the result of practical experience in the plants of that company.

In concise and ordered handbook form, it explains how cooling towers can be designed, tested, and the test data interpreted. It also includes design information on a grid-packed induced-draught tower, which uses a serrated wooden grid packing.

It is only fairly recently that the importance of the absorption methods and techniques has been realized in the design of water cooling towers, and the results of this application to the tower designs are described.

**Defense and the dollar: federal credit and monetary policies.** A. G. Hart. New York, Twentieth Century Fund, 1953. 203 pp., $2.00 (U.S.).

Having heard President Eisenhower, two days prior to this writing, state that the United States is now in a transition stage from war to peace, it seems confusing to see the executive director of the Twentieth Century Fund state that the United States is "in a period of major defense rearmament".

However, points of view be what they may, this little volume will be of both interest and value in the field of business, finance, and government, and even to the private individual.

It is simply a sensible discussion of economic stability and the value and use of money, credit controls, use of reserves, private saving and public debt, compulsory lending or saving, and long term strategy.

The text concludes with a recommendatory report from the committee and is indexed.

Although the outlook is American, the principles still apply in other countries.

**Employment and wages in the United States.** W. S. Woytinsky and others. New York, Twentieth Century Fund, 1953. 777 pp., tables, $7.50 (U.S.).

Recognizing the desire of industry for a "comprehensive factual survey, within the covers of a single volume, of the working people of the United States and their conditions of labour" this volume is an attempt to meet this pressing need.

Size and distribution of labour, occupations represented and persons employed in each; seasonal employment, wages paid and method of determining these, government controls and their effect; security schemes, and hours and conditions of labour are all covered.

The general editor and author, Mr. Woytinsky, had two major assistant directors. T. C. Fichandler prepared the chapters on labour unions and unemployment, and M. C. Bishop the preliminary study and report on labor and management opinions. Of the seventeen co-editors, each was picked from experts in the several fields, and carefully chosen for varying backgrounds of opinions, that a balanced whole might be presented in the completed volume. The Twentieth Century Fund also hopes that the facts presented may be of practical value in both private industry, and government, and to all people involved in labour management relations.

Following the committee findings are twenty-five pages of conclusions and recommendations.

Appendix notes refer back to chapters, and nearly two hundred pages of statistical tables cover wages, institutional setting, employment and unemployment, and wages and earnings. Also the book is well indexed.

**FBI register of British manufacturers —1954,** 26th ed. Federation of British Industries. London, Kelly's Directories & Iliffe, 1953. 952 pp., $8.00.

The FBI Register of British manufacturers needs no introduction to those of our members interested in British products. It is a standard export reference book to British industry, and is the only authorized directory of the FBI.

First published in 1920, this 26th edition of the Register lists some 6,600 firms and their products, which are grouped under more than 5,000 headings, and cover the whole field of British industry.

The book is divided into seven sections. The first is a classified buyers' guide of products and services, giving under each an alphabetical list of firms supplying them. A later section lists the addresses of these firms.

Section 4 provides a list of British trade associations, and other sections list brand and trade names, and trade marks.

The introductory information and the instructions on the use of the Register are translated into French and Spanish. This new edition of the Register will be a useful edition to the library reference shelf, providing as it does up-to-date information on British manufacturers and their products.

**How to troubleshoot a TV receiver.** J. R. Johnson. New York, Rider, 1953. 128 pp., illus., $1.80 (U.S.).

This handy little volume is subtitled "The physical and mental approach", and concentrates on the actual business of finding the cause and location of the trouble, rather than going into details about servicing receivers.

The book starts with a general chapter on how to get the most out of available service data, including the schematic diagram. The author then discusses the various sections of the receiver which may cause trouble, and the tools, etc. which are needed for servicing. The remaining chapters are devoted to the actual location of the trouble, and include the preliminary steps to take, and the order in which to take them, as in the opinion of the author it often takes three times as long to locate the trouble as it does to remedy it. There is a chapter on the use of test patterns and cross-hatch patterns in locating trouble, and also chapters dealing with controls, tubes, dead receivers, picture distortion and sound troubles.

There are many diagrams and illustrations in the book, which should prove useful to both TV technicians, and those of our members who may be attempting to locate their TV troubles for themselves.

***Information theory.** S. Goldman. New York, Prentice-Hall, 1953. 385 pp., figs., $9.00 (U.S.).

A comprehensive treatment for the first-year graduate student in electrical engineering, based on the pioneering and classical work of Shannon and Wiener with modifications so that the information aspects of individual messages can be treated more readily. Major topics are the transformation of both information and constraints from the time to the frequency domain, sampling theorems, and the information theory aspects of random noise.

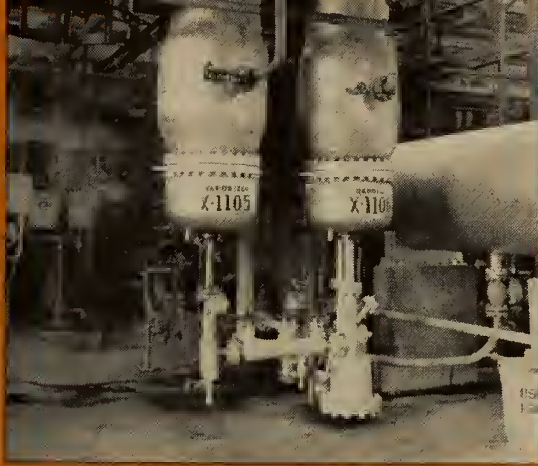
**The international year book and statesmen's who's who, 1953.** London, Burke's Peerage, 1953. 447 pp., £8. 8s. 0d.

There is something indefinable about this volume, which makes it both pleasing and easy to use. And besides this, one finds immediately information one is so often needing.

To begin with, the list of abbreviations does not always include the obvious, which can be found almost anywhere, but does list a good many of the lesser known combinations, particularly German, French, Italian and Spanish.

Reigning royal families of the world follows Mr. Bartlett's introduction, and this is logically arranged alphabetically by country, including all the immediate family members.

# Inco nickel alloys




*Monel tubes are used in this DPS reboiler and vaporizer bundles at the new Shell Oil Company of Canada Limited petrochemical plant.*

*This 33-inch vapor condenser built for McColl-Frontenac's Montreal refinery is lined with 20% Monel-clad to resist corrosion from hot oil vapors. Cooling tubes inside are 70-30 cupro-nickel.*

*This new fractionating tower at Imperial Oil's Ioco Refinery is lined with Monel strip to resist corrosion present. Monel's strength, toughness and ease of fabrication were necessary, too, for this application.*

# widely used by Canadian oil companies

The important *combination of properties* found in INCO Nickel Alloys has led to their wide application in the petroleum and petrochemical industries. As a group, they are noted for their resistance to corrosion, their strength and ease of fabrication. Individually their properties cover an extensive range of service requirements. Important, too, they are all readily available in standard mill forms and castings.

**INCO *proven* SERVICE**

Inco's technical staff, and the benefit of years of on-the-job experience solving metal problems, is available to you. Their help, assisting you with your corrosion problem or finding the right material for your particular job, is yours for the asking.

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INCO

D-4

International organization is an invaluable section, although the order of precedence, preference, or presentation has us completely baffled.

States of the world, comprising part two, has useful statistical information (though based on nineteen hundred and forty-one census for Canada, at any rate), and the states or countries are arranged alphabetically.

This concludes with sixty pages of Diplomatic section, in which the appropriate dignitaries are listed under the capitals of their respective countries, these capitals being alphabetically arranged.

The second main section, Biographics, presents some eight thousand entries, the number of entries being limited by the canons of selection: "Statesmen and politicians, those in office and those who have been in office, are included; so are ambassadors, heads of government departments, military chiefs, great ecclesiastics and lawyers of eminence, heads of the greater industries, leading bankers and merchants".

We quote the above from the editor's preface, as no one but the august house of Burke's peerage could use such expressions for the limiting of a who's who, and get away with it.

This will be a most valuable reference volume.

**Introduction to mechanical design.** T. B. Jefferson and W. J. Brooking. New York, Ronald Press, 1951. 612 pp., illus., $6.50 (U.S.).

This volume is based on the authors' experience in designing machines, and on information already presented in textbooks, handbooks, and catalogues on machines, machine design and related subjects. It has been written keeping in mind the needs of college students, and also of pre-engineering and technical institute students who may not have a very wide technical background. For this reason various topics have been treated in more detail than is usual in books of this type: for example, the fundamentals of mechanics of materials are discussed fully.

The authors approach the subject from the point of view of the functional purposes of a machine, its configuration requirements, economic considerations, the use of rational and empirical design data, and the final appearance of the machine.

The text emphasizes certain subjects which the authors feel are more important than their treatment in other works would lead one to believe. These topics include materials, of which there are many new ones, the processes for which the machines are designed, machine frames, lubrication, pipes, tubing, tanks and containers, styling, and the use of standardized machine elements already available.

There are useful bibliographies at the end of each chapter, and many tables and illustrations throughout the text.

**Irrigation engineering.** K. R. Sharma, Jullundur, India, India printers, 1953. 3 v., illus., $17.00.

Prepared primarily as a textbook for students preparing for the engineering degree examinations in the various universities in India, the aim of this work is to present modern irrigation engineering developments in as concise a form as is practicable.

It is roughly divided into six parts, namely, Lift, Flow, and Tank irrigation, Drainage engineering, Groundwater engineering, and General information. These topics are covered in the first two volumes.

Volume three consists wholly of diagrams and graphs used in irrigation designs.

The work in this edition is a translation, and a very rough one. Bibliographies are brief, and give no detail as to publisher, price or date, and examination questions are included with each chapter.

The chief value of this book will be in its unique documentary information on what is being done in India in the field of irrigation engineering, and should be of great interest to a number of our members.

**Kinematics of machines.** R. T. Hinkle. New York, Prentice-Hall, 1953. 231 pp., illus., $4.75 (U.S.).

"Kinematics of machines is usually defined as the study of the relative motions of machine parts. The emphasis has been placed here rather than on the descriptions of mechanisms."

Relative motion, inversion, and the angular velocity theorem have all been treated in detail, and the book pre-supposes a knowledge of engineering mechanics.

Also special attention has been given to velocity and acceleration polygons, equivalent linkages, special constructions, chains, rolling bodies, gears, and miscellaneous mechanisms.

Each chapter includes a series of problems, and the book is indexed.

**Mathematical methods for scientists and engineers.** L. P. Smith. New York, Prentice-Hall, 1953. 452 pp., $13.35 (U.S.).

Not written from the standpoint of the mathematician, the object of the writer of this volume is "to present the substance of the mathematical methods along with clear and understandable statements of the conditions which must be satisfied in order that the method or mathematical manipulation in question can be validly carried through".

Proofs of the methods included are not presented, as the main objective of the book is that the student may through its use, acquire facility and practice in the use of available methods of solving physical problems. Only mathematics definitely involved in engineering and science are therefore treated.

Important and typical illustrative problems have been included, along with practice problems at the end of each chapter, and short bibliographies.

Workers in science and engineering, as well as advanced seniors and graduate students should find this work of great value.

**Metallic creep and creep resistant alloys.** A. H. Sully. Toronto, Butterworth, 1949. 278 pp., figs., $5.00.

"Creep may be defined as the time dependent part of the deformation which accompanies the application of stress to a solid." It was first scientifically observed and recorded by F. Phillips, in nineteen hundred and five.

During recent years, there has been a tendency for academic experimentalists on creep, and industrial workers' observations on creep, to be kept strictly apart. In this volume the writer attempts to bring together these two aspects. The development of the existing theory of strength of metals is described with special reference to creep, and an explanation of certain metallurgical factors affecting creep is suggested, along with a survey of creep properties of most of the well-known ferrous and non-ferrous alloys.

Appendices include British and American Society for Testing Materials Standards, characteristics of test equipment, and forms for reporting data, and the book is indexed.

**National directory of the Canadian pulp and paper industries, 1953.** Gardenvale, Que., National Business Publications, 1953. 478 pp., $4.50.

Prepared from the latest statistics available at the time, and from information obtained from the companies themselves, up to the end of September 1952, this 1953 edition of the National directory of the Canadian pulp and paper industries includes information on the manufacture and distribution of pulp, paper and board.

Mills are listed alphabetically by province, for each being given the addresses of head office and mills, names of directors, officers and personnel, capital, rail and steamship connections, timber supply, equipment, production, products, etc. Also included in the book are a directory of paper converters, lists of paper distributors in Canada and foreign countries, Canadian paper merchants, foreign trade service and trade commissioners, Canadian forestry officials, and trade associations.

There are general articles on various aspects of the paper industry in Canada in 1951, the pulp and paper industry, the paper box and bag industry, and roofing paper and miscellaneous paper goods.

**National research council of Canada review, 1953.** Ottawa, Queen's printer, 1953. 244 pp., 75 cents.

This report reviews the work of the National research council for 1952-1953. It summarizes the work of the Council in a general article, and gives some information on its organization. Following this, the annual reports of the directors of the various divisions are presented, together with lists of their publications. The reports of the various special committees are also given, with a list of the members of each committee appended.

**Partial differential equations in engineering problems.** K. S. Miller. New York, Prentice-Hall, 1953. 254 pp., $6.35 (U.S.).

Written primarily for the engineering student, only an elementary knowledge of ordinary differential equation is needed for its comprehensive study, and practical solutions are provided throughout the text.

Four chapters treat of Fourier series analysis, and variables and integrals, and consideration is given to various elementary properties of the Legendre, Bessel and Mathieu functions.

Methods of solution, such as the Laplace transform and numerical procedures have purposely been omitted as first rate texts are available covering these subjects.

Problems are included, and two pages of bibliography and an index conclude the volume.

**Principles of automatic controls.** F. E. Nixon. New York, Prentice-Hall, 1953. 409 pp., $9.35 (U.S.).

The aim of this book is to present the various principles used in the design of automatic control systems. It is concerned chiefly with linear system design, there being one chapter serving as an introduction to nonlinear systems. Covered in the text are transient response, frequency response, stability criteria, numerical integration, automatic computors and transient analysis.

The author points out that simple control systems can be defined by mathematical equations for which the solutions are relatively simple, whereas the more intricate systems involve complicated interacting equations for which the solutions are very difficult by ordinary methods. It is, therefore, of great interest to designers to know the principles behind these systems, especially if they can be

easily applied, interpreted and understood.

The six Appendices give reference material often used in control analysis systems, and include topics such as Design data for cascaded functions, a table of Laplace transform pairs, and the derivation of the Nyquist criterion.

This book has grown from a company training course given by the author, and is for use as a reference book, or undergraduate text. Except for the appendix on the derivation of the Nyquist criterion, no mathematical background beyond first year calculus should be required to understand the book, although a course in first year physics is assumed, and one on electrical circuits would be helpful.

***Procedures in experimental metallurgy.** A. U. Seybolt and J. E. Burke. New York, Wiley, 1953. 340 pp., $7.00.

Intended for those new to the field, this reference work emphasizes the laboratory preparation of metal and alloy specimens up to the point of making observations on their properties. It covers furnaces, refractories, controlled atmospheres, vacuum systems, and high-temperature control; describes melting, casting, heat-treating, and basic fabrication techniques; and devotes separate chapters to powder metallurgy, the preparation of pure metals and single crystals.

**Recent developments in mineral dressing; proceedings of a symposium.** London, Institute of Metals, 1953. 766 pp., diagrs., $9.00.

Including thirty-nine papers on all aspects of mineral dressing, and also the Third Sir Julius Wernher Memorial Lecture by Professor A. M. Gaudin, this volume is the proceedings of the Symposium arranged by the Institution of Mining and Metallurgy in London, September twenty-third to twenty-fifth, nineteen fifty-two.

The depletion of rich ore reserves due to rapidly increasing demand for metals over the past century has created a great interest in improved methods of mineral dressing and mineral concentration among metallurgists.

At the time of the organization of this symposium, papers were invited to cover the following branches of the subject:

(a) Fundamental concepts and experimental methods.
(b) Advances in machine construction and in plant design.
(c) Recent practice at specific plants.

In each instance the paper is presented along with the ensuing discussion, and the author's written reply. Bibliographic footnotes occur throughout the volume, and some papers include an extensive bibliography.

The line drawing diagrams are excellently reproduced, and three folded Mill Flow sheets are also included.

The volume is indexed by both author and subject, and will be an invaluable contribution to its field.

**Statically indeterminate structures; their analysis and design.** Paul Anderson. New York, Ronald, 1953. 318 pp., figs., $7.50 (U.S.).

Assuming a knowledge of elementary stress analysis and design of simple framed structures, the author presents this work as a suitable text for a first course in statically indeterminate structures.

Application of methods to design is stressed, rather than theorems of analysis. Also most of the problems considered deal with steel structures, as nearly all structural curricula cover separate courses in reinforced concrete.

Deflection and the behaviour of a structure under load are stressed; one chapter is devoted to typical problems of design and examples of actual practice and the last two chapters consider wind pressure analysis and space structures.

Twenty-eight pages of invaluable charts and tables are reprinted with acknowledgments to the Portland Cement Association, and problems are included with each chapter.

This will be a valuable contribution to the field of statically indeterminate structures.

**Television tube location guide,** v. 4. Indianapolis, Sams, 1953. 189 pp., illus., $2.00 (U.S.).

This is the fourth volume in a series of books on tube location issued by this publisher. Their purpose is to help technicians repair receivers quickly and efficiently, as many troubles in television receivers are caused by tube failures.

The location of the blank pin or locating key in the tube socket is shown as it has been in previous volumes, as it aids in replacing tubes in sockets which cannot be seen by the technician. There is also data on the fuses used in receivers.

This volume follows the pattern of previous ones, in that it shows by diagrams the location of the various tubes in different makes of receiver, and also lists the tubes which may be responsible for different types of trouble. There is a combined index to volumes one to four.

***Temperature measurement in engineering,** volume 1. H. Baker, and others. New York, Wiley, 1953. 179 pp., $3.75.

This first volume of a two-volume work is primarily concerned with thermocouple techniques and includes introductory chapters on fundamentals, basic information necessary for the design of temperature measuring apparatus, and specific designs for measuring internal temperatures and temperature gradients in solid bodies. The emphasis is on specific procedures and techniques for various circumstances, classified on a physical basis rather than by industry or type of instrumentation.

**Traffic management in industry.** L. A. Bryan. New York, Dryden press, 1953. 452 pp., $5.50 (U.S.).

The smooth functioning of industry is becoming more and more dependent on a well trained traffic manager, so much so that traffic management is fast being accepted as a profession in itself.

As the author is professor of management and director of the Institute of Aviation at the University of Illinois, he has had ample experience in the organization and presentation of information.

The volume opens with a general discussion of the whole field of traffic management, its function, organization, and administration. All aspects of receiving and despatching are later covered, including routing, classification and tracing, intra-plant, local and long distance despatching by express, mail and passenger, and finally an excellent glossary of terms.

Five pages of supplementary reading are arranged by application to chapter. Appendix A lists general traffic publications, and Appendix B, American Society of Traffic and Transportation, Inc. examination number two, on Principles of Traffic Management.

One item for consideration by our Canadian readers is that specific rates and regulations, though probably similar, do not necessarily apply in Canada.

Discussion questions are included with each chapter, and the book is well indexed.

## BOOKS RECEIVED

**The atomisation of liquid fuels.** A. Muraszew. London, Chapman & Hall, Toronto, British Book Service, 1953. 246 pp., illus., $7.25.

**British petroleum equipment,** 1951 edition. London, Council of British manufacturers of petroleum equipment, 1951. 751 pp., illus., $7.00.

**The casting of non-ferrous ingots.** Leslie Aitchison and Voya Kondic. London, Macdonald & Evans. Toronto, Burns & MacEachern, 1953. 370 pp. diagrs., $9.25.

**The control of quality in melting and casting. Institute of metals—symposium, March 1953.** London, The Institute, 1953. 88 pp., illus., $2.50. (Monograph and report series, No. 15).

**Cybernetics.** Heinz von Foerster, ed. New York, Josiah Macy, Jr. Foundation, 1953. 184 pp., illus., $4.00 (U.S.).

**Diesel engine design,** 2nd ed. T. D. Walshaw. London, Newnes, Toronto, British Book Service, 1953. 416 pp., illus., $7.00.

**Director of the international rubber industry,** 1953 ed. Zürich, Verlag fur Wirtschaftsliteratur G M B H, New York, Swiss American Advertising, 1953. 416 pp., $12.60 (U.S.).

**Electro-magnetic machines.** R. Langlois-Berthelot. London, Macdonald., 1953. 535 pp., diagrs., 65/-.

**Fabricated materials and parts.** T. C. DuMond. New York, Reinhold, 1953. 332 pp., illus., fold. table, $6.50 (U.S.).

**The Financial Post survey of mines,** 1954. Financial Post. Toronto, Maclean-Hunter, 1954. 382 pp., $3.00.

**Guide to audio reproduction.** David Fidelman. New York, Rider, 1953. 232 pp., illus., $3.50 (U.S.).

**Handbook of probability and statistics, with tables.** R. S. Burlington and D. C. May. Sandusky, Ohio, Handbook Publishers, 1953. 332 pp., diagrs., tables, $4.50 (U.S.).

**Housing and building in hot-humid and hot-dry climates. Proceedings of a conference, November 1952.** Washington, D.C., National research council, Building research advisory board, 1953. 179 pp., $6.00 (U.S.). (Research Conference report No. 5).

**Industrial wastes: their disposal and treatment.** Willem Rudolfs. New York, Reinhold, 1953. 497 pp., illus., $9.50 (U.S.).

**International brewers' directory.** Zürich Verlag fur Wirtschaftsliteratur, G M B H, New York, Swiss American Advertising, 1950. 504 pp., $12.60 (U.S.).

**Introductory circuit theory.** E. A. Guillemin, New York, Wiley, 1953. 550 pp., figs., $8.50.

**Marine steam boilers.** J. H. Milton, London, Newnes, Toronto, British Book Service, 1953. 256 pp., illus., $5.50.

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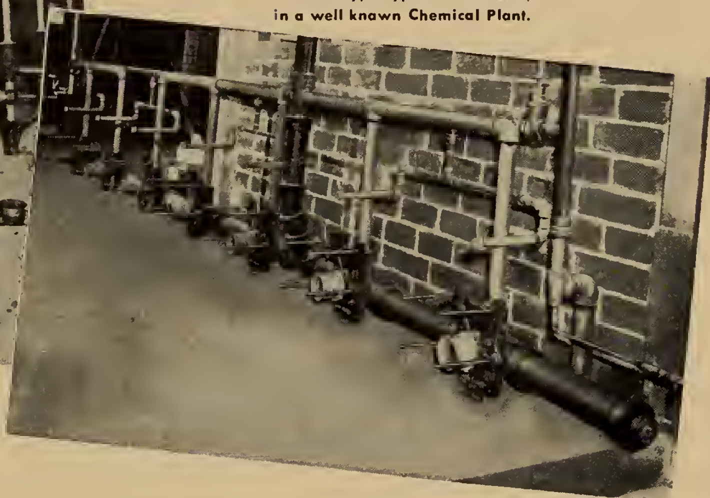

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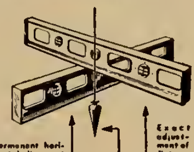


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**Modern pumps.** E. Molloy, ed. London, Newnes, Toronto, British Book Service, 1953. 240 pp., illus., $4.25.

**The mystery of other worlds revealed.** Willy Ley and others. New York, Sterling, Toronto, Saunders, 1953. 144 pp., illus., $4.50.

**Newnes electrical pocket book,** 12th ed. E. Molloy, ed. London, Newnes, Toronto, British Book Service, 1953. 391 pp., figs., $2.00.

**Nuclear moments.** N. F. Ramsey. New York, Wiley, 1953. 169 pp., figs., $5.00.

**Principles and practice of radar,** 4th ed. H. E. Penrose and R. S. H. Boulding. London, Newnes, Toronto, British Book Service, 1953. 795 pp., illus., $10.00.

**Renewing our cities.** M. L. Colean. New York, Twentieth Century Fund, 1953. 181 pp., illus., $2.50.

**Retirement and the industrial worker.** Jacob Tuckman and Irving Lorge. New York, Teachers College, Columbia University, 1953. 105 pp., $2.75 (U.S.).

**Small motors and transformers: design and construction.** E. Molloy, ed. London, Newnes, Toronto, British Book Service, 1953. 176 pp., diagrs., $3.50.

**Static electrification—a symposium held in the Institute of Physics, March 1953.** London, The Institute, 1953. 104 pp., illus., 25/-. (British journal of applied physics, supplement No. 2).

**Stress concentration design factors.** R. E. Peterson. New York, Wiley, 1953. 155 pp., charts, spiral binding, $8.50.

**Toxic solvents.** Ethel Browning. London, Arnold, Toronto, Macmillan, 1953. 168 pp., $3.00.

**UHF television antennas and converters.** Allan Lytel. New York, Rider, 1953. 118 pp., illus., $1.80 (U.S.).

**Welding, brazing and metal cutting.** E. Molloy, ed. London, Newnes, Toronto, British Book Service, 1953. 192 pp., illus., $3.50.

## TECHNICAL BULLETINS AND PAMPHLETS RECEIVED

**Alloy casting institute. Reprint:**

Corrosion by aqueous solutions at elevated temperatures and pressures, by F. H. Beck and M. G. Fontana.

**American institute of electrical engineers. Standards:**

504 — Proposed test code for carbon brushes. 700 — Aircraft direct-current apparatus voltage ratings. C37.7 — 1952 — Interrupting rating factors for reclosing service on power circuit breakers. C37.8 — 1952 — Rated control voltages and their ranges for power circuit breakers. C37.12 — 1952 — Guide specifications for alternating-current power circuit breakers. C39.2 — 1953 — Direct-acting electrical recording instruments, switchboard and portable types.

**American iron and steel institute. Committee on reinforced concrete research. Reprint:**

The effect of sustained overload on the strength and plastic flow of reinforced concrete beams, by G. W. Washa and P. G. Fluck.

**American road builders' association. Technical bulletins:**

No. 191 — Soil-cement stabilization: a committee report. No. 192 — Application of the contract method for major highway maintenance operations, by H. A. Radzikowski. No. 193 — The Hollywood — Santa Ana freeway, by Fred Grumm. Problems involved in expressway design and construction, by A. A. Anderson. No. 194 — Rubber in bituminous pavements, by H. F. Clemmer and others. No. 195 — Cornell test projects in low-cost roads, by J. W. Spencer. No. 196 — The control and placement of graded aggregate base courses on the Turner Turnpike, by H. E. Bailey. Vibration for placing stone for base courses, by F. E. Swineford. No. 197 — The rehabilitation of bituminous surfaces by the heater-



## These papers will appear in the April issue

Job Control on the Yonge Street Subway.
W. H. Paterson, M.E.I.C.

Installation of Electrical Equipment on the Yonge Street Subway.
J. Y. Doran.

Cars, Shops and Mechanical Equipment of the Toronto Subway.
J. G. Inglis.

Aspects of Welding Research in British merchant shipbuilding.
R. B. Shepheard.

Reconnaissance of the Labrador Railway from Seven Islands to Lat. N. 54 44', Long. 66 42' W.
D. A. Livingston, M.E.I.C.

Some Fire Protection Aspects of Building Design.
Douglas R. Abbey, M.E.I.C.,
William E. Emmerson, JR.E.I.C.

The Development of a New Concept in Modern Office Building Construction.
G. Lorne Wiggs, M.E.I.C.

Modernization of the N.R.C. Impulse Testing Facilities.
F. C. Creed, N. K. Kusters and W. J. Purvis.

The ASME Boiler Code. Part VI. Times of National Emergency and War, 1941-1943.

planer method, by J. N. Robertson. Curing slippery pavements, by G. E. Martin. No. 198 — Prestressed concrete for highway construction, by M. J. Holley. Prestressed concrete roads, by W. P. Andrews. No. 199 — Lime-fly ash soil stabilization in Maryland, by J. E. Wood. No. 200 — Stabilization of soil with asphalt. Part I Granular soils. Part II Plastic soils. No. 201 — Public relations in the highway field, by Vear Mann. Personnel problems of our state highway departments, by J. A. Anderson. No. 202 — Increase in land values following construction of expressways, by D. C. Greer. The expressways program of Massachusetts, by John McCloskey.

**American society for testing materials. Special technical publications:**

No. 132 — Symposium on plastics testing — present and future. No. 149 — Symposium on chemical analysis of inorganic solids by means of the mass spectrometer.

**Bell telephone system. Monographs:**

No. 2057 — Transistors in our civilian economy, by J. W. McRae. No. 2058 — An optical position encoder and digit register, by H. G. Follingstad and others. No. 2061 — Properties of silicon and germanium, by E. M. Conwell. No. 2064 — Silicon p-n junction alloy diodes, by G. L. Pearson and B. Sawyer. No. 2066 — Transistor equations, by F. R. Stansel. No. 2074 — Measurement of magnetostriction in single crystals, by R. M. Bozorth and R. W. Hamming. No. 2075 — Analysis of measurements on magnetic ferrites, by C. D. Owens. No. 2076 — Magnetic crystal anisotropy and magnetostriction of iron-nickel alloys, by R. M. Bozorth and J. G. Walker. No. 2077 — Rigid coaxial transmission lines, by V. J. Drvostep and A. W. Lebert. No. 2078 — Regenerative amplifier for digital computer applications, by J. H. Felker. No. 2080 — Low-loss waveguide transmission, by S. E. Miller and A. C. Beck. No. 2081 — Drift velocity of ions in oxygen, nitrogen and carbon monoxide, by R. N. Varney. No. 2082 — Connection formulas between solutions of Mathieu's equation, by G. H. Wannier. No. 2086 — Surface properties of germanium, by W. H. Brattain and John Bardeen. No. 2088 — A transistor shift register and serial adder, by J. R. Harris. No. 2089 — A junction transistor tetrode for high-frequency use, by R. L. Wallace and others. No. 2092 — Transistors in switching circuits, by A. E. Anderson. No. 2093 — Dynamics of transistor negative-resistance circuits, by B. G. Farley. No. 2094 — Measurement of minority carrier lifetime in germanium, by L. B. Valdes. No. 2095 — Transistor amplifier-cutoff frequency, by D. E. Thomas. No. 2096 — Properties of M-1740 p-n junction photocell, by J. N. Shive. No. 2099 — Four-terminal p-n-p-n transistors, by J. J. Ebers. No. 2100 — Auditory tests with synthetic vowels, by R. L. Miller. No. 2101 — Transistor electronics: imperfections, unipolar and analog transistors, by W. Shockley. No. 2102 — The permalloy problem, by R. M. Bozorth. No. 2104 — Lifetimes of metastable states of noble gases, by A. V. Phelps and J. P. Molnar. No. 2105 — Behavior of magnetic materials, R. M. Bozorth. No. 2106 — How to detect the type of an assignable cause, by P. S. Olmstead. No. 2109 — Frequency economy in mobile radio bands, by K. Bullington. No 2118 — The evaluation of wood preservatives, by R. H. Colley. No. 2128 — Intermodulation interference in radio systems, by W. C. Babcock.

**Bituminous coal research, inc. Reprint:**

Dust emissions from small spreader-stoker-fired boilers, by E. J. Boer and C. W. Porterfield.

**British electrical and allied industries research association. Technical reports:**

No. A/T136 — Tracking in solid insulating materials: variables in the test for susceptibility to tracking, by V. E. Yarsley and others. No. G/T280 — Flameproof electrical apparatus: flanged joints, one inch in radial breadth, in mixtures of ethyl ether vapour and air, T. J. A. Brown and N. Simpson. No. G/T284 — Flameproof electrical apparatus: flanged joints, one inch and one-half-inch in radial breadth, in mixtures of the vapour of methyl ethyl ketone and air, by T. J. A. Brown and N. Simpson. No. L/T275 — The dielectric properties of polytetrafluorethylene and polychlortrifluorethylene, by J. V. L. Parry. No. L/T281 — Effects of contamination on structure and properties, with special reference to long-chain ketones, by V. Daniel and C. Turner. No. N/T63 — Bitter figures on single crystals of nickel and nickel-iron, by L. F. Bates and G. W. Wilson.

**California institute of technology. Industrial relations section:** Recognition of individuals. Annual report, 1952-1953.

**Canada. Dept. of citizenship and immigration.** Annual report for the fiscal year ended March 31, 1953. 50c.

**Canada. Dept. of mines and technical surveys. Mines branch.**

Summary review of federal taxation and certain other legislation affecting mining, oil, and natural gas enterprises in Canada. September, 1953.

**Canada. National research council. Canadian government specifications board. Specifications:**

17-GP-1A — Welding high temperature steam piping. 32-GP-161A — Butter; fresh and canned. 32-GP-162A — Cheese. 32-GP-163A — Ice cream. 32-GP-165A — Milk; fresh, pasteurized, homogenized. 32-GP-166A — Milk; whole, evaporated and vitamin D increased. 32-GP-167A — Milk; condensed, sweetened. 32-GP-168A — Milk; powder, whole. 32-GP-169A — Milk; dry, skimmed. 32-GP-170A — Cream; fresh and canned. 32-GP-171 — Milk; reconstituted; pasteurized; homogenized. 40-GP-1 — Schedule of methods of sampling and testing cordage. 40-GP-2 — Rope; manila, general purpose untreated and rot resistant. 41-GP-5 — Polyethylene pipe for underground cold water service.

**Canada. National research council. Technical information service. Reports:**

No. 30 — Humidity control in the printing plant, by L. L. Covert. No. 31 — Static electricity and methods for its elimination, by E. Rabkin, revised by L. L. Covert.

**Canada. Dept. of resources and development. Forestry branch. Reprint:**

The significance of wood failure in glued joints, by E. G. Bergin.

**Canadian automobile chamber of commerce.**

Facts and figures of the automobile industry. 1953 edition.

**Canadian chamber of commerce.**

Policy declarations and resolutions. 1953-1954.

**Canadian electrical association.**

Proceedings of the 63rd annual convention, 1953.

**Institution of electrical engineers. Advance paper:**

M1532 — Alternating-current-instrument testing equipment, by A. H. M. Arnold.

**Institution of mechanical engineers. Advance papers:**

Comparative high-temperature properties of British and American steels, by W. E. Bardgett and C. L. Clark. Corrosion aspects of the vanadium problem in gas turbines, by S. H. Frederick and T. F. Eden. A critical examination of procedures used in Britain and the United States to determine creep stresses for the design of power plant for long life at high temperatures, by R. W. Bailey. Fuel systems and controls for marine gas turbines, by R. F. Darling. Main propulsion gas-turbine set for the oil tanker Auris, by B. E. G. Forsling. Present trends in surge tank design, by C. Jaeger.

**Investment dealers' association of Canada.**

To help you share in Canada's growth.

**National warm air heating and air conditioning association. Manual.**

No. 9, 4th ed. — Code and manual for the design and installation of warm air winter air conditioning systems.

**Portland cement association.**

Modern developments in reinforced concrete, by W. J. Bobisch.

**Tin research institute. Reprint:**

The structure and mechanical properties of copper-manganese-tin alloys, by J. C. Blade and J. W. Cuthbertson.

**United States. Geological Survey Bulletins:**

No. 988-F — Uranium-bearing deposits west of Clancey, Jefferson County, Montana, by W. A. Roberts and A. J. Gude. No. 989-B — Gypsum deposits near Iyoukeen Cove, Chichagof Island, Southeastern Alaska, by G. M. Flint and E. H. Cobb.

**United States. Geological survey. Professional paper:**

No. 248-G—Mica deposits of the Southeastern Piedmont. Part II — Alabama district, by E. W. Heinrich and J. C. Olson.

**United States. Geological survey. Water-supply paper:**

No. 1227-A — Floods of March-April 1951 in Alabama and adjacent states.

**United States. National research council. Highway research board. Bulletins:**

No. 75 — Effect in concrete of pellet and flake forms of calcium chloride. No. 76 — Origin and destination surveys — methods and costs.

**United States. National research council. Highway research board. Special report:**

No. 12 — Research needed in geometric highway design.

# STANDARDS REVIEWED

**British Standards, British Standards institution, 2 Park Street, London, W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.**

**B.S. 2045: 1953—Preferred numbers. 2/6.**

The series of standardized numbers known internationally as 'Preferred numbers' are finding increasing application in the preparation of standards and in the devising of ranges of products and processes. The technical features, advantages and practical applications of these numbers are discussed fully in B.S. 1638: 1950 'Report on the selection of ranges of types and sizes (preferred numbers)', by J. E. Sears, C.B.E. The present standard B.S. 2045: 1953, has been prepared with the objects (a) of giving authoritative status to these numbers for application, where appropriate, in British practice, and (b) of providing readily accessible information on the numbers themselves for those who may have occasion to use them.

The British Standard lists the preferred numbers in the four principal series (R5, R10, R20 and R40), as well as the additional R 80 series intended for special application. These numbers are the same as those agreed internationally by the International Organization for Standardization (Technical Committee ISO/TC 19, Preferred Numbers) in New York, June 1952, and now published as ISO Recommendation No. 7. For the series R5 to R40, the ISO recommendation is in exact accord with the earlier agreement of the ISA, as given in ISA bulletin No. 11, 1935.

A special clause has been added explaining how supplementary series of any desired step ratio can be obtained directly from the principal series, provided the ratio corresponds with a preferred number. In this way the range of application of preferred number series is much extended.

**B.S. 2049: Part 1: 1953—Kerosine (paraffin) appliances for domestic use. Part 1: Burners, portable space heaters, cooking and boiling appliances. 10/-.**

As a result of the work carried out by a committee set up by the Ministry of Fuel and Power, the Petroleum Equipment Industry Standards Committee authorized the preparation of a British Standard for domestic appliances using kerosine as fuel. This, the first part of the standard, specifies general constructional, guarding and safety requirements of these appliances, and detailed performance tests. Numerous illustrations of typical burners and appliances are provided.

**Canadian standards, Canadian standards association, National research building, Ottawa, Canada.**

**C.S.A. 0116-1953—The physical properties of power and communication wood crossarms. $1.25.**

The requirements for power and communication wood crossarms are covered in this specification, which applies to suitable Canadian woods, and also Southern pine, in case it is found necessary in any instance to import crossarms.

The first part of the specification is concerned with the physical properties of wood crossarms, and in this section are listed the species from which crossarms may be made, the defects in the wood which are prohibited, and those which are permitted to a limited extent.

The second part deals with the manufacture and preservative treatment of crossarms, and includes specifications for pin and bolt holes, dimensions and tolerances, marking, conditioning, storing and ordering.

The appendices include illustrations of various types of knots, and drawings of typical details of crossarms.

**C.S.A. W48.2-1953—Corrosion-resisting chromium and chromium-nickel steel welding electrodes. $1.50.**

Developed primarily to classify high-alloy chromium and chromium-nickel welding electrodes, this Specification prescribes requirements for covered chromium and chromium-nickel steel electrodes yielding deposited weld metal in which chromium exceeds 4 per cent and nickel does not exceed 50 per cent.

The tests required by the specification are: The chemical analysis of weld metal; The fillet-weld test; and the all-weld-metal tension test. The requirements for these tests are given, as are methods of conducting them. The all-weld-metal tension test serves as a control of the uniformity of quality of the electrodes for the intended applications, and measures strength and ductility. The tension test requirements provide assurance of freedom from weld metal flaws, such as check cracks and serious dendritic segregations, which if present may cause failure in service. Any further tests which may be required for certain applications are to be agreed upon by the manufacturer and the purchaser.

# BUSINESS & INDUSTRIAL BRIEFS

## A Digest of Information received by The Editor

## Appointments and Transfers

**Peacock Bros.** — The Vancouver address of Peacock Brothers Ltd., has been changed to 1660 West 4th Ave., Zone 9. Telephone number remains the same, BAyview 3815-6.

**Canadian Marconi.**—Canadian Marconi Company has just announced the promotion of W. Ornstein to supervising engineer. In his new position Mr. Ornstein will be responsible for all engineering projects in the development of equipment in the mobile and marine communications field.

C. R. Hughes

**P. J. McGale.** — P. J. McGale has been appointed to special assignments at the head office of The B. F. Goodrich Rubber Company of Canada, Limited, it was recently announced by W. E. Ireland, vice-president and general manager, tire sales.

Mr. McGale was formerly London district manager. J. F. Horton has been appointed London district manager and C. E. Beauchamp succeeds Mr. Horton as bus-truck representative at London, Ontario.

**J. C. McCarthy.** — Robertshaw-Fulton Controls Company announces the appointment of Joseph C. McCarthy of Toronto as Canadian sales representative for the company's Robertshaw thermostat, American thermostat and Grayson divisions. Mr. McCarthy was formerly with Consumers' Gas Company and John Inglis Company, Ltd., Toronto.

**Trane Company.** — R. H. Fitzsimons, manager Hamilton Office, Trane Company of Canada Limited, announces the opening of a branch office in Kitchener, Ontario, for the purpose of serving that area with permanently located personnel.

The Kitchener office will be operated by Gordon T. Bockmaster.

**Automatic Electric Executive Changes.** — Concurrent with the general expansion of Automatic Electric Sales (Canada) Ltd., the directors announce effective January 1st, 1954, the election of Carman R. Hughes as president, and the appointment of Stuart C. Bird as general manager of the Company.

**D. C. R. Miller.** — D. C. R. Miller has been appointed general manager and director of the recently formed, new Canadian company, Dow Corning Silicones Limited. Mr. Miller was previously associated with the Dow Corning products division of Fiberglas Canada Limited through which the new company's products have been merchandised in Canada since 1945.

On February 1st the company moved into its new office and warehouse located on Tippet Road, fronting on No. 401 Highway, Wilson Heights, Toronto.

**T. P. Kirkham.** — Dunlop Tire and Rubber Goods Company, Limited, has

(*Continued on page 366*)

S. C. Bird

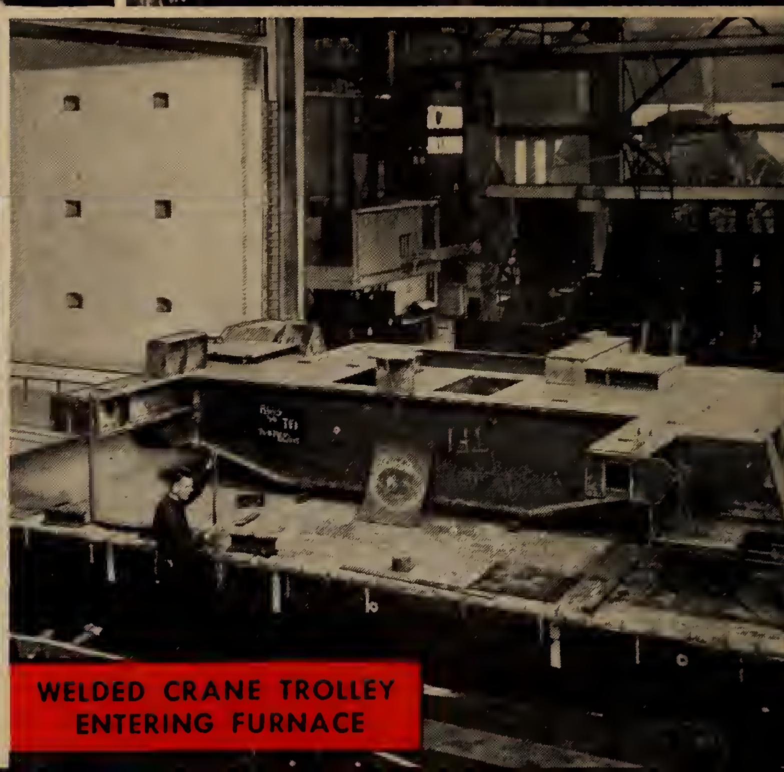
SECTION OF DESIGN OFFICE

PART OF FORGE SHOP

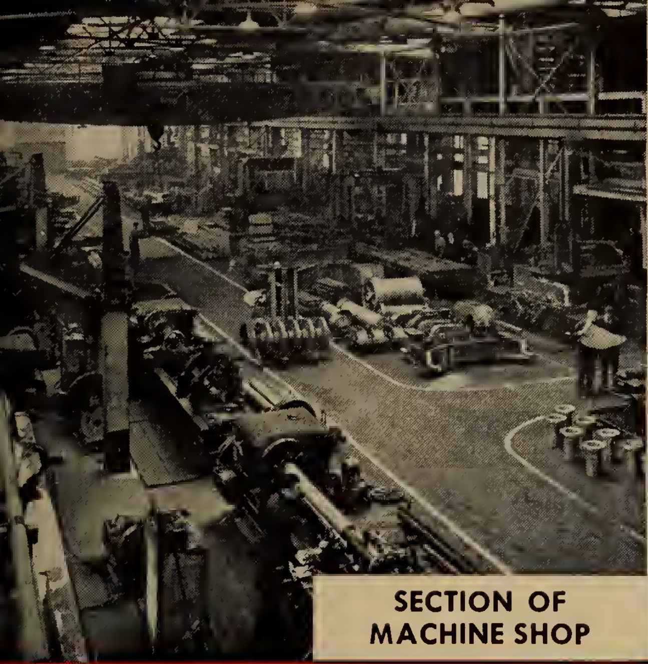
FOUNDRY

GEAR CUTTING SHOP

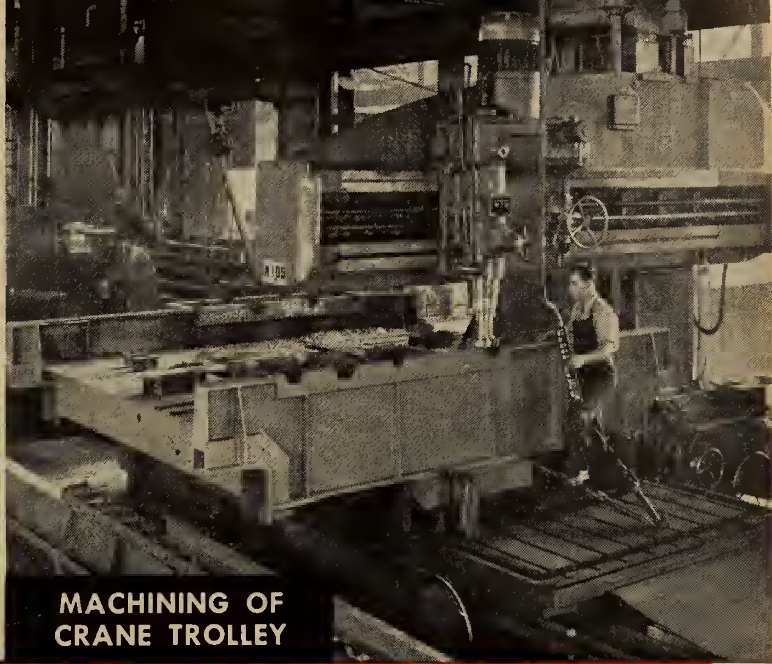
STRESS RELIEVING FURNACE



WELDED CRANE TROLLEY ENTERING FURNACE



SECTION OF MACHINE SHOP



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# "UNDER ONE ROOF"

Dominion Bridge facilities for building cranes are the most complete in Canada. With the exception of electrical equipment, all main components are produced in our own organization with the most up-to-date equipment.

These plant facilities with our large and experienced design staff, enable us to provide outstanding service in the field of mechanical handling.

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OVERHEAD CRANES ..ORE AND COAL UNLOADERS ...ORE AND COAL BRIDGES ...PULPWOOD STACKERS...DOCK CRANES...HYDRAULIC REGULATING EQUIPMENT...SPECIAL MACHINERY.

*Illustrated brochure on mechanical handling problems (F- 103) available on request.*

SEMBLY SHOP

**Plants at:** Montreal, Ottawa, Toronto, Winnipeg, Calgary, Vancouver

**Assoc. Companies:** Amherst, Quebec, Sault Ste. Marie, Edmonton

MECHANICAL DIVISION*
DOMINION BRIDGE
COMPANY LIMITED

***Other Divisions:** Structural Boiler, Platework, Warehouse

(*Continued from page 363*)

announced the appointment of T. P. Kirkham as sales manager, industrial rubber products division, Ontario.

●

**Stelco Sales Appointments.** — Lee T. Craig, vice-president, The Steel Company of Canada, Limited has announced the following appointments affecting the company's sales staff.

C. S. Kidd, formerly sales manager, pipe division, Montreal, moves to Canada Works, Hamilton, to fill the position of assistant general sales manager, wire, wire products and screw division. He will assist C. P. Short, general sales manager of that division. H. W. Stevens succeeds Mr. Kidd in Montreal as sales manager.

●

**Askania Representative.** — Askania Regulator Co., Chicago, announces the appointment of G. Albert Rice of Process-Instrument Systems Ltd. of Toronto as sales representative in Ontario and eastern Canada.

●

**L. R. Copp.** — Amalgamated Electric Corporation Limited announces the appointment of L. R. Copp to the position of sales supervisor duct systems. Mr. Copp joined the distribution equipment sales division of Amalgamated in 1946. In 1950 he transferred to the Toronto District Sales Division where he has served until his present appointment.

**T. P. Kirkham**

●

**Alchem Limited.** — R. C. Williamson, vice-president and general manager of Alchem Limited, announces the appointment of W. C. Heim as assistant general manager, and also the appointment of R. M. Gale as manager of the Railroad Department.

●

**J. H. Ross.** — Hamilton Gear and Machine Company, Limited, recently announced a new agent in Alberta. The representative is J. H. Ross and Company, Limited, with offices at Edmonton and Calgary.

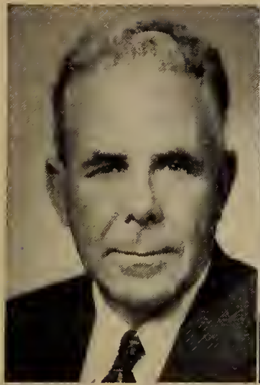
●

**West Kootenay Power & Light.**—The appointment of R. G. Anderson to the position of vice-president and general manager of the West Kootenay Power and Light Company, Limited, was announced by R. W. Diamond, president of the power company. At the same time Mr. Diamond announced that C. H. B. Frere has been elected a director and appointed solicitor. The retirement of A. L. Johannson and his resignation from the positions of vice-president and director were also announced.

●

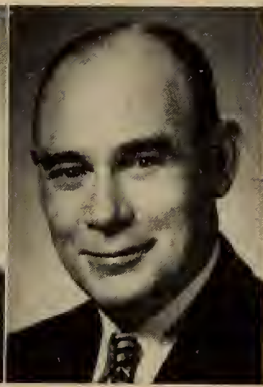
**Industrial Electronics.** — Industrial Electronics of Canada, Ltd., Toronto, Ontario, has recently become a subsidiary of Servomechanisms Incorporated, producers of electronic and electromechanical equipment, having three operating divisions in the United States. To accommodate the increased business which has already resulted from this affiliation, the company is now moving to new and larger quarters at 83 Torbarrie Road, Toronto 15, Ontario.

●



L. G. A. Hawkins

A. Sandilands



W. Mulroy

Also announced were the appointments of L. G. A. Hawkins as manager eastern region, A. Sandilands (see Personals) manager western region, and W. Mulroy as manager Pacific region.

●

**Reliance Appointments.**—J. M. Smeaton has been appointed manager of the new Winnipeg Branch of Reliance Electric & Engineering (Canada) Limited at Room 60, Electric Railway Chambers, Winnipeg. The new office will function as a sales and service depot for Reliance customers in north-western Ontario, Manitoba and Saskatchewan.

Appointment of C. G. Plaxton to the position of branch manager, St. Catharines office is also announced.

●

**Read Standard Corporation.** — Read Standard Corporation have recently announced the appointment of Laurie & Lamb Engineers of Montreal and Toronto as their sole representative in Eastern Canada for the sales and servicing of their heavy duty positive displacement axial flow blower and vapour pumps.

●

**Canadian Westinghouse.**—Three Montreal district appointments within the Canadian Westinghouse Company's district apparatus division have been announced by general manager E. E. Orlando.

C. H. Allen, formerly manager of industrial sales, has been named central station sales manager, succeeding W. O. Sorby (see Personals) who is transferred to Halifax as district sales manager.

G. W. Pettigrew has moved up to the post of industrial sales manager. He was formerly manager of agency and resales and C. F. MacNeil has now been appointed to that position.

A fourth appointment announced by the general manager of the Westinghouse district apparatus division is that of R. B. Carter as central station sales manager in Vancouver.

●

**Monsanto Canada Limited.** — The appointment, effective immediately, of Norman F. Smith and Russell B. Bridges as technical service representatives on plasticizers, Monsanto Canada Limited, was recently announced by Douglas D. Stokes, general sales manager of the company.

●

**Phillips Wires and Cables Appointments.**—T. A. Lindsay, vice president (sales) of Phillips Electrical Co. (1953) Ltd., announces the appointment of F. W. Barnhouse (see Personals) as sales manager (general), E. M. Lloyd as sales manager (specialties), and D. C. Brazier as manager central region.

D. C. Brazier

E. M. Lloyd

F. W. Barnhouse

# New Equipment and Developments

**Canadian Designs.** — Canada's showroom for designs of merit, the Design Centre, near Confederation Square in Ottawa, operated by the National Industrial Design Council and the National Gallery of Canada, has now been open for almost a year. It has been attracting a steady flow of visitors. During the first ten months, attendance was 28,862 or an average of almost one hundred a day.

It is open daily from 10.00 a.m. to 6.00 p.m. and on Sundays from 2.00 p.m. to 5.00 p.m. It offers exhibitions and displays of Canadian and international designs in manufactured products and a reading room stocked with the latest books and magazines on industrial design from Great Britain, the United States, Sweden, Germany, France, Italy and Japan.

●

**Catalytic Exhausts.** — The OCM catalytic exhaust is now available for factory installation on gasoline-powered lift trucks and tractors manufactured by Clark Equipment Company.

The catalytic exhaust oxidizes more than 95 per cent of the carbon monoxide and hydro carbons in the engine exhaust, converting them into harmless carbon dioxide and water vapor. In so doing, it removes the hazard of carbon monoxide and hydrocarbons when gasoline engines are operated indoors. The elimination of noxious gases improves employee morale and contributes to plant safety.

As an added benefit, a temperature indicator on the unit shows when the engine needs adjustment and can thereby decrease gasoline consumption. The noise level is equal to that of regular mufflers and back pressure is often less.

The catalytic exhaust can be used on any engine, mobile or stationary, as long as unleaded gas is used. Space requirements for installation of a unit are approximately the same as for the regular muffler which it replaces.

●

**Electrode for Welding New-Type Cast Iron.** — Specially designed for the welding of the new semi-ductile cast iron of the spheroidal graphite type is a recently introduced 55 per cent nickel alloy electrode. Pressure tests on pipes made from this material and joined together in lengths by welding with this electrode have shown that rupture takes place in the parent material and not in the weld. This electrode is also suitable for the making of strength welds in normal grades of cast iron.

The makers are also introducing a complete range of multi-operator welding plant and a duplex regulator capable of supplying two operators up to 350 amperes or one operator up to 700 amperes. Single and duplex regulators are available in the 200-350 ampere ranges and single type only in the 450 and 600 ampere ranges. New models of the company's well established 160, 250, 350 and 500 ampere oil-cooled single operator transformers incorporate a patent tap change switch of a new design. Firm: — Rockweld, Ltd., of Commerce Way, Croydon, Surrey, England.

●

**Industrial Changeover.**—A well-known name disappeared from the Canadian industrial scene on February 1st, when the Dominion Hoist & Shovel Co. Ltd., became the power, crane and shovel division of Dominion Engineering Works Limited. The name change is being made to conform with recent developments in the operations of the organization.

●

**Brass Valves and Fittings.**—A complete new line of brass valves and fittings is being introduced to the plumbing and heating industry by Dahl Brothers (Canada) Limited, Toronto. One feature is that many parts are hot pressed instead of cast, which eliminates the possibility of having pores in the material and, at the same time, ensures high precision and excellent finish and appearance. Distributors have been appointed in some districts.

●

**Allen-Bradley Canada Limited.** — An open-house party was held on Friday and Saturday, January 22 and 23, commemorating the official opening of the new Allen-Bradley plant at Galt, Ontario on January 25.

The factory and offices of the new plant, located at 135 Dundas Street, cover 45,000 sq. ft. of floor space. However, the property comprises 28 acres to provide room for future expansion. The Allen-Bradley line includes starters, relays, contactors and other motor control equipment. In the radio field, Allen-Bradley makes fixed and variable composition resistors, ceramic capacitors and ferrite parts.

●

**Hand-Operated Hydraulic Pump.**—A new hand-operated hydraulic pump has been developed by Chamberlain Industries, Ltd., of Staffa Road, Leyton, London, E.10., England, which can be supplied in standard form with or without pressure key and with a reservoir capacity of either half a gallon or two gallons, suitable for foot mounting.

The pumps, of extremely robust design, are constructed throughout from steel and it is claimed that they are absolutely free from leaks and that users will find that maintenance is almost unnecessary. The body consists of two plungers which deliver the maximum volume of oil under low pressure in order to move the ram up to its working position quickly, and then by means of a manual device the low pressure piston is automatically cut out and the pumping is continued at high pressure to a maximum of 5,000 pounds per square inch (352 kilograms per square centimetre).

From years of experience the manufacturers have appreciated the advantages of boring the body straight through to receive the pistons, thus ensuring that minute pieces of swarf do not become lodged in the machined oil-ways, resulting in hydraulic failure, whilst the pistons are of so rugged a character that it is almost impossible to damage them.

●

**Magamps Help Team a D-C and an Induction Motor.** — Westinghouse magnetic amplifiers helped solve a difficult rolling-mill problem for the Algoma Steel Corporation. A military application required billets rolled to a rather unusual precision. Finished billets were to be three inches on a side with the diagonal held to 1/64-inch tolerance. This was to be done in a six-stand mill in which the first five stands were gear driven by a 4000-hp. low-slip induction motor and the sixth by a 1000-hp d-c motor supplied through an ignition rectifier. The difficulty — to get these two motors to team together under all conditions of load and supply voltage. The a-c machine is much less sensitive to variations in a-c line voltage than the rectifier-supplied d-c machine.

To provide good speed harmony between the two motors a pilot generator was placed on the shaft of each motor. The output of these two pilots are compared and the result is fed to a two-stage magnetic amplifier, which also takes a-c voltage into account. The output of this regulating system operates on the phase-shifting circuit of the rectifier. This alters the voltage on the d-c motor to make its speed match that of its running mate.

●

**C.I.L. Expands.** — Expansion of the new polythene plant of Canadian Industries Limited at Edmonton to increase capacity by one-third was recently announced. Installation of additional equipment is expected to be completed by the end of 1954 at an estimated cost of $1,000,000, bringing the total cost to $15,000,000.

This plant, using ethane obtained from Alberta's gas as its basic raw material, will then have capacity to produce 16,000,000 pounds of polythene resin per year.

Construction of the Edmonton plant was started in April 1952. Now employing 230 persons, the plant went into production in November 1953 and initial shipments to customers were made in January 1954.

●

**International Harvester.** — International Harvester Company of Canada Limited has announced that an agreement has been made between the Heil Company of Milwaukee, Wisconsin and the International Harvester Company, Chicago, Illinois, for the manufacture of two wheel rubber tired tractor-scraper units for use in heavy construction work. The announcement was made jointly by Joseph F. Heil, president of the Heil Company and Harold T. Reishus, vice-president of International Harvester and executive head of International's industrial power division.

Under terms of the agreement, International acquires Heil patents, designs and manufacturing data covering two wheel rubber tired tractors. The agreement also includes an arrangement whereby the Heil Company will manufacture and supply two wheel tractors exclusively for the International Harvester Company until such time as International begins to manufacture the units themselves.

●

**Emission Microscope.**—A new Philips emission microscope is now under development and will soon be shown publicly in Canada according to R. G. Archer, manager, Scientific Department, Rogers Majestic Electronics Limited, Canadian distributors of Philips scientific products.

The new microscope will be a companion to the Philips EM-100 electron microscope which is now in use in Canada. It is being designed especially for metallurgical studies of metals and various metal oxides during heating.

●

**Portable Dust Collector.** — The new Standard Twin 92" portable cyclone dust collector offers peak efficiency in dust collection and tops in portability for 3,000-4,000 or 5,000 pound asphalt plants. The new unit is mounted on its own gooseneck trailer-type frame, and is available with or without running gear. It is designed for use with standard truck-size tires, thus permitting inter-change with other equipment. Operated with either Diesel engine or electric motor drive, the new portable cyclone dust collector is complete with large exhaust fan, dust return screw and fan stack with louver damper for maximum dust control. Complete unit meets all known state highway clearances. Manufactured by the Standard Steel Corporation of Los Angeles, California.

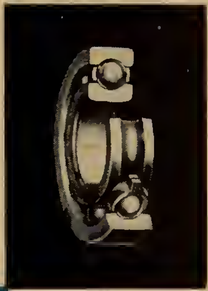
●

**Test Sieve Vibrator.** — To give quick and accurate and comparative sieve analyses and to free laboratory staff from a tedious operation for more skilled tasks Podmores (Engineers) Ltd., of Pyenest Street, Shelton, Stoke-on-Trent, England, has specially designed a test sieve vibrator. The machine is operated electro-magnetically, which eliminates all wearing and striking parts and the need for adjustment and lubrication. It is quiet in operation and the transference of vibration to the work bench is eliminated by anti-vibration mountings. The test sieve sleeve lawns are subjected to a rotational and vertical vibration which ensures quick and accurate results. The amplitude of the vibration is adjustable by means of a built-in controller but remains constant for any given setting. A time switch can also be built in to stop the test sieve after a pre-determined period of time. The machine can be arranged to take up to 10 eight-inch British Standard sieves.

●

**Bolt Saver.** — When replacements of special purpose bolts are not available immediately, many industrial managements may find it useful to turn to an ingenious and simple tool produced by Lawrence Edwards and Company Ltd., of Commercial Buildings, Oxford Street, Kidderminster, Worcestershire, England. For reconditioning threads on dirty or damaged bolts, this device is made to precision standards in best quality hardened and tempered steel. The bolt saver is opened like a book to receive the damaged bolt and it is, therefore, possible to deal with bolts which are damaged at the end. This is usually an impossibility with a conventional die. The reconditioning is done by clamping the tool shut and by withdrawing the bolt by unscrewing with a spanner. The bolt saver is available for internationally agreed standards of threads and will

*(Continued on page 372)*

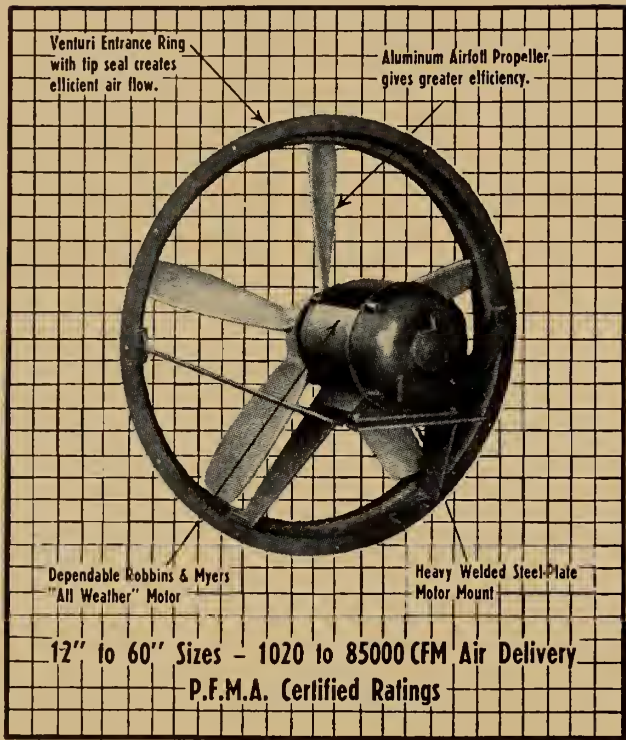











Venturi Entrance Ring with tip seal creates efficient air flow.
Aluminum Airfoil Propeller gives greater efficiency.
Dependable Robbins & Myers "All Weather" Motor
Heavy Welded Steel-Plate Motor Mount
12" to 60" Sizes – 1020 to 85000 CFM Air Delivery
P.F.M.A. Certified Ratings

(*Continued from page 370*)

deal with a full range of eight sizes from a quarter inch to three-quarters of an inch (6.3 to 18.9 millimetre) diameter.

**Plan Printer and Developer.** — A new machine that gives medium-fast output of good quality dye-lines which are printed and fully developed on the one machine has been produced by E. N. Mason and Sons, Ltd., Arclight Works, Colchester, England. The machine has been designed to make dye-line printing and developing almost effortless and it will deliver prints completely developed free from stain and odourless. Cut sheets or continuous rolls of sensitized material can be used and the operator does not need to stoop, bend or stretch during any part of the operation. Developing speeds of up to 12 feet (3.6 metres) per minute can be obtained. The machine is mobile, occupies only 15 inches by 64 inches (38 centimetres by 163 centimetres) of floor space, and is of clean, simple design and finished in hammered grey stoved enamel.

**Mid-Western Industrial Gas Limited.**— Mid-Western Industrial Gas Ltd. officially turned on natural gas supplies at the $19,000,000 Sherritt-Gordon nickel refinery, north of Edmonton at ceremonies held at the plant recently.

Ore supplies for the refinery's operations will be received by rail from mines at Lynn Lake in Northern Manitoba.

**Recording Instrument.** — A new portable recording instrument for obtaining a permanent record of alternating current and voltages is available from Canadian General Electric Company's apparatus division.

The new volt-ammeter, designated G-E type CF-7, combines features of a self-latching multirange hook-on current transformer and the simplicity of the type CF recorder in equipment suitable for indoor and outdoor applications.

It is expected to be particularly useful for checking loads on distribution lines, verifying motor loads, and in detecting overload circuits, transformers, motors, and other a-c apparatus.

**Fischer Bearings.** — Fischer Bearings Canada Limited, Toronto, has opened an office in Montreal at 6546 Upper Lachine Road.

Complete stocks of ball and roller bearings, pillow blocks, unground ball bearings and kilian casters will be kept available for quick delivery.

**First Overhead Line in East Africa.**— The first 132 kv overhead transmission line in East Africa is now being constructed for the Uganda Electricity Board by British Insulated Callender's Construction Company through their contracts office in Uganda.

This line of approximately 120 route miles is in two sections and runs westwards from Owen Falls to Kampala, the commercial centre of Uganda, and eastwards from Owen Falls to Tororo, a growing township near the Kenya border. These lines will transmit power from the Owen Falls Hydro-Electric station which is being built to harness the waters of the River Nile at Lake Victoria and which Her Majesty the Queen will officially open on April 29th during her visit to East Africa.

**Bristol Type 173 Helicopter.** — The prototype of the Bristol twin-engined, twin-rotor helicopter, known as the Type 173, Mark 1, recently carried out a successful series of trials at sea aboard the Royal Navy's aircraft carrier, HMS Eagle, The Bristol Aeroplane Company of Canada, announced recently.

The trials were designed to collect information on the behaviour of the large twin-rotor helicopter in varying conditions of deck motion; to test rotor blade behaviour, particularly during the stopping and the starting phases; to determine ease of manoeuvrability on the flight deck and to examine stowage problems below decks, all under varying conditions of deck, wind and ship motion.

**Canadian Aviation Electronics Limited.** —A revolutionary new storage battery, the nickel-cadmium type, only recently off the "secret-list" in the United States where it was originally developed, will be manufactured in Canada for the first time, at the Vancouver plant of Canadian Aviation Electronics Ltd.

U.B.C.-trained physicist David F. Manders, general manager of C.A.E., reports that a pilot operation is being established at the company's Cambie Street plant, and that introductory models of the new battery will be coming off the assembly line within two months.

**British Canadian Venture.** — One of Britain's largest firms in the engineering and construction industry with a unique organization, Balfour Beatty and Co. Ltd. has formed a Canadian subsidiary, Balfour Beatty Co. (Canada) Ltd., with temporary offices in Toronto.

The parent company, which already has permanent branches in South America, Malaya, East Africa and Iraq, has come to Canada with a view to collaborating with Canadian interests in the general expansion of utility and other development projects throughout the country.

**Steam Turbine.** — The recent installation of a 22,000 kilowatt Metrovick steam turbo generator for the Nova Scotia Light and Power Company in Halifax is the first of a series of Metropolitan Vickers installations to be made in Canada.

The Metropolitan Vickers Company operates in conjunction with the Canadian Westinghouse Company Limited who sell, install and service Metrovick units in Canada.

**Pipe Lines.**—Western Pipe Lines and Trans-Canada Pipe Lines Limited have merged their interests to bring Alberta's natural gas to Eastern Canada at the earliest possible date, it was recently announced by The Right Honourable C. D. Howe.

At the request of Mr. Howe, the two groups have held a series of meetings with him in Ottawa this week and have agreed to get together on a fifty-fifty basis to build a pipe line. The name of the company is to be Trans-Canada Pipe Lines Limited. Initially, there will be a twelve-man board of directors and a management committee, consisting of the president, who is yet to be named, Clint W. Murchison, Ray Milner, Frank A. Schultz and Alan H. Williamson.

**Water Pipe Contract.** — A major contract, amounting to over three million dollars has recently been awarded to

(*Continued on page 377*)



68th

ANNUAL MEETING

QUEBEC, QUE.

MAY 12, 13, 14, 1954

(*Continued from page 372*)

Dominion Bridge Company's Pacific Division, Vancouver, B.C., for the supply of 36 miles of 36 ins. steel water pipe from the Buffalo Pound Lake filtration plant to the city of Regina.

Dominion Bridge will manufacture the steel pipe from British plates in a section of its Vancouver plant. It will be made up into 40 ft. lengths with ends prepared for sleeve type couplings. All requirements of the American Waterworks Assn. standard specifications will be fully met.

The important operations of lining, coating and wrapping of the pipe will be carried out at Regina where Dominion Bridge Company will build a plant especially for this purpose.

●

**Mechanical Handling System.**—A new manufacturing plant for Canadian Mechanical Handling Systems Ltd., will be opened in Windsor in the next few weeks. The company maintains a sales office at 106 Adelaide St. W., Toronto, with Robert G. McKay as sales representative.

●

**English Electric Equipment at Kemano.** — "English Electric" equipment is to play its part in the huge Kemano-Kitimat power scheme of the Alcan project in Northern B.C. Recently arrived at the site was a large transformer and a 1-6,000 Kva output water-turbine driven alternator. Total weight of the alternator is 490 tons. It was shipped in units weighing from 27 to 41 tons.

●

# Publications

**For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.**

**Please mention *The Engineering Journal* when writing.**

**Graduate Training Featured.** — The January-February issue of 'Spotlight'—external house-organ of The English Electric Company of Canada Limited—carries an interesting article on the much-discussed subject of graduate engineer training and development.

The article emphasizes the need for more fully-trained engineers in Canadian industry, and details the scheme which is jointly operated by the John Inglis Co. Limited and English Electric.

It also outlines the training being offered to selected Canadian graduates on an English Electric Fellowship course in one of the company's several works in England.

Other features include stories on equipment going to Kitimat and into the northern latitudes of Canada.

●

**Aircraft and Ordnance Motor Bulletin.** —A new eight-page bulletin on the selection and application of aircraft and ordnance motors has been announced as available from the Canadian General Electric Company Limited, aviation equipment sales, 212 King Street West, Toronto, Ontario.

The booklet (GEC-988) contains photographs and diagrams of the equipment, explaining testing and application services, and gives estimating dimensions. Covering intermittent—and continuous-cycle motors, the publication includes operating and manufacturing data.

●

**Research and Control Instruments.**— A new 64-page reference book titled "Research and Control Instruments — X-ray and Analytical Equipment" is available from the research and control instruments Division. North American Philips Company, Inc., 750 South Fulton Avenue, Mount Vernon, New York.

In addition to X-ray diffraction, spectrometry and spectrography, the volume covers such components and accessories as tubes, rectifiers and cameras. It also has sections devoted to camera mounting brackets, film illuminators and measuring devices, and monochrometers.

●

**Stock List.**—A new stock list of distribution transformers is available from Ferranti Electric Limtied, Mount Dennis, Toronto 15, Ontario. An interesting graph shows the production rate and stock picture in one easy glance.

●

**Hydraulic Truck Dumper.** — Link-Belt Folder No. 2482, just released, provides information about the Link-Belt hydraulic truck dumper, with photographs and dimensional information.

A copy will be sent on request to the company at P.O. Box 173, Station "H", Toronto 13, Ont.

●

**Wrought Iron.**—For the first time in Canada a catalogue featuring standard wrought iron constructions is to be issued to the trade. The booklet, an attractive blue and white edition with a stiff cover, is being issued by Art Wire & Iron Co. Limited, 5 Carlaw Avenue, Toronto, Ontario, and will be in distribution within a few weeks.

●

**Forced Recirculation Steam Generator.**—A booklet describing the features of the 15-100 h.p. Clayton forced-recirculation steam generators is available from Construction Equipment Company, Limited, 180 Vallee Street, Montreal.

Space, weight, efficiency and installation are a few of the features highlighted. General data are also included.

●

**Westinghouse News.** — Westinghouse News, published every three weeks at Hamilton, Ontario, features in the January 28 issue "Division Faces Threat From Europe". The loss of factory manhours in 1954 due to orders lost to overseas competition is discussed and a remedy suggested.

All communications should be addressed to Bill Cockman, The Westinghouse News, Canadian Westinghouse Company Limited, Hamilton, Ontario.

●

**Canada's Growth.** — The Investment Dealers' Association of Canada, 170 Bay St., Toronto, is making available a handy little booklet designed to assist the individual in placing savings to the best advantage and suggesting how a share in Canada's growth can be secured. Three types of securities are discussed: those offering a high degree of safety of principal, those with a higher income as their chief appeal, and securities selected for their prospect of increase in value. The Association's service is also explained.

●

**Water Columns.** — New data unit No. 232 describes, illustrates, and gives specifications on Jerguson water columns. Principle of operation and features that assure positive alarm signals if boiler water falls too low or rises too high are explained.

The literature is available from Peacock Brothers Limited, P.O. Box 6070, Montreal, Que.

●

**Flexible Shafts.** — Engineering Bulletin No. 525 and a slide torque calculator shows how to select the correct size and type power drive flexible shafts for any application, maximum capacity—1,500 pound inches. Also given are the necessary data for the remote control of flexible shafts, maximum capacity—4,000 pound inches.

For the bulletin and the slide torque calculator, write Stow Manufacturing Co. of 150 Shear St., Binghamton, New York.

●

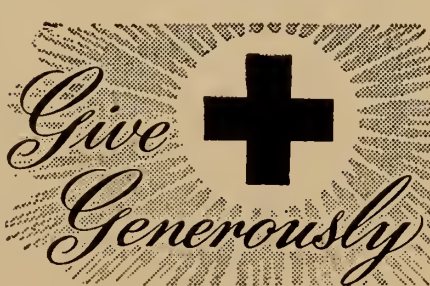
**Three Mode Controller.** — Specification Sheet 771 describes a new three mode stack type pneumatic controller, which incorporates proportional, automatic reset and rate action. Such control is particularly effective for the control of slow processes.

The new literature is available from Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Toronto 17, Ontario.

●

**Concrete Form Work.**—General notes on plywood form construction; methods of framing and erecting forms; design data and tables; and deflection curves are given in a booklet entitled "Concrete Form Work", issued by the Plywood Manufacturers Association of British Columbia.

It is available from the association at 810 West Hastings Street, Vancouver 1, British Columbia.



# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 37 MONTREAL, APRIL 1954 NUMBER 4



Price $6.00 a year in Canada, British Possessions, United States and Mexico. $7.50 a year in Foreign Countries. Current issues, 75 cents a copy, back issues from $1.00 per copy up. To members and affiliates, 50 cents a copy, $4.00 a year.—Authorized as second class mail, Post Office Department, Ottawa.



"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

*16,400 copies of this issue printed*

# CONTENTS



*Indexed in The Engineering Index*

# CANADA'S FIRST SUBWAY

*Three Papers Describing*

## Job Control

*by W. H. Paterson, M.E.I.C.*

## Electrical Equipment

*by J. Y. Doran*

## Cars, Shops and Mechanical Equipment

*by J. G. Inglis*

# Job Control

*by*

W. H. Paterson, M.E.I.C.

*Chief Engineer,*
*Toronto Transit Commission, Toronto.*

*A paper to be presented at the 68th Annual General and Professional Meeting of The Engineering Institute of Canada, at Quebec City, May 1954.*

This paper emphasizes the value of the advance studies and policy formation in the early "forties", permitting a start on design of the subway well in advance of construction. Functions of the Public Utilities Co-ordinating Committee are described. The careful co-ordination of the construction schedules, both with operating departments and with member groups of the Toronto Traffic Conference, is outlined. Standardization of plans, testing and inspection procedure, materials procurement, and the functions of the Records and Estimates Section are also discussed.

Controls for a project the size of the Toronto Subway are not necessarily complex, but to be effective they must extend from policy-making level to the field supervision.

Policy decisions of the Toronto Transit Commission are made by the Commission. The Commission was first established in 1921 by an Act of the Provincial Legislature, by which the City turned over to the Commission its rights and powers in connection with the construction and operation of transit facilities.

This Commission consisted of three members. On January 1, 1954, it was replaced by a five man Commission, under a new Act which extended the responsibility of the Commission to include all of the Toronto metropolitan area.

All policy decisions regarding the Subway can not be discussed in this paper, but the timing of the major decisions are of particular interest:

1942 — Report presented to the City of Toronto recommending subways as a solution to Toronto's traffic problem.

1943 — Norman D. Wilson, M.E.I.C., planning consultant, retained and a small staff set up to develop the basic plans.

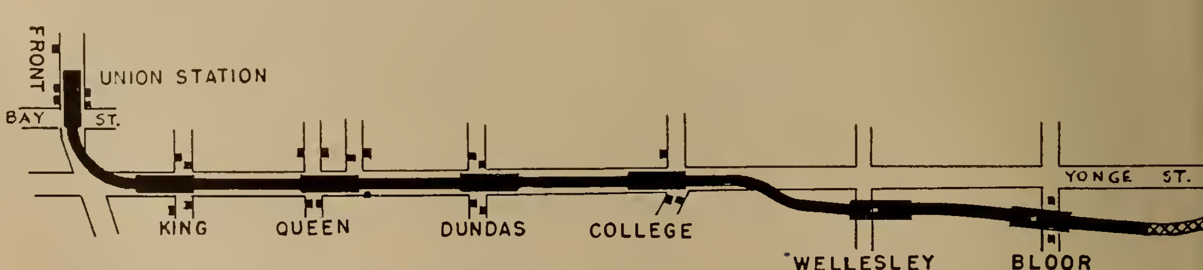
1944 — DeLeuw, Cather and Company retained to advise in the design of structure. Established Rapid Transit Department and approved budget for a staff of about forty. A. S. Mathers and John B. Parkin retained as consulting architects. Robert F. Legget, M.E.I.C., then on the staff of the University of Toronto, retained to advise on soil conditions.

1945 — Having been furnished with a report showing the location and characteristics of structures and cost of an initial system of subways, the Commission authorized the preparation of contract drawings for the Yonge Street Subway.

These early decisions to get on with the job were of great importance, as they permitted thorough investigation of many design aspects resulting in substantial savings. These savings would not have been accomplished if the decision to prepare contract drawings had been set aside until the time of construction was definitely known. The following example could illustrate this point.

Where the subway crosses Bloor Street just east of Yonge Street, one block north of Bloor Street the Bell Telephone Company have an exchange building containing several millions of dollars worth of equipment. It had been decided at an early date that this building could not be removed economically, and that alignment of the structure must be laid out to pass it.

Originally the subway passed to the west of the Bell Telephone Company building. However, further investigation of costs of right-of-way, subway structures, rearranging Bell cables, subway opera-



tion and surface car operation, all indicated that a better station could be developed at Bloor Street on an alignment east of the Bell Telephone Company building, at a saving to the Commission of approximately $500,000. Redesign of track was another instance of change in original plans, resulting in a saving in excess of $500,000.

Before construction started the Commission spent, for engineering and promotion, about $1,000,000 or roughly 2 per cent of the final cost of the job, but this sizable expenditure was more than equalled by savings in costs made possible by an early start on design.

#### Staff

The Commission approved the appointment of consultants, but the employment of a staff of engineers, draughtsmen and others required to develop plans and specifications was a function of the general manager, who delegated this responsibility to his staff. During the years 1944, 1945 and 1946, competent personnel were not easily acquired, particularly when the future of the project, and therefore the staff associated with it, was unknown.

After some months of attempts to employ experienced men with only moderate success, we embarked on a programme of employee training. Fortunately we had enough experience in the group to do a training job, and although most of those who were trained have left the Commission, the cost of training was returned, and were we faced with the same problem again we would not hesitate to follow this method of developing a staff.

By the end of 1944 we had an effective group of about forty employees working in the following sections: general office (clerical), general plans, structural, mechanical, architectural, and specifications and estimates. Electrical design was undertaken by the Commission's existing Electrical Department.

#### Utilities

The Yonge Street Subway was scheduled for completion of structures by the end of 1953. The work was completed generally in accordance with this schedule, as a result of careful scheduling of work and the willing co-operation of contractors, governmental and other authorities, companies, utilities affected, and suppliers of materials and equipment.

Co-operation, which is the key word in the story of job control, was sought by the Commission when the project was first contemplated. When problems of location were still at the discussion stage the Commission's proposals were informally discussed with officials of the City, Toronto Harbour Commissioners, Toronto Traffic Conference, Toronto Terminals Railway, etc.

One of the early meetings called to discuss the project was a special meeting of the Public Utilities Co-ordinating Committee. This committee (referred to as the P.U.C.C.) is made up of representatives of the Roadway, Sewer, Bridge and Waterworks Sections of the Works Department of the City of Toronto, the Bell Telephone Company, the Consumers' Gas Company, the Toronto Hydro Electric System, and the Toronto Transportation Commission.

The Committee prepares drawings showing the location of the various utilities occupying the streets, and the cost of making these drawings is shared equally by the members. The Committee meets under the chairmanship of the Deputy Commissioner of Works, and at these meetings many problems regarding the occupation of streets are resolved.

It was therefore most important to the Commission that this Committee be advised at a very early date of the Commission's plans for a subway on Yonge Street. At this meeting, and continuously thereafter, the Commission received the full support and co-operation of this Committee and the organizations represented.

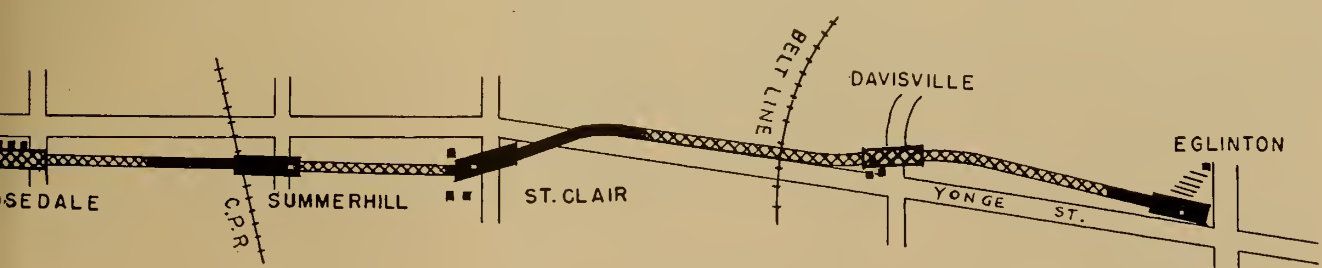
The maintenance and restoration of utilities during the construction of the Subway was probably one of the most important requirements of job control. It was known that subway excavation would dislocate sewers, watermains, gas mains, Bell Telephone cables, Hydro cables, C.P.R. and C.N.R. Telegraph services and the services of the Dominion Electric Protection Company.

Through the Public Utilities Co-ordinating Committee many discussions were held on methods of maintaining and restoring the various services. However, the plans showing the restored location of utilities were made by the staff of the Commission but approved by the members of the P.U.C.C.

To permit work to proceed without delay the Commission negotiated with each utility company, an agreement which set out those operations for which the Commission or its contractor would be responsible, and the method of payment. As a result of this co-operative planning and careful work on the part of the contractor, consumer complaints were practically negligible, although a slight mistake could have resulted in cutting of cables and leaving the downtown area without electric power or communication.

#### Co-ordination of Plans

While the Commission was developing plans for the subway, the City of Toronto Planning Board was actively engaged in preparing a master plan for the City. Through the co-operation of the Planning Board, arrangements were made for representatives of the Commission to attend such meetings as were necessary to make sure that the Commission's plans for improvement of services would not be in conflict with improvements proposed by the Planning Board.



#### Standard Plans

Early in the development of the project it was determined that all drawings should be made on sheets of standard sizes, multiples of letter size, so that they could be folded to accompany correspondence. Some special location study plans and profiles were the exceptions to this rule which was otherwise rigidly enforced.

To develop uniformity in drawings a standard practice manual for draughting was prepared which established such details as thickness of lines, size of letters, abbreviations, standard notations, etc. Early attention to these details helped to avoid errors and to produce a workable set of drawings.

To control the use of plans an effective filing system was established, and drawings were not released for reference without the approval of the head of the section which produced the plan, thus placing on that section head full responsibility for releasing those drawings only that were revised to-date of issue.

#### Specifications

Before undertaking the writing of specifications for this project, specifications written for many other similar projects were examined. It was the Commission's desire that subway structures be built in accordance with the highest accepted standards, and at reasonable cost. The specifications were therefore written with the intention of giving complete and accurate information regarding the design of structures to the tendering contractors, but leaving the contractor free to use his ingenuity with regard to construction methods.

In this regard, when the first set of contract drawings was completed, but before the project was scheduled for construction, most of the major Canadian contractors in the heavy construction field were invited to review the Commission's plans and specifications and discuss them with the Commission's engineers.

#### Supply of Critical Materials

During the post-war years many materials essential to subway construction were in short supply, and many critical materials were available with government approval only. Because subway construction would disrupt traffic in the downtown area, it could not be undertaken until material became available in the necessary quantities to maintain all contracts on schedule.

The timing of subway construction was therefore discussed with the proper authorities at Ottawa, and it was not until their assurance of co-operation was obtained that the first structural contracts were advertised for tender. The subway was never given priority classification by Ottawa, but every reasonable assistance was given the Commission at all times in the procurement of critical materials.

Before advertising the first structural contracts the Commission purchased 8,000 tons of structural steel required for the falsework and shoring. This avoided the delay in starting work which would have occurred if the contractor had placed the order after procuring the contract. Similarly, on Structural Contracts S-3, S-4 and S-5, sufficient steel for falsework and shoring to get the job started was purchased from European sources before these contracts were released for tender.

As the job progressed, material, particularly steel, instead of becoming easier to procure as anticipated, became much more difficult to obtain. Fortunately, the contractor on Contracts S-1 and S-2 had placed all orders for steel promptly, and through his own efforts procured the necessary steel to complete his contract.

As the work progressed on other contracts a shortage of reinforcing steel developed, and to avoid delay on this account the Commission purchased substantial tonnages of steel from Europe and the United Kingdom. This steel was purchased at a price much in excess of the controlled Canadian prices, and was made available to contractors to make up shortages in their Canadian deliveries at Canadian prices.

In order to reduce the quantity of reinforcing steel required to complete the subway structures, some structures such as retaining walls were re-designed to increase the volume of concrete and reduce the amount of reinforcing steel required.

To avoid delay in completion of the entire project on account of shortages in items other than steel, a very comprehensive quantity of critical materials and equipment was purchased by the Commission and furnished to the contractors. Some of these items purchased and supplied by the Commission are as follows:—

Brick
Cables
Insulated wire
Conduit
Electrical outlets
Supervisory equipment
Switchboards
Telephone equipment
Light fixtures
D.C. breakers
Pumps
Louvres and fans
Plumbing fixtures.
Cast iron pipe and fittings
Wrought iron pipe and fittings
Brass pipe
Fire equipment
Boilers and heating equipment
Shop equipment
Tile pipe
Reinforced concrete pipe
Corrugated sheet metal pipe
Hardware
Plumbing equipment
Partition tile

It might be of interest to mention that the storage of this material presented another problem which was handled by the Stores Section of the Commission's Treasurer's Department, which extended the existing storage areas and took over an abandoned substation to provide storage for some of this material.

#### Construction Schedules

At the time of undertaking the first contract, a comprehensive schedule for all contracts of the entire project was established showing date for completion of plans and specifications, date of advertising for tenders, date of commencement of work and the date of completion of work.

This schedule was, of course, a general control only, and each contract had its own schedule for its various phases. Of these, probably the most complex were the heavy construction contracts in the downtown section where almost every operation affected the downtown merchants and their customers.

Before the contractor could commence excavation on Yonge Street, the car tracks had to be removed. To permit their removal it was necessary to divert the Yonge cars to another street, and for this purpose a series of diversions using Church and Victoria Streets for north-south operation, and various east-west streets, were devised.

After the contractor had completed the first phase of his excavation and had replaced the timber deck, the street cars were restored to Yonge Street. To permit removal of the timber deck and back filling of the street, it was necessary to again divert the Yonge traffic to the diversion routes.

These diversions were not made until they had been carefully studied by the operating departments and brought to the attention of the Toronto Traffic Conference which is made up of representatives from the following:—

Toronto Board of Trade

Downtown Businessmen's Association
Ontario Motor League
Ontario Safety League
City Police Department
Toronto Transportation Commission
City Traffic Engineer
City Works Committee

By bringing the proposed diversions to the attention of the Conference, those most concerned were aware of the Commission's intentions. Although it was not possible to satisfy every requirement, a sincere and genuine effort was made by the Commission to avoid undue interruption to the street, and to provide service when it was essential.

For example, no traffic diversions on Yonge Street were permitted during the month of December on account of Christmas shopping. No traffic diversions were permitted on Front Street in the week before Christmas or Easter on account of heavy traffic at the Union Station. Long diversions were avoided during January and February, on account of the difficulty of travelling during the winter months.

After the plan of a diversion had been developed and reviewed by the Toronto Traffic Conference, it was then taken up with officials of the City departments affected—i.e. Police, Traffic and Fire. After obtaining these approvals the diversion was then advertised in the daily newspapers.

As well as diverting street car traffic, it was necessary to arrange alternate routes for the free-wheel traffic that normally used Yonge Street. These alternate routes were jointly planned by the Commission's Director of Development and Research and the City Traffic Engineer, and were included in the diversion plans.

### Testing and Inspection

The procurement of wide variety of materials for the project presented a problem in inspection and testing. Certain testing procedures were already established in the T.T.C., but it was decided to set up a separate Test and Inspection Section of the Rapid Transit Department.

A survey showed materials and equipment would be coming from coast to coast of North America, and from Europe and Great Britain. As there are a number of commercial inspection companies who maintain inspection services in principal industrial areas, the Commission called for tenders for inspection and testing of specified items. In this way inspection was assured when needed of such items as cement, steel, cast iron pipe, concrete pipe, vitreous pipe, rail and special work, etc.

All concrete in the subway structure was supplied to contractors from "Ready-Mix" plants. The cement, aggregates and mixes were all supplied to T.T.C. specifications. Continuous batching plant inspection and testing was maintained by commercial service, under the overall supervision of the Rapid Transit inspectors. In addition to this, on-the-job inspections took some 6,100 concrete test cylinders.

Where possible, materials were specified to Canadian Engineering Standards Association, British Standards Specifications, American Society for Testing Materials standards. An example of the diversity of inspection services is found in reinforcing steel. That material was made in Canada to C.E.S.A. specifications, in the United States to A.S.T.M. Code, and in Great Britain and Luxembourg to B.S.S. In each case our commercial testing service supplied certificates of inspection at the various mills.

Mechanical equipment such as pumps, fans, etc., were inspected and tested at the factories by the Rapid Transit Testing Section. This Testing Section also undertook to evaluate tests on paint suitable for an underground structure. Since conditions were more severe than found in most places in the country, a series of special tests were carried out to complement the specifications submitted by reputable paint makers.

### Assistance of National Research Council

Throughout the entire project the Division of Building Research of the National Research Council kept in close touch with the project, and for two years furnished a full-time engineer to make observations of job conditions and conduct certain tests. The assistance given the Commission by the National Research Council on the project was of great value to the Commission. The result of observations such as sub-soil conditions and behaviour of falsework under load will be of value to both owners and contractors on future construction projects.

### Records and Estimates

The Records and Estimates Section was formed to keep records of the progress reported by the Field Staff, calculate the amount of work completed, prepare monthly statements for payment, and estimate the cost of any modifications to the original contracts. The contracts were written on the basis of an approximate bill of quantities, against which the contractors submitted unit prices for each item; that is, a price for a cubic yard of excavation, or of concrete, or for a pound of structural steel, and so on, installed in place according to the contract drawings. Therefore a detailed and comprehensive record of all the construction work, providing a factual report of progress and expenditures, was required.

Questions on contract terms, affecting payments, were referred to this section. Useful modifications, frequently required by material shortages, were developed by the contractor's and the Commission's staffs. Therefore, in addition to maintaining records, this section had the responsibility for supervising payment on account of changes, setting rates on new items, and applying the control terms as required by these modifications. √

# Installation of Electrical Equipment

*A paper to be presented at the 68th Annual General and Professional Meeting of The Engineering Institute of Canada, at Quebec City, May, 1954.*

*by*

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The most modern electrical equipment, embodying the most up-to-date safety devices, has been installed in the new Toronto Subway. In this paper the author deals with the distribution of auxiliary a-c. power, the lighting facilities for stations, tracks, yards and shops. The a-c. traction power distribution is described, including the calculation of a-c. power requirements. Details of substations and feeders are given, as well as for the supervisory control system, communications, the emergency alarm system, and the signal system including the dispatching of trains by automatic train dispatchers.

In the Yonge Street Subway, recently placed in operation by the Toronto Transit Commission, the double track main line is four and one-half miles in length. Approximately two thirds of this length is below ground, and the balance in open cut section. There are twelve passenger stations, each with five hundred foot loading platforms, and a storage yard and maintenance shops for the handling of over one hundred rapid transit cars.

In the construction of this underground railway system the installation of electrical equipment embraced a wide range of facilities for the distribution of auxiliary a-c. power, lighting, distribution of d-c. traction power, supervisory control, communication and signalling, each of which is of primary importance in the operation of the system.

#### Distribution of Auxiliary a-c. Power

The mechanical equipment in the subway includes escalators, drainage pumps, ventilating fans, sewage ejectors, heating units, and other miscellaneous devices with 25 hp. being the maximum capacity of any unit.

Auxiliary a-c. power for the operation of mechanical equipment, lighting and signalling is supplied at each passenger station by duplicate three phase, four wire, 120/208 volt, 60 cycle services, taken from the Toronto Hydro-Electric System's low-voltage network, where available, and at other locations, from separate feeders or transformer banks. In order to ensure as far as possible the continuity of supply to essential services, duplication is carried through main service breakers, secondary breakers, main busses and, in the case of lighting, branch feeder breakers and feeders to distribution panelboards.

The main a-c. switchboards are of totally-enclosed dead-front design, and incorporate two electrically operated main circuit-breakers, two manually operated secondary air circuit-breakers, main busses, distribution breakers, transfer relays and metering equipment.

The main a-c. breakers automatically transfer load from normal service to standby service in the case of failure of normal service. The distribution breakers on the main switchboard and all distribution panelboards in the subway are of the thermal or thermal-magnetic type.

The lighting panelboards are specially designed, with two sets of three phase busses in the same cabinet separated by insulating barriers. The lighting circuits are so arranged that alternate lights in any area are fed from different main bus, branch feeder and distribution panel bus.

At drainage sumps where two pumps are installed, each pump is supplied from a different main bus. Similarly at ventilating fan and signal supply locations each of the two units is supplied from a different main bus.

As the subway structure has been built for an expected long life, and as excessive moisture conditions were anticipated, stainless steel electrical metallic tubing and pull boxes, outlet boxes and distribution cabinets are used throughout the subway. In the train tubes exposed mineral insulated copper sheathed conductors are used for lighting and convenience outlet circuits.

A 125-volt stand-by battery, for the supply of emergency lighting and control circuits only, is installed at each passenger station, as a further guarantee against people being stranded below ground without light. Automatically regulated battery chargers of the selenium type are installed in association with each battery.

Service to Davisville Yard and Shops area is supplied by individual 550-volt and 120/208-volt three phase, 60 cycle services. The total connected auxiliary power load of the subway including shops is approximately 1,750 kilowatt and the expected average demand approximately 1,150 kilowatt.

#### Lighting

The lighting of Yonge Street Subway presented many problems peculiar only to this type of project. The lighting intensities had to be sufficient to present a bright and pleasant atmosphere to the underground locations. Elaborate precautions had to be taken to guarantee the continuity of light in the underground locations, in order to prevent any tendency of the public to panic in the event of a power outage.

The ever present dust and moisture conditions in a subway made special fixtures a necessity. In addition, the design and layout of the fixtures had to complement the modern architectural treatment of the stations. On the other hand, as about 6,000 fluorescent fixtures would be required for the job, an economical fixture in regard to initial cost, maintenance and operation, consistent with quality, was also a necessity.

### Illumination Levels

The lighting intensities in Toronto's subway are considerably lighter than those in general use in most other existing subways. The intensities for the various areas are as follows:—

| *Area* | *Foot Candles* |
|---|---|
| Control areas | 7.5-12.0 |
| Stairways and escalators | 10.0-12.0 |
| Passenger platforms | 7.5-12.0 |
| Long passages | 7.5-10.0 |
| Train tubes and open cut | 0.5- 1.0 |

In order to assist in the study of lighting levels, the Commission built a full scale model of one half of a typical mezzanine control area, complete with lighting, traffic control facilities, ceiling, floor and wall finishes.

### Choice of Light Source

Single-lamp fluorescent fixtures were selected for the main lighting source on the basis of long-life, high efficiency and low power consumption. The fluorescent fixture pattern also permitted the continuous row light source required by the architects. For all indoor locations except train tubes, the 40-watt T-12 hot cathode lamp is used. Starting does not present any problem in these locations, because the lighting units are in operation twenty-four hours a day and an average lamp life of at least 10,000 hours is expected.

In the tube areas and at all outdoor platform locations, 40-watt T-12 instant start lamps are used. This lamp is not as critical of voltage requirements and ambient temperatures as is the hot cathode lamp.

The choice of the standard bi-pin, 48-inch fluorescent lamp, so familiar to everyone, was made on the basis of initial cost, low replacement cost, satisfactory life, and requires only simple auxiliaries and permits economical fixture design.

In addition to the main lighting, emergency lighting circuits are installed throughout the subway which provide sufficient light to prevent any panic and to enable the public to leave the subway safely in the event of a power interruption.

The incandescent lamps were selected for emergency lighting because under normal conditions they operate on a-c., and only in the event of a power failure will they switch over automatically to the d-c. battery feed. A fluorescent unit to function on both a-c. and d-c. was deemed impractical.

Incandescent lamps were again the choice for the illumination of utility areas, i.e. heater rooms, switchboard rooms, etc. These lamps are installed in standard industrial type fixtures.

### Design of the Special Fixtures

Two basic types of fluorescent fixtures are used throughout all passenger areas of the subway. The first type is a single lamp, flush-mounted, recessed unit, commonly known as a troffer fixture, for use in control areas with acoustic tile ceilings. The second type is a single lamp, surface-mounted fixture for use on platforms, passages, tubes and other locations where direct mounting on concrete ceilings is required.

Owing to the anticipated long life of the lamps, a dust-tight fixture was desirable so that it would not be necessary to open the fixture for cleaning except at the time of relamping. Achieving the dust-tight feature in the troffer type was easily accomplished by adding necessary gaskets to a high quality standard commercial unit. Ribbed opal glass is used as the diffusing panel in the troffer fixture.

The surface fixture presented more of a problem. No commercial fixture available could meet the requirements of dust-tight construction, corrosion resistance, easy maintenance and, last but not least, present a pleasing appearance to satisfy the architects' aesthetic tastes. It was necessary to start from scratch and design a fixture that would embody all the foregoing requirements.

A fixture with a body of an extruded aluminum section with die cast aluminum end plates was developed. The shape of the base plate and glass frame side rails was such as to form a continuous hinge for the glassware cover. The use of molded ribbed opal glassware with good diffusion and light transmission characteristics was decided upon, together with anodized aluminum reflectors, gaskets, and locking devices.

The Commission's engineers produced drawings and specifications showing the basic requirements of the fixture, and tenders were invited for the supply of the required number of the various types of fixtures. The successful tenderer engineered the details of the fixture.

To maintain that very important appearance factor, a common housing design is used for both the fluorescent and the emergency incandescent units. This applies to both the troffer fixture and the surface type. In the incandescent units, five lamps are installed, four of which are fed from the a-c. source, and the fifth lamp in the centre is fed from the d-c. battery source in the event of power failure.

A one-foot incandescent fixture of the same cross section as the fluorescent fixture was produced to act as the emergency lighting unit in continuous row installations. Seven hundred fixtures of the troffer type and 5,300 fixtures of the surface type were required for the project.

Fig. 1. Lighting of a typical station.

Fig. 2. Lighting of a typical control area.

#### Fixture Location

All station platforms are 11 ft. 10 in. wide and five hundred feet long. A continuous row of the surface fluorescent fixtures is located three feet back of the edge of the platform and extending the full length. Every seventh one is the one-foot emergency unit. This arrangement provides a maintained average of 7.5 foot candles with 20 foot-candles at the point of loading.

The system of mounting and feeding these units is unique. A recess eight inches wide and two inches deep was left in the concrete ceiling of the platform. In this recess was installed a special two section wireway for the full 500 feet. One half of the wireway contains the a-c. supply feeders and the other half contains the feeders of the d-c. battery supply.

The fixtures themselves are mounted directly to the wireway by special nipples. This design was adopted to overcome a complex system of buried conduit and provide maximum flexibility in the longitudinal arrangement of the fixtures.

Between stations in the tube areas the surface type fluorescent fixture is mounted on the ceiling above the catwalk. These units are on 20 foot centres opposite the arches in the centre wall, and provide a maintained level of approximately one foot candle. An incandescent fixture of the vapourtight condulet design is installed every sixty feet for emergency lighting in the tube area.

Illumination for the control areas in the five downtown stations is provided by recessed troffer units built into the acoustic tile ceiling. The average mounting height for these areas is approximately eight feet, and the units are spaced to provide a maintained illumination of 7.5 foot candles.

For the control areas in the remaining stations both troffer and surface mounted fixtures are used, depending on the architectural design of the structure. In both control areas and platforms there is a system of illuminated signs fed from the d-c. source to direct the public to the stairways and exits.

#### Open Cut Lighting

In the open cut sections of the private right-of-way the standard street lighting luminaires are mounted at 25 feet on concrete poles located between the north and south bound running rails. Two units are installed on each pole, with the luminaire located over the running rails.

The pole spacing is approximately 140 feet. Supplementary lighting is provided under the numerous bridges by an enclosed incandescent fixture with a wide spread light pattern. All wiring in the open cut is underground and consists of plastic insulated cables buried directly in the ground and protected by tile cover slabs.

#### Davisville Area

The Davisville area of the Yonge Street Subway is the maintenance centre of the system. In this location is a modern building for the inspection and repair of the rolling stock used in the subway, together with buildings for the Way and Structures Department and a modern boiler plant for heating. A network of trackage provides for the movement and storage of the subway trains in the area.

The main lighting of all buildings is by two lamp, 48 inch industrial fluorescent fixtures with anodized aluminum reflectors. The fluorescent fixtures in the main shops are supported and fed by single phase trolley ducts suspended from a messenger. This arrangement provides a flexible and neat lighting layout.

In the wash bay area of the Rolling Stock Building, where the washing of the external surfaces of the subway trains is done, the fluorescent fixtures are of the enclosed vapour proof type, because of the excessive moisture conditions that may exist in this area.

The outside trackage at Davisville is illuminated by narrow and medium beam spread enclosed floodlights, on two sixty foot steel poles. Again all outside wiring is underground in a network of ducts below the surface of the yard.

#### Distribution of d-c. Traction Power

The Yonge Street Subway was designed to attain its ultimate capacity with a maximum service of eight car trains at a two minute headway, or thirty trains per hour in each direction. However, initial operation was planned with a peak load service of approximately sixty per cent of this maximum. The number of subway cars purchased and the facilities for the supply and distribution of traction power to these cars were based on initial service requirements, with provision for the future extension of these facilities when warranted.

The subway cars were designed for operation on an average of 550 volts, direct current, the same voltage as used by the surface streetcars and trolley coaches. The direct current is supplied from modern automatic rectifier substations, which also supply surface routes in their respective areas, and is distributed to subway cars by means of a positive contact rail.

#### Calculation of Power Requirements

The subway route is approximately four and one-half miles in length with twelve passenger stations and an average of 2.4 stops per mile. The weight of a fully loaded subway car is approximately 114,000 pounds, and each car is equipped with four 68 horsepower motors. A service with six-car trains at a 2.5 minute headway is proposed for initial operation, with an average of 30 second stops at intermediate stations.

Speed-time and current-time curves were drawn for northbound and southbound runs based on the physical characteristics of route, car characteristics supplied by manufacturer and proposed operation. From these curves it was computed that, for the combined runs, the average demand per car would be 102 kilowatts and the average consumption per car mile would be 6.7 kilowatt hours at the car including auxiliaries and electric heating during winter months.

It was also computed that 13.8 six car trains, exclusive of those laying over in terminals, or an average of 83 cars would be required in operation on the route to maintain a 2.5 minute headway. The total expected demand at the car would therefore be 83 cars at 102 kilowatts per car or 8,466 kilowatts.

The addition of calculated line and conversion losses to this figure resulted in a total expected a-c. substation demand of approximately 9,800 kilowatts. The average current of a six-car train was computed to be 1,110 amperes, with a maximum during acceleration of approximately 4,000 amperes. Similar calculations were made of expected loads on individual feeder sections to determine loading on individual substations.

#### Rectifier Substations

Direct current power is supplied to subway cars at an average of 550 volts from five substations located along route, with provision for the addition of one substation and the doubling of capacity of another substation when warranted by future requirements.

All of these substations are equipped with modern mercury-arc rectifier units including sealed glass bulb and sealed steel tank types. The standard size of rectifier adopted is a 1,250 kilowatt unit for Class III Railway Service, with an overload capacity of 150 per cent for two hours, or 300 per cent for five minutes following rated load.

Substations are of unattended type, and function completely automatically under normal operation. Over-riding control and supervision of the substation equipment from a central power dispatcher's office is provided by a modern supervisory control system. Sixty cycle, three phase power is supplied to substations at 13,200 volts by the Toronto Hydro-Electric System.

Outgoing direct current feeder breakers supplying the subway are of semi-high-speed type, with a capacity of 3,000 amperes and an interrupting capacity of a potential 150,000 amperes. Each breaker is equipped with impulse and rate-of-rise tripping devices, designed to distinguish between normal accelerating currents in excess of 5,000 amperes and short circuit currents at remote points on contact rail. The feeder breakers are also equipped with load measuring and automatic reclosing devices.

#### Sectionalization of Feeders

For the segregation of trouble and to facilitate maintenance, the contact rails on northbound and southbound tracks are each divided into six feeder sections, a total of twelve sections exclusive of the Davisville Yard, averaging .75 miles in length. Division points between feeder sections are arranged to coincide with locations of five intermediate crossovers installed to facilitate operation under abnormal conditions.

Each of the twelve feeder sections may be individually isolated, automatically due to overload conditions, by supervisory control from load dispatcher's office for maintenance or other purposes, or by the operation of one of the emergency alarm boxes spaced at regular intervals along the route in the event of emergency that makes it desirable to cut off power to the contact rail.

Each feeder section is normally fed at both ends, in most cases, by direct feeders from two adjacent substations. In other cases, they are fed firectly from substation at one end and indirectly, through tie breaker, from the adjoining feeder section at the other end. Tie breakers between the heavier loaded northbound and southbound feeder sections made it possible to take advantage of diversity of load between sections.

The Davisville Yard and Shop area is also divided into three feeder sections, separately fed from the Davisville substation. In addition, disconnecting switches are provided in the yard for the isolation of contact rail on individual tracks.

#### Positive Contacts and Return Rails

Power is distributed to the subway cars by means of a positive contact rail. The contact rail is of 150 pound mild steel with a conductivity equivalent to approximately 2,500 M.c.m. of copper. It is located 4 1/16 inches above and 22 inches outside of the running rail, for the most part on the left hand or inside, but at terminals with centre platforms and at crossovers on the right hand or outside.

The rail is mounted on dry process porcelain insulators at approximately eight foot centres. Expansion joints are provided at approximately 1,000 feet intervals. The rail is anchored midway between these expansion joints, but is allowed to move longitudinally between anchor points.

At frogs and crossovers in track, gaps are provided and inclined approaches installed on contact rail, enabling the current collectors on the cars to leave contact rail while passing over switch points and crossings and to then smoothly re-engage the contact rail.

Between separate feeder sections a gap is provided of sufficient length to prevent the bridging of sections by the front and rear current collectors on a car. The contact rail is thermit-welded, eliminating the ne-

**Fig. 3. A 600-volt d-c. breaker board in a typical automatic rectifier substation.**

cessity of bonded joints, except at expansion joints and gaps in rail where bonds are provided.

The contact rail is protected by an eight inch wide board mounted $3\frac{1}{2}$ inches above rail and supported, at same interval as contact rail, by steel forgings. This protection board is designed to prevent, as far as possible, accidental contact with rail and, in open cut sections, the formation of sleet on rail.

The negative return circuit is provided by one of the running rails of each track, the other rail of each track being insulated from the return rail for operation of signal circuits. Each return rail is of 100 pound cross section, with a conductivity equivalent to approximately 1,000 M.c.m. of copper. The running rails are also thermit-welded, eliminating the necessity of bonded joints except through special work.

In longer feeder sections the capacity of each return rail is reinforced by the installation of a 1,500 M.c.m. parallel copper feeder on the centre wall in the train tube, under the platform edge in stations, and in underground duct in open cut and crossover sections. The return rails and reinforcing feeders are bonded together at approximately 400 foot intervals through tunnel sections, and 800 foot intervals in open cut sections.

#### Feeders and Connections

Positive and negative feeder connections from substations to subway structure are provided by 1,500-M.c.m., plastic insulated cables run in underground conduit. In the subway structure actual connections between feeders and contact and return rails are made by 500 M.c.m. extra flexible, rubber insulated, neoprene jacketed cables, which are welded to the rails.

Two 1,500-M.c.m. positive cables, terminating in four 500-M.c.m. cables, are provided from each substation feeder breaker to the contact rail of each feeder section. The 1,500-M.c.m. negative cables from the substation bus terminate at a negative bus in the subway structure, from which reinforcing cables are run and from which connections are made to the return rail by 550-M.c.m. cable. Bonds around expansion joints and gaps in contact rail are provided by four 500-M.c.m. cables.

The insulation of 1,500-M.c.m. cables consist of 10/64 inches of PVC (polyvinol chloride). The insulation of 500 M.c.m., extra flexible cables consist of 6/64 inches of ozone resisting rubber plus a 5/64 inch neoprene jacket.

#### Car Current Collection

Each car of the subway train has its own traction motors, and collects its own power from the contact rail. There is no 600 volt train line or connection between the individual cars of a train. Four current collection devices are provided on each car, one on each side of both front and rear trucks, enabling the car to pick up power from contact rail mounted on either side of the track, and to retain contact while passing over short gaps in the contact rail at special track work.

Each current collection device consists of a malleable iron shoe, which slides along the top of the contact rail. The shoe is hinged to its support, and is pressed against the rail-head by an adjustable tension spring. Provision is made in the support of the shoe for vertical adjustment, to compensate for wheel and rail wear.

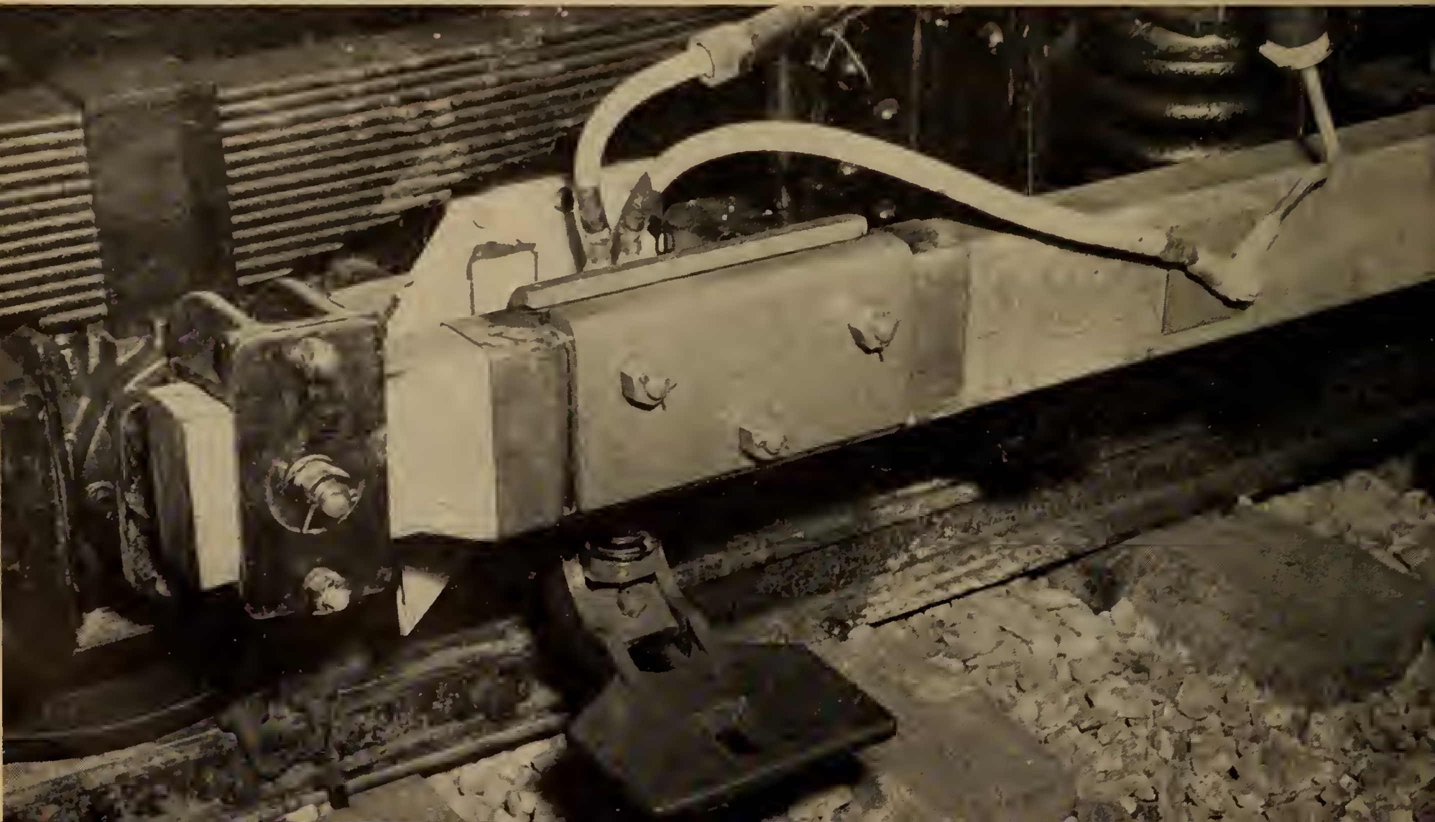
A fixed stop is provided to limit the maximum downward movement of shoe, and thus prevent it from making contact with the running rail or wayside equipment while not engaged with the contact rail. This stop also retains shoe at proper elevation to smoothly engage inclined approaches to the contact rail.

Each shoe is supported on a varnished ash beam, and adjacent parts of the truck are protected from flashing by insulating guards. The two shoes on each truck are connected by a conduit-enclosed cable and thence, by similar type connection, to the main and auxiliary fuses on the car underbody.

#### The Supervisory Control System

In order to keep pace with the steadily increasing traction power demands of the system as a whole, including the subway, a programme of installation of modern automatic rectifier substations is being carried out, while obsolete manually-operat-

Fig. 4. Current collecting device on subway car.



ed substations are being abandoned. The operation of the subway involves the use of auxiliary electrical equipment for lighting, drainage, ventilation and heating, in addition to that required for the distribution of traction power.

For centralized control and supervision of this equipment a supervisory control system of the coded-frequency type has been installed. The supervisory control system is divided into two distinct sections, one controlling equipment in traction power substations and the other traction and auxiliary power equipment in the subway.

The substation system, embracing twenty-three automatic rectifier substations supplying subway and surface routes, provides control and indication of the a-c. line, rectifier and d-c. feeder breakers. It provides indication only of incoming a-c. line potential, rectifier firing and lockout circuits, outgoing d-c. feeder breaker load measuring circuits and the semi-urgent alarm annunciator.

In addition it provides telemetering facilities for as-called-for indications of individual rectifier loads and d-c. bus voltage. Also included is continuous indication of individual substation loads and totalized substation load for the system.

The subway system provides control and supervision of electrical equipment in, and adjacent to, the twelve passenger stations along the route of the subway. For control purposes the subway has been divided into four zones of three stations each, with the supervisory equipment for each zone being located in the a-c. switchboard room of the middle station of the three served.

The system provides control and indication of traction power feeder breakers, reversible ventilating fans, off-peak station heaters and open-cut lighting. It provides indication only of the continuity of normal and emergency auxiliary power services, low emergency battery voltage, emergency lighting transfer contactor, high water level and pump motor overload at drainage sumps and supervision of the emergency alarm system.

The dispatching equipment for both the substation and subway supervisory control systems is located in a separate room of a building on the Commission's Hillcrest property, which is the approximate centre of the system as a whole. Features of the control room include fluorescent lighting, acoustic treated ceiling and temperature-controlled air conditioning.

The dispatching equipment is in the form of self-contained stand-up-to-operate cubicles. The substation cubicles are of the straight front type, arranged to form a U-shaped board. Bench type cubicles are used for subway control, complete with an electric map. The four zone cubicles are mounted side by side, so that a complete picture of the subway results, showing the condition and relative position of all auxiliary equipment, including the emergency alarm boxes.

Remote station supervisory control equipment of the free standing cubicle type is located in each of the automatic substations and at each of the four zone control centres in the subway.

One pair of interconnecting wires from the control room to each remote station equipment is all that is necessary for complete operation. However, an extra pair is run as a spare channel, in case of failure of the operating pair. A third pair is included to each substation for station load telemetering and totalizing purposes.

These control pairs are No. 19 B&S paper insulated, and form a part of multi-conductor lead covered cables installed for combined use with the private automatic telephone system. Double throw switches, mounted in each supervisory equipment cubicle, are utilized to facilitate quick transfer to the spare channel.

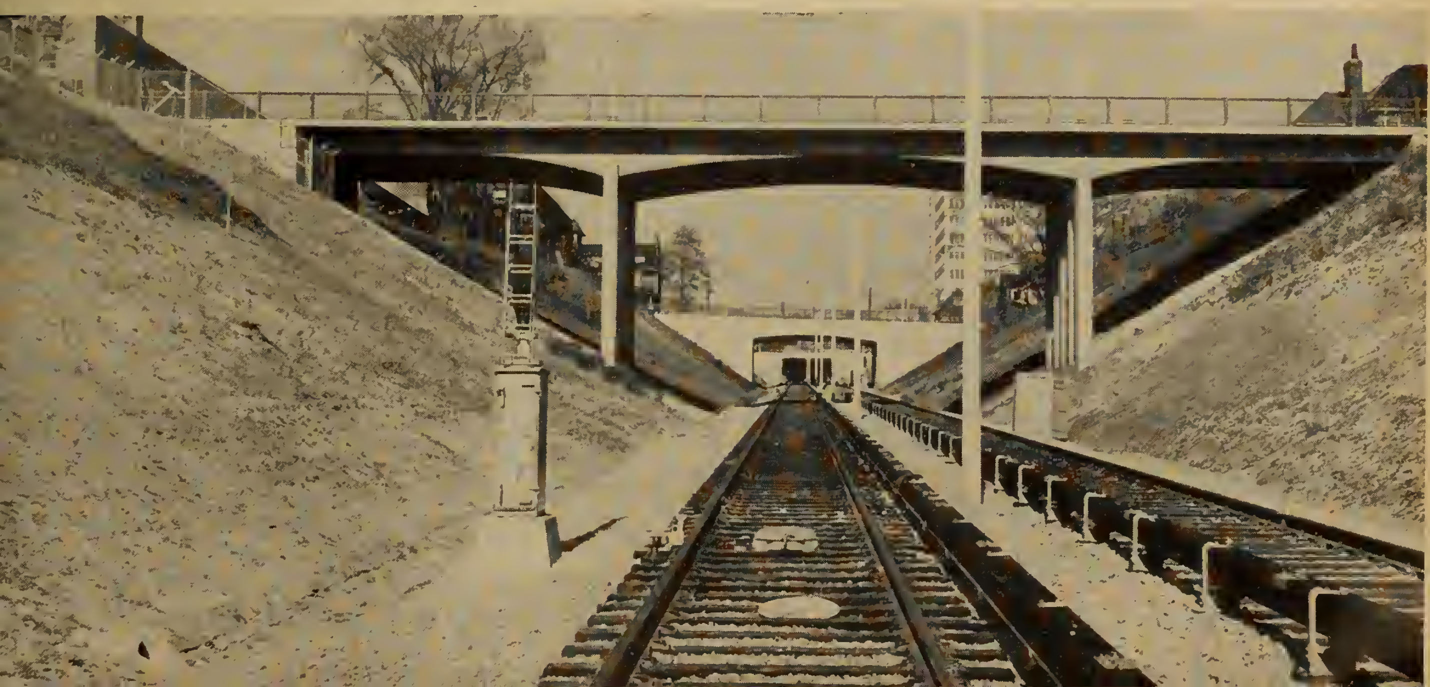
Except for the dispatch equipment signal-lamps which are a-c. fed, the supervisory system is operated entirely on 129 volt d-c. supplied by control or emergency batteries located in the substations, the zone control centres and at the control room. In case of failure of the signal lamp a-c. supply, provision is made for transfer to battery operated converters.

#### Auxiliary Equipment Control

The actual control of the subway auxiliary equipment is done by direct wire supervisory, from the zone control centres to remote supervisory boxes located adjacent to the controlled equipment, and containing all the necessary interposing and supervising relays.

In this system of supervisory control, a frequency code, made up of various combinations of four available frequency tones, is allotted to each desired device operation. To guard against possible splitting of a pulse causing a wrong operation, two pulses of the same frequency are never used consecutively in a

**Fig. 5. Typical open cut section showing the location of the contact rail and automatic block signal.**



code. Otherwise all combinations of the four frequencies, four at a time, are available for control functions.

The total number of different operations which may be performed is thus the product of the possible combinations or one hundred and eight. By increasing or decreasing the number of available frequencies or the number of frequencies used in each code, the maximum number of operations possible may be altered to suit the particular application.

The frequency tones are produced by a very stable electronic signal generator. The frequencies used are in the low audio range (200-450 cycles per second), and are carefully selected so as not to approach any possible power frequency harmonic.

A control escutcheon, for each device to be operated, is provided on the associated dispatch cubicle panel. On this escutcheon is mounted all the controls and indicating lamps associated with the complete operation of the device. The basic control escutcheon is comprised of a green lamp to indicate trip or off, a red lamp to indicate close or on, a two-position selector switch to select the desired position and a push-button to initiate the operation.

A white lamp is provided to indicate disagreement between the indication displayed and the actual condition of the remote device. The dispatch elements of the equipment are the signal generator to supply the four audio pulses, a signal divider to control the duration of each pulse and the push-button-selector switch combination to initiate the transmission of the frequency code.

The actual make-up of the codes is preset in the equipment. The remote station elements include four frequency-responsive relays for decoding of the transmitted signal, selector relays for selecting the proper interposing relay and the interposing relays themselves for final operation of the device.

To perform an operation the operator sets the control escutcheon selector switch assigned to the equipment whose operation is desired, and then presses the push-button. This starts the rotation of the signal divider which keys the signal generator, causing it to transmit a particular code of four frequency tones. At the remote station these are decoded by the frequency-responsive relays which operate the selector relays in sequence, thus operating the proper interposing relay.

The energizing of this relay operates the desired device. The action of position change of the device itself causes a checkback pulse to be sent while the push-button is still held down, thus changing the indication displayed at the control room to conform with the new condition of the device. The time elapsed during the operation is two seconds plus the operating time of the device.

The equipment provides indication of automatic operation of any of the remote equipment by the use of dispatch and remote station step switches and polarity-sensitive relays. Automatic reclosures of feeder breakers, which occur within the operating time of the supervisory control equipment, are indicated by a flashing of the associated red "close" lamp. Provision is made for checking the condition of all equipment under control at any time.

Self-supervision features of the equipment include supervision of the remote line, incomplete sequency indication and blackout of the board in the event of false indication.

#### The Emergency Alarm System

The Emergency Alarm System forms a part of the Subway Supervisory System and provides, at intervals of a few hundred feet throughout the subway route, means for the quick removal of the 600 volt traction power from the contact rail in the vicinity of each alarm box. Thus, in the event of an emergency such as a wreck or a fire, the motorman or other employee can quickly de-energize the contact rail so that the passengers can leave the train and walk safely to the nearest station.

The operation of an alarm box will cause the removal of power from the rails over a section extending at least to the far limits of the two passenger stations either side of the box location. A total of seventy-four alarm boxes are employed. The action taken to operate the boxes is similar to that used with the city fire alarm boxes. To facilitate the locating of the boxes in an emergency, each is identified by a blue light, the colour blue being used to avoid confliction with the signal system aspects.

The alarm circuit consists of a pair of normally open mercury contacts operated by a spring return lever in the box with a two wire interconnection to the particular supervisory zone centre where, by the use of multi-contact relays, the breaker tripping combinations are made.

Indication of box operation is executed by the supervisory control. It will appear at the control room in the form of an audible alarm and the illumination of a blue lamp on the subway control panel and on the electric map. From here the operator will be informed which box was operated, and where in the subway the trouble has occurred. The position change of the affected breakers will also be displayed.

A private telephone is provided at each alarm box location to connect with the supervisory operator, for explanation of the trouble so that he may take the proper action.

Due to the self-sealing feature of the alarm relays, momentary contact at the alarm box is sufficient to initiate a tripping sequence. Indication of an alarm box operation will be displayed at the control room until reset by the operator. This reset action will also return control of the breakers, so that they can be reclosed as the situation allows.

In the event of an alarm box lever jamming in the operating position, or in the case of a short on the interconnecting wires, the breakers can be reclosed after operation of the reset. The box indication will remain displayed, however, until the circuit has been cleared. Of the breakers tripped by this system, approximately half are feeder and tie breakers located in the various subway breaker rooms. The remaining breakers are located in the automatic substations which are close enough to the subway route for direct feed to the contact rails. These breakers are under control of the substation supervisory system.

The trip circuits are extended to the supervisory equipment in these stations where connections are made for proper breaker tripping execution. The system, being a part of the subway supervisory system, and similarly zoned, operates on 129 volt battery supply via the zone control centres. Ground detection to 100,000 ohms is provided on all trip circuit conductors.

#### Communications

To facilitate a high standard of communication between the various properties of the Commission, a complete 400 line private automatic telephone system has been installed, of which 136 are located in the subway. The system is of the selective talking, selective ringing dial type, and operates over an extensive multi-conductor lead-covered cable network shared by the supervisory control system. The conductors are No. 19 B&S double wrapped paper insulated.

An automatic switchboard complete with uniselector, group and final selector racks equipped for four hundred line circuits, is located in a separate room adjacent to the supervisory control room at Hillcrest. The room is kept dust-free by the use of a precipitron-fan unit. The various exchange equipment failure alarms are repeated in the supervisory control room for continuous supervision.

A feature of the exchange is the use of uniselector or pre-selector switches in place of the usual line finder types. In this system each line is provided with an individual line switch which hunts for and connects to an idle first selector when a call is made. This system is faster than the more commonly used line finder type.

The connection time, in itself, is not so important, but since few people check for dial tone, premature dialing will involve further time for re-dialing. In this equipment dial tone is almost coincident with the lifting of the telephone receiver, which makes for faster communication, an important feature particularly in the case of emergency calls.

Another feature of the equipment is the provision of conference facilities. Conference line circuits to certain telephone instruments, in addition to the system line pairs, provide a common talking line over which telephone conferences can be held.

### The Subway Signal System

In the operation of the Yonge Street Subway, trains of from six to eight cars will be used. A train of eight loaded cars weighs approximately 400 tons. Since its average speed will be in the region of 30 m.p.h. the minimum safe stopping distance is about 450 feet. Thus, in order to operate the service safely, a train operator must have warning of conditions at least 450 feet ahead.

In order to ensure this, a complete signal system has been provided. The basic unit of the signal system is the track circuit. One of the two rails on which the trains run is bonded continuously, throughout its length, to serve as a traction power return conductor. The other rail is divided into sections corresponding to safe braking distances for a train, each section being electrically insulated from the other by the insertion of insulated joints.

A low voltage alternating current is fed into both rails at the leaving end of each block and taken from the rails at the entering end through the coils of a double coil a-c. relay, which is thus energized. When a train enters the track circuit, the wheels and axles shunt the current from the relay, which consequently becomes de-energized. Contacts on the relay are used to control the aspects of the block signals.

At the beginning of each block a signal is located to govern entry to that block. These automatic block signals are of the three-aspect colour light type. A green light is for the "proceed" indication, a yellow light is for a "caution" indication, permitting a train to proceed prepared to stop at the next signal, and a red light is for "stop". The operation of these signals is automatic, the indication displayed being determined by the presence of trains in the various blocks.

In order to enforce obedience to signals displaying the "stop" indication, a train-stop machine is associated with each signal. This machine is mounted at track level at each signal location, and has an arm which is held in the "clear" position whenever the signal is green or yellow. When the signal is red, the arm is raised to a tripping position to contact a trip cock, which extends down from the front right-hand side of the leading car of all trains. Displacement of the trip cock initiates an emergency brake application, bringing the train to a stop.

A train in passing a signal is at once protected by having that signal display a red aspect. Since it is possible that a train may be stalled only a few feet beyond this signal, in order to provide a full block protection, the next signal to the rear must also display a red aspect.

Each signal then, is under control of its own block and the next one ahead also. It is thus evident that, in normal operation, a train approaches a red signal when two blocks to the rear of the train ahead; it approaches a yellow signal when three blocks to the rear, and at a distance of four blocks to the rear it will approach a green signal.

In line with modern signalling practice, the signals in Toronto's subway will be arranged to permit a train to proceed past an automatic red signal at restricted speed, after it has come to a full stop. This arrangement, known as automatic key-by, is for the purpose of allowing a train to close in on the train ahead at station stops or under abnormal operating conditions.

At certain locations where the physical conditions require speed restrictions to be enforced, special time controls are inserted into the signal circuits to ensure that trains traverse the section of line concerned at no more than the maximum safe speed limit shown. If this safe speed is not adhered to, the signal in advance of the trains will not clear and the train will be forced to stop.

### Interlocking Home Signals

At the Union and Eglinton Terminals, and in the Davisville Yard area, where track switches exist, as it is not always possible to provide the braking overlap necessary for the standard automatic signals, interlocking home signals are used. These signals consist of two three-aspect units and one single-aspect unit mounted one above the other.

The top unit displays an indication determined by the track occupancy ahead and conveys to the motorman the same information as the automatic block signal. The central unit indicates the route which is set up, green for principal or through route, yellow for secondary or divergent route or red for stop, when the top unit indicates stop. The bottom unit is a yellow aspect.

This last indication is the call-on signal, and is used for closing-in moves when the block and route signals are at stop, and the block is occupied. Again, automatic train stops will enforce obedience to the stop indication. However, at the interlocking signals, no provision for automatic key-by is made as the stop indication is absolute. Should a red-over-red-over-yellow call-on aspect be subsequently displayed, a manual release must be operated to clear the train stop before a train may proceed.

At certain locations, particularly in Davisville Yard, the delay occasioned by carrying out this procedure on a busy track would slow down traffic movements too much. In such cases the call-on displays a flashing yellow aspect, with the train stop in the clear position.

Interlocking dwarf signals display red or yellow aspects, and are provided to govern speed-restricted back-up moves within the yard and tail tracks. These signals are manually controlled and do not normally have train stops associated with them.

To facilitate emergency traffic movements, in the event of a blockage of the main track, crossovers controlled by electrically-locked hand-throw switch machines are provided at four locations along the subway route. Small control panels, in conjunction with the electric locks on the switch machines, ensure that movements through the crossover cannot take place unless all main track movements in the section concerned have been brought to a stop, or the area is clear of trains.

All main track switches other than those at the emergency crossovers are operated by means of electrical switch machines. The operating power used is 110 volts d-c.

Interlocking plants are located at Union and Eglinton terminal stations and at Davisville. The switch machines and signals at the Union plant are controlled by an interlocking machine located in the signal room at Union Station. The Davisville interlocking plant is controlled by a machine in a signal tower at the south end of the station east platform. The Eglinton terminal plant is also controlled from this tower.

The interlocking machines consist of a control board, upon which is displayed a representation of the track layout, showing switches and signals within the limits of the plant together with all the necessary indications. The track diagram is illuminated according to the track sections, to show the presence of a train as it approaches and moves through the plant. The setting up of switches and signals for the routes is done by the use of multi-position control keys provided on the diagram at each signal location.

A signal operator will be in attendance in the signal tower for operation of the Davisville interlocking. The Union and Eglinton areas will normally be under automatic control.

#### Automatic Train Dispatchers

As an added feature of the system, the dispatching of trains from the two terminals is to be done by the use of automatic train dispatchers. These units, developed by the Philadelphia Transportation Company, are electronic in principle. They consist of a length of 35 mm. film punched with holes, which are spaced according to the desired schedule times and driven at constant speed by a synchronous motor.

A light source and photo-electric relay unit, two rotary stepping switches and a repeat relay for connection to the signal system are incorporated in the unit. In operation the film, driven by the synchronous motor, is made to pass between the light source and the photo-electric relay unit. Two rotary stepping switches and a repeat relay for connection to the signal system are incorporated in the unit.

In operation the film, driven by the synchronous motor, is made to pass between the light source and the photo-electric unit. Each time a hole is encountered, the light source will be uncoverd, causing operation of the photo-electric unit. This in turn will cause one of the rotary switches to step one contact. Normally the two rotary switches are in step, holding the repeat relay in an energized condition.

The out-of-step condition of the switches now existing will cause the repeat relay to drop out, thus starting the time delay unit to obtain signal clearance for setting of the departure route. The departure of the train concerned from the terminal will cause the second switch to step one contact. This brings the switches back in step and picks up the repeat relay, in readiness for the next scheduled departure. The rotary switch under the control of the photo-electric unit is thus stepped ahead as a function of schedule time.

The other switch is caused to step only upon the departure of trains. In the event of a delay in service, the first switch will continue to step around according to the scheduled time, even though no trains are departing. The second switch will be left behind, and will not step during the delay. The trains, when they do arrive, are dispatched immediately, independent of the schedule.

When a sufficient number of trains have arrived and departed to bring the switches back in step, the repeat relay will again be picked up, and the last train to arrive will be dispatched on schedule. Means are provided for cancellation of the automatic dispatcher control, in the event of a serious tie-up, at which time dispatching can be done manually. The dispatcher units are designed for mounting close to the interlocking machines, with a multi-contact plug connection being made thereto.

**Fig. 6. Automatic train dispatcher.**

For convenience of maintenance all relays used in the system are of the plug-in type. Interlocking and signal control relays operate on 24 volts d-c. and switch indication relays on 110 volts a-c. Track relays which have two windings operate on 3 volts and 110 volts a-c. At the interlocking plant locations the relays are mounted on racks in the signal relay rooms. At all other locations the relays are housed in instrument cases, one case for each signal location.

The signal lamps operate on 12 volt a-c., supplied by small individual air-cooled transformers mounted in the signal head behind each colour lens. Signal line controls in the subway are carried in multi-conductor cables which, together with the 2 conductor a-c. and d-c. power cables, are run on messenger wire, on ceiling brackets and in underground ducting. In the open cut sections cables are buried in the sub-grade.

Electrical power equipment is located at each interlocking plant and at four intermediate points along the route. At each location, duplicate transformers feed 110 volts through an automatic transfer switch to the a-c. signal mains. Two rectifiers connected in parallel feed power to the d-c. signal mains at 24 volts. At the three interlocking power supply locations a 110 volt battery and charger is used for supply to the electric switch machines.

The a-c. signal mains feed the interlocking machine lights, all signal lights, train stops and the track circuits. The d-c. mains feed the relays at interlocking plants and all intermediate signal control relays. √

# Cars, Shops and Mechanical Equipment

*by*

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In this paper the author discusses the rolling stock, listing the precautionary measures taken to insure safety. The shops and yards are described, and the mechanical equipment for heating, ventilation, escalators and drainage of the subway are explained.

In the construction of Canada's first subway the Toronto Transit Commission has drawn upon the knowledge and experience of a great many individuals and firms. It has sent representatives to study methods in effect in many cities of the world where rapid transit service is provided. It has collaborated with operating and manufacturing companies to obtain the most modern methods, equipment and plant for its patrons. And, as far as possible it has provided cars which combine efficiency, appearance, comfort, and above all, dependability and safety.

## Cars

The 104 cars for the Yonge Street subway of the Toronto Transit Commission were built in England. One hundred cars are of steel construction, whereas the last four utilize aluminum to the maximum practical extent, in order to determine if the economies due to lighter weight justify the additional first cost.

Significant dimensions of the cars are given below:

| | |
|---|---|
| Car Length—over bumpers | 57 ft. 1½ in. |
| Car length—over body | 55 ft. 7½ in. |
| Car width | 10 ft. 4 in. |
| Car height | 12 ft. 0 in. |
| Truck centres | 38 ft. 0 in. |
| Truck wheelbase | 7 ft. 0 in. |
| Wheel diameter—inches | 30 |
| Door openings—per car side | 3 |
| Door opening width | 3 ft. 9 in. |
| Door height | 6 ft. 4 in. |
| Seat capacity | 62 |

## Train Size

The cars are semi-permanently connected in pairs to form two-car units. This reduces both first cost and maintenance costs. Train size will vary with the traffic, up to a maximum of eight cars (four two-car units) which is the maximum number that can be accommodated at the 500-foot platforms provided at all subway stations. Operation of eight-car trains will accommodate some 40,000 passengers per hour in each direction.

### Car Body

The underframe, body and roof are of steel. The side panels are attached to the structure with countersunk rivets thus giving a smooth appearance. The floor is of ¼ in. rubber, laid on 1½ in. of cork fastened to a dovetailed steel sub-floor. This arrangement has excellent sound-deadening qualities. In addition, special sound-deadening paint is applied to the inner side of the exterior body panels, including a layer of fabric from floor to window bottom.

The seats, consisting of a combination of longitudinal and cross types, are arranged to provide adequate comfort, and rapid passenger movement at stations. The frames are of cast aluminum, to which is attached rubber latex cushions and rubberized hair seat backs, both covered with red plastic upholstery. A liberal supply of stanchions and ceiling-attached grab handles accommodate standing passengers.

There are three door openings, each of 45 in. clear width per car side. The sliding aluminum alloy doors are operated by pneumatic engines. Each abutting door edge is of rubber, and one leaf of each door opening in the closed position can be pulled open 4½ in. against a spring, in order to free any object that might get caught. Windows are arranged with the bottom half stationary and the top half movable vertically.

There is one driver's cab per car body, located at the coupling end. In effect this provides a two-car unit, 114 feet long with a cab at each end. This arrangement provides for double end operation, which is less expensive than it would be to provide underground turning facilities.

### Multiple-Unit Operation

The cars are equipped for multiple-unit operation. That is, in a train of any length, all cars are motor driven. When the controls in the leading car are operated, the motors or brakes of every car in the train respond simultaneously. This feature results in faster speeds, smoother and faster acceleration

Fig. 1. A southbound subway train shown as it emerges from Pleasant Portal, just south of St. Clair Ave.

and braking, and, in general, greater train efficiency.

#### The Guard

The guard is stationed in an unoccupied operator's cab on the platform side of the train. From this position he is able, by means of a full drop window, to view the station platform in both directions, and he has control of all the doors on that side of the train by means of push buttons.

#### Lighting and Heating

The lighting is provided by incandescent fixtures. The units are of the circular ceiling-recessed type, commonly used on modern street cars and trolley coaches. There are 47 fixtures in each car to provide an illumination of 18-20 foot-candles on the reading plane at 550 volts.

Forty-one of these lamps operate in 2 parallel circuits off the 600-volt power supply, while the remaining six are connected to the 50-volt supply from the storage batteries. In case of a power failure the battery-operated lights remain in operation to provide sufficient illumination.

Heating is furnished from underfloor current resistors of 30 kw. capacity over which air circulates to the car through seat pedestal louvres. Thermostatic control in three 10 kw. steps provides a temperature of 62-65° F. A combination of fresh and/or recirculated air may be obtained by adjusting the controls.

#### Propulsion and Braking Equipment

The four motors per car are rated at 68 hp. each, and are wound for 300-volt operation with two-in-series. The drive is by propeller shaft to a hypoid gear on each axle, similar to automotive practice and the P.C.C. car. This reduces the unsprung truck weight, thereby reducing noise and vibration.

Automatic acceleration is provided, with a choice of three rates under control of the operator. There are also three running positions: switching, series (half speed) and parallel (full speed). The maximum speed of an empty train on level track is approximately 50 m.p.h. although proximity of stations will seldom permit this speed to be attained.

The control is known as type PCM (Pneumatic Cam Magnetic), and is manufactured in England. It is very nearly identical with that used almost exclusively by the London Underground for many years. Its predominant characteristics are its compactness, simplicity and extreme reliability.

The car increases in speed from standstill by the cutting out of resistance placed in series with the motors. This is done by rotating a cam shaft automatically by pneu-

Fig. 2. A subway driver's cab showing the main controls and the indicating light panel.

Fig. 3. An interior view of the Davisville Shop.

matic pressure, the various cams operating electrical contactors. The control, and various low voltage devices are operated from a battery which is charged from a motor generator set.

The braking is by compressed air operating on brake shoes on the wheels. It is practically identical with that used on the London Underground System. The system is of the electro-pneumatic type, that is, the application and release of air to the brakes of each car is controlled simultaneously to all cars from the operator's position by electric wires.

This ensures that all brakes on a train operate simultaneously, and those on a long train as quickly as on a short one. In the unlikely event of a failure of the electric portion, the same functions can be performed—but not quite so rapidly —by straight pneumatic means.

A unique feature is a retardation controller. In principle, it is two mercury "U"-tubes located in each cab and having electrical contacts, which are made or broken by the movement of the mercury. It operates in two ways: (a) Initially, to prevent the application of more air if or when a predetermined braking rate has been obtained, and (b) further, to exhaust air if the rate tends to exceed the predetermined rate of braking as a train decreases in speed. Its chief purpose is to bring the train to rest as smoothly and as rapidly as possible.

The braking mechanism consists of two brake shoes per wheel with one brake cylinder per shoe, or eight per truck. Each cylinder has an automatic slack adjuster. This arrangement, which reduces the amount of brake rigging required, also reduces noise and vibration and increases the uniformity of braking.

#### Trucks

The trucks are manufactured by the car builder, and are similar to those used in London, except for the modifications needed to mount two propeller-shaft driving motors per truck instead of one axle-hung motor. The frame is of structural and cast parts, assembled by a combination of welding and riveting. Anti-friction journal bearings and 30-inch solid steel wheels are used.

The suspension system consists of leaf springs and double coil helical springs, suitably connected for maximum passenger comfort. Spring-loaded friction pads provide suitable damping. A screw adjustment compensates for wheel and rail wear to keep the floor height uniform.

Each truck has a third rail shoe on each side for current collection from the top surface of the contact rail. Also, there is a pneumatic trip cock on each leading truck, and it is engaged by a corresponding wayside track trip to effect an automatic emergency stop if a train should be operated past a red signal light.

#### Connections Between Trains

The two cars of each unit are held together mechanically by a coupling bar together with a suitable amount of cushioning or "draft gear". The electrical and pneumatic connections are made by means of multi-conductor cables and hose lines respectively. The two halves of a unit will not be uncoupled except in the case of major shop repairs or maintenance. They are not exactly similar, but consist of an *A* and a *B* car. The *A* or pneumatic car contains the air compressor, while the *B* or electric car contains a 50-volt storage battery and a battery charging MG set.

The coupling between any two units is by means of an automatic electro-pneumatic coupler. The coupling and uncoupling are accomplished by remote control from within the cab of the moving part of the train. The coupler transmits the mechanical forces, the pneumatic brake lines and the electrical control. The contacts of the electrical control are protected by a metal cover in the uncoupled position, the cover being pushed aside automatically as the couplers engage.

#### Summary of Safety Features

In an underground system where multiple-unit trains operate at high speeds, frequent headways, and with rapid rates of acceleration and braking, all precautions must be taken to ensure that a very high degree of safety is incorporated. For that reason, the chief safety features of the system are summarized below in order to show the care that has been given this important subject:

The line is protected with an automatic block signal system, equipped with wayside track trips and interlocking in the yards and terminals, all designed to prevent trains from coming in contact with each other.

A system of underground telephones together with adjacent push buttons, permits contact with supervisory forces and permits power to be cut off from any section of track with minimum delay.

Brakes will be applied automatically on a train if a driver attempts to pass a red signal,

**Fig. 4. Davisville yard and station. Taken looking north, this affords a good view of the shops, the station platform, and the signal tower.**

releases his hand from the controls has his train break in two, or a guard or passenger operates the emergency cord in any car.

A train cannot start until all doors are closed.

A system of battery lights provides adequate illumination in every car in case of failure of the power supply. Front and rear marker lights would automatically remain lit also under such conditions.

A system of pantograph gates and chains prevents passengers from falling on the track between cars, either from the platform or when walking from one car to another.

A train cannot be moved, or connected to another train, or disconnected from another train, unless there is an adequate supply of air for braking.

There are two independent means of applying the air brakes. The system used normally has an indicating light to show that it is in good condition, similarly for the retarder that provides the high and uniform rate of braking. Also, by using electricity to effect application and release of all cars in a train, a long train can have its brakes applied as quickly as a short one.

Each brake shoe has its individual brake cylinder, 16 per car. Thus, failure of one, or even several, would still leave a substantial proportion to bring a train to standstill.

An exterior red light over the centre door on each side of each car indicates when any side door of the car is open. Similarly when not lit it indicates that the doors are closed. Likewise a dual-light indicator in the driver's cab and and guard's cab gives a green indication when all side doors are closed.

The abutting door edges at each side door opening are protected by soft rubber. Also, one leaf of each pair can be shoved open manually by about $4\frac{1}{2}$ in., in case of an object becoming caught.

Marker lights at the front and rear of a train are lit automatically in the performance of other functions essential to train movement.

A system of spring buffers between cars provides an uninterrupted and smooth floor between cars, thus minimizing dangers of falling and of accidents.

All compressors start and stop simultaneously, thereby ensuring equal division of load.

Each car has a plainly visible fire extinguisher.

## Shops

An area of some fifteen acres adjacent to Davisville Station is devoted to the car storage area, the car maintenance building, the maintenance of way building and the heating plant. The car maintenance building, referred to as Davisville Shop, is of concrete, steel and brick construction, with precast concrete roof sections. East and west walls are of glass brick to permit maximum use of natural illumination.

Heating of the building is by ceiling-suspended blast heaters, each one thermostatically-controlled, supplemented by radiant heating in all pit floors, offices, washrooms, storerooms, locker and lunchrooms. Fluorescent lighting is used throughout, both for the general illumination and in the pits.

The two westerly shop tracks are separated by a wall from the rest of the building to form the car cleaning section. The first track contains an automatically-controlled motor-driven car washer, having brushes to wash both sides and the roof, as well as a detergent spray to be used when required. The entrance and exit doors of the wash track are under electric eye control. The second track is for car storage during the daily car interior cleaning.

The next two tracks are in the inspection section, have doors at both ends and will accommodate a total of four four-car trains. With pits of 56-inch depth below rail head and with the devil strip 32 inches below rail head, practically all underbody and truck inspection is done at eye level. Steel balconies at car floor height permit entrance to the cars for interior inspection.

In addition to fixed lights, the pits are equipped on 18-foot centres with outlets for electricity and compressed air. One of the pits in the inspection section has a water-wash dust-collecting unit by which dust can be blown off the underbody equipment and removed without creating dust in the surrounding shop air.

The wheel control section occupies the next two tracks, each track being over a pit and having capacity for four cars and containing a high-speed pit-located wheel grinder. The wheel grinders, of T.T.C. design and manufacture, will be used to maintain tread and flange contour, to control flange height and to grind out tread flat spots, all without removing wheels from the trucks.

This practice has been developed to a high degree on the Commission's surface cars, and is believed to be the only known case where control of the contour of subway car wheels will be maintained with the trucks and wheels in their normal position.

The repair section occupies the remaining three westerly tracks in the building. Two of them have 220-foot pits while the third, at floor level, is used for wheel and axle storage, truck repairs and motor changing, etc. A drop table serves all three tracks and provides means whereby truck replacement can be made rapidly. By spotting a train so that the defective truck is on the drop table, it may then be disconnected from the body and lowered on a carrier to a transverse track connecting with an underground truck storage area.

A floor-controlled motor-driven travelling crane is located above the wheel storage track and it, together with a hydraulic hoist at the end of the same track, provides adequate facilities for handling of heavy parts and for their transfer to and from an automotive truck in connection with the heavy repairs which will be done at Hillcrest.

There is no third rail power supply in the shop except in the car cleaning section where workmen are not in proximity to live parts. Instead, power to move and to test trains is by ceiling-mounted overhead conductors parallel to each track and from which hang insulated cables running on trolley wheels on the conductors. The lower end of the cable may be exposed when required for connection to a car for movement or test.

The boiler house is situated at the south of the yard, and supplies heat for the station and shop. Two stoker-fired boilers are fed from bins, in which coal is dumped directly from railway hopper cars on the siding above them.

The maintenance of way building is heated separately by an oil-fired boiler. It contains facilities for the receipt, storage and delivery of track parts, and for necessary repairs to them. Like the boiler house, it is connected with the belt line of the C.N.R. Beside it was built a permanent ramp for unloading the subway cars which were received mounted upon railway flat cars.

The yard has sufficient tracks for car storage, for movement to and from the running tracks, for increasing and decreasing train size at Davisville Station, for wyeing cars if required, and for the storage and movement of service cars.

This yard contains 19,000 feet of track and 41 switches, of which 16, affecting movement to and from the running track, are electrically-controlled from a signal control room overlooking the yard. Communication between the control room and the yard is by telephone and by an oral two-way communication system.

Fire protection of the yard is by fire monitor towers, augmented by hydrants. The fire alarm boxes throughout the area are connected with the Toronto Fire Department and the location of any alarm sent in is recorded in the signal control room for the attention and action of the operator there.

The contact rail in the yard is protected by a wooden cover board, as it is throughout the system, for the protection of workmen. A system of push buttons will disconnect the power from the entire area instantly, while various sections of the yard can be isolated individually by knife switch for maintenance or other purposes.

## Mechanical Equipment

### Heating

Heating by thermostatically-controlled forced hot air has been

**Fig. 5. An escalator at Queen Station.**

provided for all public areas in the surface stations. In the smaller of these stations the heat source is by hot water from off-peak 600-volt d-c automatic heating boilers, arranged to be cut off by supervisory control whenever traffic power demand reaches a predetermined value. In the larger stations or where steam heat is available, it is obtained from steam boilers.

All ticket booths and washrooms are electrically heated by hot air blown over resistance heaters under thermostatic control. Heating of the cars and repair shops is described in the corresponding sections. Heating of the public areas in the underground stations is considered unnecessary, due to the heat generated by the trains, lighting and passengers, also due to the protection and distance from the outside atmosphere.

#### Ventilation

Subway ventilation is necessary to dissipate, particularly in warm weather, the heat produced by trains, lights and passengers; to relieve blasts of air produced at stations by moving trains; to circulate air to provide moisture relief; and to exhaust objectionable fumes or smoke.

Moving trains produce in the tunnels a "piston action" which forces air ahead of them and produces most of the ventilation required. In the downtown tunnel section it was considered necessary to have openings to the surface at intervals of about 500 feet in order to dissipate the heat and to reduce air movement in the stations.

Accordingly, at both sides and both ends of each station in this area, vent shafts were provided to the surface. These are rectangular openings about 35-feet in vertical height, extending from rail level through manually-adjustable louvered openings in the wall and terminating in sidewalk gratings of 106 square ft. free openings.

Supplemental forced ventilation has been provided in the form of thirteen remote-controlled motor-driven reversible fans, each of 50,000 c.f.m. capacity, located in the tunnel side walls midway between stations. By means of closing or opening louvres in the vent shafts and operating one or more fans, it is possible to exhaust smoke or fumes from any section of the tunnel.

The fans are surrounded by louvres through which air flows when the fans are stopped, but which close automatically when the fans are started. Individual forced ventilation has been provided in all washrooms, ticket booths and battery rooms.

#### Escalators

Thirteen escalators have been installed at various stations in accordance with the amount of traffic or the lift involved. Provision has been made for the installation of others if found to be necessary.

Mounted on heavy steel trusses with drip pans beneath, and each with a capacity of from four to eight thousand persons per hour, the escalators are reversible to provide for changed traffic direction during the day. There are two widths, 32 and 48 inches, and the rise between nine and seventeen feet.

The escalators are equipped with all of the latest desirable features, including many safety devices. Emergency stop buttons are located at the upper and lower landings and also at the ticket booths. Also, an automatic stop will be made if any foreign object becomes lodged in the floor tread, or if any handrail or driving chain becomes slack or broken.

Mechanically-applied and electrically-released brakes on motor shaft and main drive shaft can make an almost instantaneous emergency stop. All steel is grounded to prevent the build-up of static electricity. The stainless steel covered balustrades and stainless steel trim are attractive in appearance and easy to maintain.

**Fig. 6. Looking up into the vent shaft at the north end of St. Clair Station platform.**

#### Drainage

The drainage system for the subway was designed and constructed to permit proper drainage of water from the usual sources, such as rain water from open vents and stairs, seepage through the structure; as well as the water from broken water mains, flooded streets, et cetera.

Floor drains and catch-basins are located so as to intercept water and direct it to a main which is usually from about 4 to 6 feet below the top of the subway rail. Manholes, spaced from 160 to 360 feet apart, provide for branch connections and cleaning. One manhole at each station is deeper than usual to provide for the collection of silt.

As the downtown portion of the subway is below the level of the city sewers, all drains in this area lead to sumps which are equipped with pumps to lift the drainage to the city sewers. Three underground pump rooms, located at track level about 3,000 feet apart have been provided for the Yonge subway. In addition, underground pump facilities were provided at the intersection of Queen and Yonge for a future Queen Street subway.

The pump rooms are rectangular structures 10 feet wide, 18 feet long and 12 feet high with a sump 9 feet deep. Each pump room has two pumps, and estimated emergency conditions governed the size and capacity of the pumps selected.

Two types were used: a 4-inch pump with a capacity of 500 U.S.g.p.m., and a 6-inch with a capacity of 750 U.S.g.p.m. The electric motors for the pumps range from 10 to 25 hp. each. The system is arranged for automatic operation, with the addition of a high water alarm and an emergency portable pump connection.

Staff washrooms at five stations are located below city sewer level and waste from these locations is pumped to the sewers by 2 inch pumps. The motors for these pumps are from ¾ to 1½ hp. √

# Reconnaissance of The Labrador Railway...1945

Seven Islands to Lat. N. 54°44′ Long. 66°42′ W.

*by*

D. A. Livingston, M.E.I.C.
*Vancouver, B.C.*

**Introduction**

It was a fortunate chance that brought the author of this paper back to Seven Islands at the time the president of the Institute and the general secretary visited there last September. Conversation with Mr. Livingston and others on the job indicated clearly that the story of the reconnaissance was an unusually interesting one, and so right on the spot, Mr. Livingston was "signed up" for it.

The form of the paper is unusual, but perhaps it makes a more dramatic presentation than would be the case with the usual style of writing. This is really just a series of extracts from a diary, but they are all joined together closely by the continuity of the story and the excitement of the adventure.

Mr. Livingston has made a very modest presentation of his story. There is much to be read between the lines, much that can be picked up from others who know what went on. If the story were told by someone else, emphasis would be placed on the author's performance, and credit would be allocated to him, which is missing completely from his own account. However, each reader can readily appraise the accomplishment as the story unfolds. —The Editor.

Proceeding to C.P.A. airbase at Lac des Rapides, Elev. 270, an eight-mile taxi trip from Seven Islands, I boarded pontoon-equipped Fairchild Plane 71, Hank Gates, pilot, and being airborne at 10.33 commenced an aerial reconnaissance for a standard gauge railway from tidewater to the iron ore deposits in Labrador.

I knew where I was going and what route I should follow but, even so I would have to feel my way. A study of the excellent aeronautical map sheets published by the Hydrographic Map Service at Ottawa showed the drainage system of the St. Lawrence north shore as far up as the height of land between the St. Lawrence and

The valley of the Wacouno River at Mile 55.

Hamilton drainage, as well as the Labrador country north thereof.

The main stream of this system and the one that looked the most promising was the Moisie, although any of its tributaries, the Nipissis, the Caopacho or the Taoti—might do just as well.

The plane was headed east to come over the Moisie, which we did at 10.41, at the lower end of the four-mile long Moisie Canyon and 12 miles from Pointe aux Basques, the proposed starting point of the railway. The river drops 50 feet in its course through the canyon and in places is not more than 200 feet wide, which would allow a good railway crossing. Continuing north up the Moisie to railway mileage 28 and the forks where the Nipissis joined the Moisie, we turned up the smaller stream at 10.53.

The Nipissis valley had good direction, a width of about a quarter of a mile and easy slopes to the valley sides. At 11.12 we came to the Wacouno River entering the Nipissis with good direction and followed its course up to Wacouno Lake, where we landed for lunch at 11.45, 10 miles from its south end. The barometer registered an elevation of 1,680 feet, and one hour later it read 1,720 feet.

| | |
|---|---|
| Assuming north end of Moisie Canyon as | 100 ft. |
| 15 miles of good water to Mile 30 at 4 ft. per mile | 60 " |
| MacDonald Rapids and Falls at Mile 30 | 50 " |
| Good water on Nipissis and Wacouno to Mile 58 at 5 ft. per mile | 150 " |
| Miles 58 to 75, 30 rapids and falls | 1,040 " |
| Miles 75 to 95, at 15 ft. per mile, including rapids | 300 " |
| | 1,700 ft. |

This elevation of 1,040 feet was arrived at by working back from Wacouno Lake to Mileage 75, using the rate of fall given over that distance.

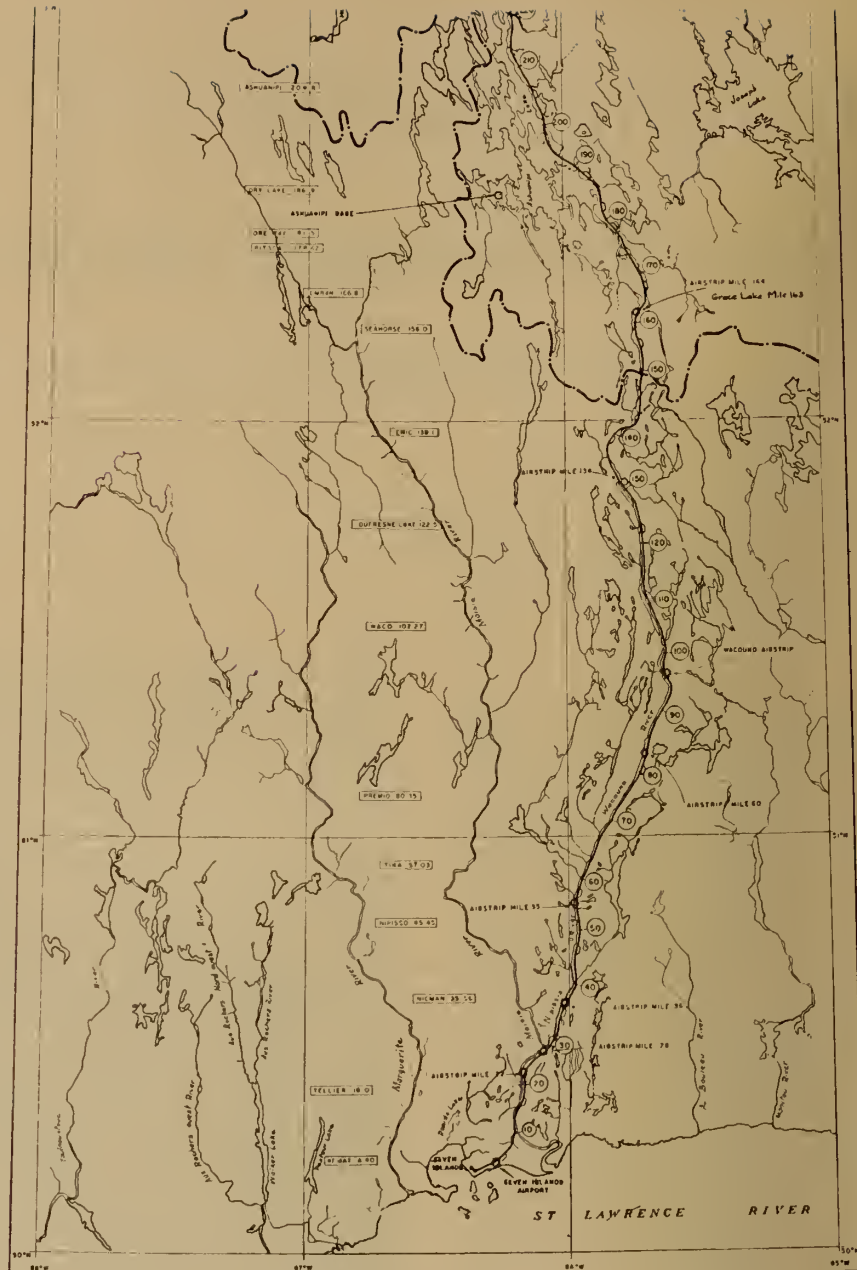
At 12.56 we were off Lake Wacouno and continued our course north. This lake is about a mile wide. We passed its north end at 13.07, proceeding up its drainage over St. Patrick and Ethel Lake. The latter drains north to the Moss River—thence we continued northerly and over the height of land into Labrador at 13.20.

Five minutes later we landed on a long narrow lake which we judged to be Lac de Dimanche and recorded an elevation of 1,680 feet; temperature 65°. At 13.43, we started back to Seven Islands, recrossing the divide. The small lakes thereon were all frozen over, making it impossible to land for an elevation, but on our way south we flew low and estimated the altitude as 1,900. The trip back was bumpy, the weather bright and warm. We came down on Lac des Rapides at 15.18, where the thermometer registered 63°.

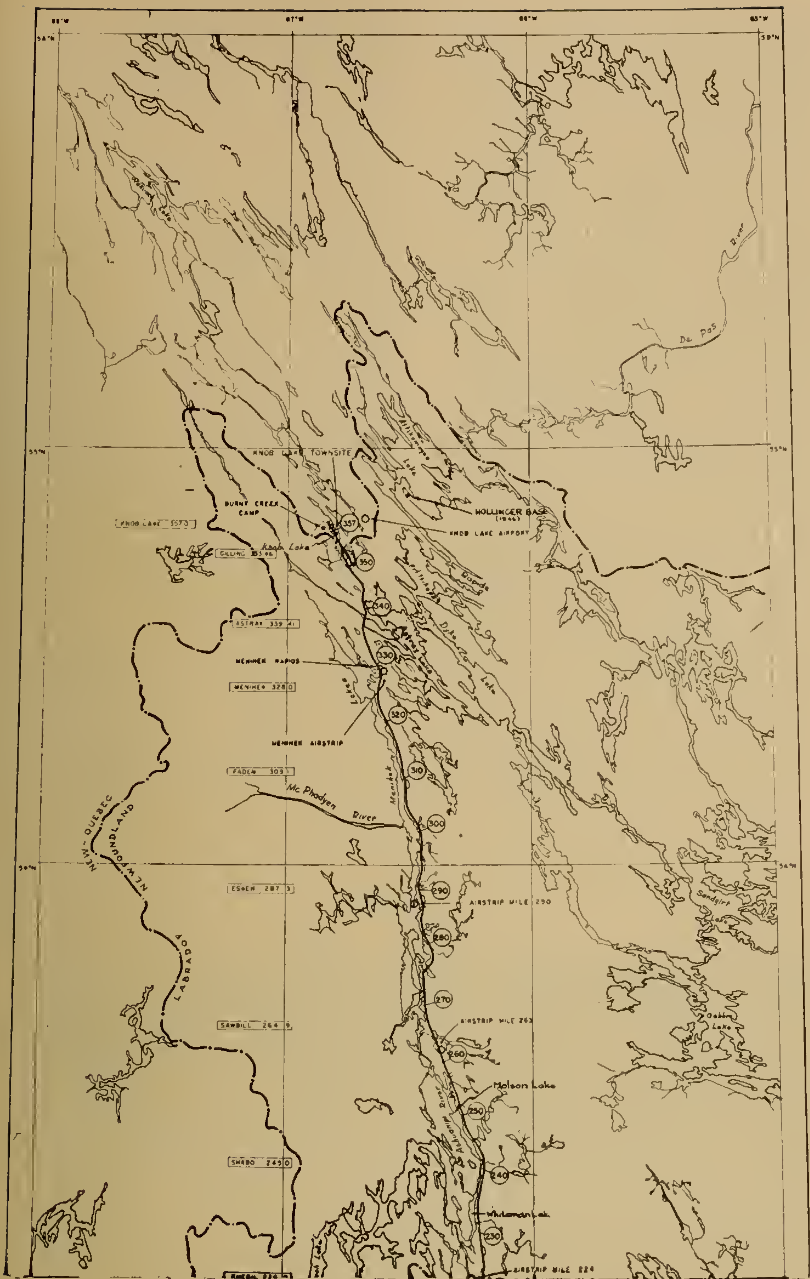
From the north end of Wacouno Lake to the height of land I had estimated a rise of 15 or 20 feet per mile. This would make the divide elevation about 2,200 feet. The mileage would be somewhere in the neighbourhood of 145 from tidewater.

On June 9, the country between Pointe aux Basques and the south end of the Moisie Canyon was examined. For the first 8 or 9 miles the country rose gradually to an elevation of 180 feet, the terrain being generally sand with some muskeg. Beyond that, as far as the canyon rock, about Mile 11, the terrain became heavier, much cut up by coulees and small streams. I expected that through the canyon considerable tunnelling would be encountered.

On account of various delays, especially lack of air transportation, nothing was done until June 16, when I boarded the Company's freighting plane at Lac des Rapides with pilot Brown and air engineer Harris. This was a Stranraer flying boat. It was heavily loaded with supplies for the geologist's base camp at Hollinger Lake. Its route was due north for 35 miles, where the Moisie River was crossed. From



The Route.




**The Route** (continued from the top of page 400).

there on it was to deviate slightly and follow my direction, so an idea of the Caopacho country could be obtained.

We were off the water at Lac des Rapides at 16.28 and at 16.50 came in sight of the Moisie River, which we followed up the the Caopacho mouth, when at 17.12 we turned up this stream on past its source at Lake Caopacho. At 17.49 we crossed the divide into Labrador at about the same place as on the trip of June 8, thence angling easterly to come over the east side of Ashuanipi Lake and so down the chain of lakes of the Ashuanipi River drainage, past the Menihek Lakes and north across Astray Lake where my reconnaissance observations ceased. We arrived at Hollinger Camp at 19.43. The camp consisted of log storehouse, bunkhouse and cook-house, 2 long sleeping cabins and 3 tent sleeping quarters.

This trip showed the Moisie River to be a tortuous semi-canyon with sharp bends and much tunnelling, with solid rock predominating. The Caopacho River was in a rocky box canyon for 25 miles above its junction with the Moisie, and had 40 rapids and chutes in that distance. Above this canyon the river valley gradually betters until in 8 or 10 miles it shows easy flats, sandy beaches along the lakes and altogether a more pleasant looking terrain. However, it had no superiority over the Wacouno route, and therefore was not considered.

After crossing the divide into Labrador the country becomes swampy with some low ridges and sandy islands. This condition continues to half way up Ashuanipi Lake, where it then becomes more or less easy north as far as the north outlet of Menihek Lake.

The railway would have to cross the divide somewhere between the Caopacho summit and that of the Embarrassee source, keep along the east side of the Ashuanipi drainage and cross it at the Slate Rapids north of Menihek, thence north and west crossing Howells River near its mouth, and on through some heavy work to its northern terminus in the vicinity of Lat. N 54° 44′, Long. 66° 42′ W.

As aerial reconnaissance of a railway route is not always satisfactory in a rough country, I decided to make a ground examination from the height of land to the proposed northern terminal. With this in mind I remained at Hollinger Lake Camp and prepared for such a trip by canoe.

Canoeman 22-year-old Armand Ferguson and I loaded our 17-foot square-end canoe with a 2½ hp. Johnson motor with sufficient gasoline, tent, tin stove, bedding and 2 weeks' supplies on the Stranraer flying boat, and at 15.25, June 19, set out for Grace Lake, arriving at 17.10. We set up camp on the east side about half way along the lake at Lat. N 52° 10′, Long. 65° 40′ W, the barometer registered 1,800 feet. The following morning we started south and in two miles came to the end of the lake. Grace Lake is 12 miles long and 1 mile wide. Here a river 100 feet wide flows in from the south with a rapid 1,000 feet long and a drop of 40 feet. We portaged the canoe up a steep hill to good water on which we ascended the current for 2 miles with an estimated rise of seven feet when we came to a rapid that fell 22 feet in a quarter mile. We left the canoe and ascended the hill on foot and saw the upper reaches of this stream full of rocks and fast water. We estimated the height of the divide near the source of this stream as 2,400 feet. We returned to our camp, loaded up our equipage and headed north for the Embarrassee River.

The country to the south of Grace Lake is rough and broken to the height of land and probably for some distance beyond. On the west side a ridge rises up 700 feet above lake level. The east is also high, but not so abrupt. It is about 300 feet above lake level on an easy slope and continues to rise for some distance beyond. At the north end of

Grace Lake a rapid commences and falls 30 feet in its mile length. Here we lined the canoe down and reached its foot, both wet to the waist, so made camp and changed to dry clothes.

*June 21:* We were on our way at 6.50. By noon, when we again changed to dry clothes, we were some 5 miles below Grace Lake and at the head of a mean-looking rapid full of large boulders 10 to 15 feet across. This rapid falls 8 feet and in the 5 miles we had come from Grace Lake, we had counted ten rapids that put us 75 feet below Grace Lake. After lunch it took us 'til 15.05 to get through this rapid. Three miles lower down a river 200 feet wide entered from the west. This would be Summit River, now about Mile 170 of the Q.N.S. & L. Railway. The Embarrassee River width above this junction is 200 feet. We stopped and camped on the west shore at 18.10, 4 miles above the entrance to Ashuanipi Lake.

*June 22:* We left our camping place of the previous night at 7.15 and proceeded down to Ashuanipi Lake on good water. Turning northwesterly we soon encountered a bad head wind and rough water. Having come through so many rapids our canoe was leaking badly so we landed on an island and proceeded to dry and patch the canvas covering which was badly cut and broken. The drop from Grace Lake would make Ashuanipi 1,725 feet elevation. By the time we had finished our task the wind had dropped, so we proceeded on our course having to make a detour through the west bay of the lake, it being the only water route that would allow us to get back to the east shore. Camping spots were scarce, but by 19.00 we found a suitable place in the narrow entrance to Northeast Bay, Lat. N 52° 40′, Long. 66° 07′ W.

*June 23:* We left our campsite at 6.20 and entered Northeast Bay where a strong wind was blowing. We lost considerable time with the outboard motor giving trouble, probably due to water in the gasoline. This overcome, we reached the east shore due east of our camp of the night before, where a small creek with an 8-foot rapid entered from a 6-mile long lake lying to the east of the main lake. This seemed to allow a passage for the railway from the Southeast Bay of Ashuanipi on good direction. We explored this route and found it satisfactory. It was while we were thus employed that the small supply plane we were to have a rendezvous with on June 22nd appeared, flew over us, continued on south, returned a half hour later down the middle of the lake and disappeared to the north.

We continued our trip north along the east Ashuanipi shore and made camp for the night half a mile north of the Fraingue River. From the mouth of the Embarrassee River to here the lake shore is generally low-lying, running inland some distance. The Fraingue River is 400 feet wide from its mouth to half a mile inland where it narrows to 80 feet at the foot of a rapid that rises on a 0.5% grade. Lake Ashuanipi and other lakes and streams encountered so far appeared to be at high water stage.

*June 24:* Today the country became slightly rougher, not materially increasing construction cost, but showing a departure from the low wet terrain. It being Sunday we made camp at noon at a gravel beach near the north outlet of Lake Ashuanipi on the west bank where a tumbledown winter trading post had been located. We fished, washed clothes and thought the supply plane might return.

*June 25:* We loaded up and left at 7.20 heading down the river which commences here and at 8.00 came to the head of a rapid. Before starting down it we landed and climbed the 75-foot high ridge and saw that the ground continued low in good direction northerly from Bob Ross Bay of Ashuanipi, suggesting the possibility of placing the railway line through to Whitman Lake on better direction than following the river would allow.

We returned to the river and ran the rapids with loaded canoe; the drop was 12 feet. We next ran riffles of 5 and 3 feet and at 9.40 we came to the next rapid, down which we lined the loaded canoe, arriving at the lower end some two hours later, both wet to the waist. This was of little consequence, as it had rained during our progress. The rapid falls 45 feet in its length of one mile. We stopped for lunch and changed to dry clothes.

According to the map we should now be through with rapids until we passed Whitman Lake, but we ran three more riffles, which made the total drop from Ashuanipi to Whitman Lake 102 feet.

The drizzling rain continued all day. We stopped at 16.45 and made camp on the east side of Whitman Lake one mile north of its south end. All our dunnage was now very wet. Canoe was leaking badly, making constant bailing necessary. The elevation of Whitman Lake is estimated at 1,600 feet.

*June 26:* We continued along the east shore of Whitman Lake and in one and a half miles we passed a creek entering from the east 25 feet wide.

The country along this shore is flat with a gentle rise to the east; from time to time low knolls appear. The timber is spruce with some tamarack, a few of which are 10 inches in diameter at the butt. At 9.00 we came to the north end of Whitman Lake and the start of a rapid which we lined and ran alternately. This rapid drops 40 feet and is approximately 1½ miles long. It took 1¾ hours to reach its foot where the river broadens to a circular lake about one mile across; at its outlet a bank of good gravel stands up 25 to 40 feet high.

Between Whitman and Molson Lakes the total drop is estimated as 54 feet, making the latter lake 1,540 feet elevation. The Miron River enters from the south-east at the south end of Molson Lake, showing a rocky rapid for at least half a mile back. Its channel is 500 feet wide where it enters the lake, but narrows to 200 feet in a quarter mile. At 12.00 we stopped for lunch and dried our clothes and bedding in the warm sun. At 14.30 we took to the canoe again.

A strong north-west wind was blowing, but we had shelter in the lee of an island until 1½ miles north of Talzie Lake Creek, where the lake widened and heavy waves striking full abeam threw water into the canoe and threatened to wet all our dunnage again. We went ashore, and, climbing a bare knoll about 700 feet inland, could see a parallel range of hills about 3 miles east across a valley. Large angular boulders lay strewn about although the flat nature of the ground still continued along the lake side.

Half way along Molson Lake the topography changes and the rocky knolls stand well out in the water. These are sometimes connected to higher ground inshore by a hogback as high as 40 feet. Grading costs would be increased here. We camped at the north end of Molson Lake at 18.00 within sight of the next rapid. In spite of the strong wind the sand flies and mosquitoes were bad.

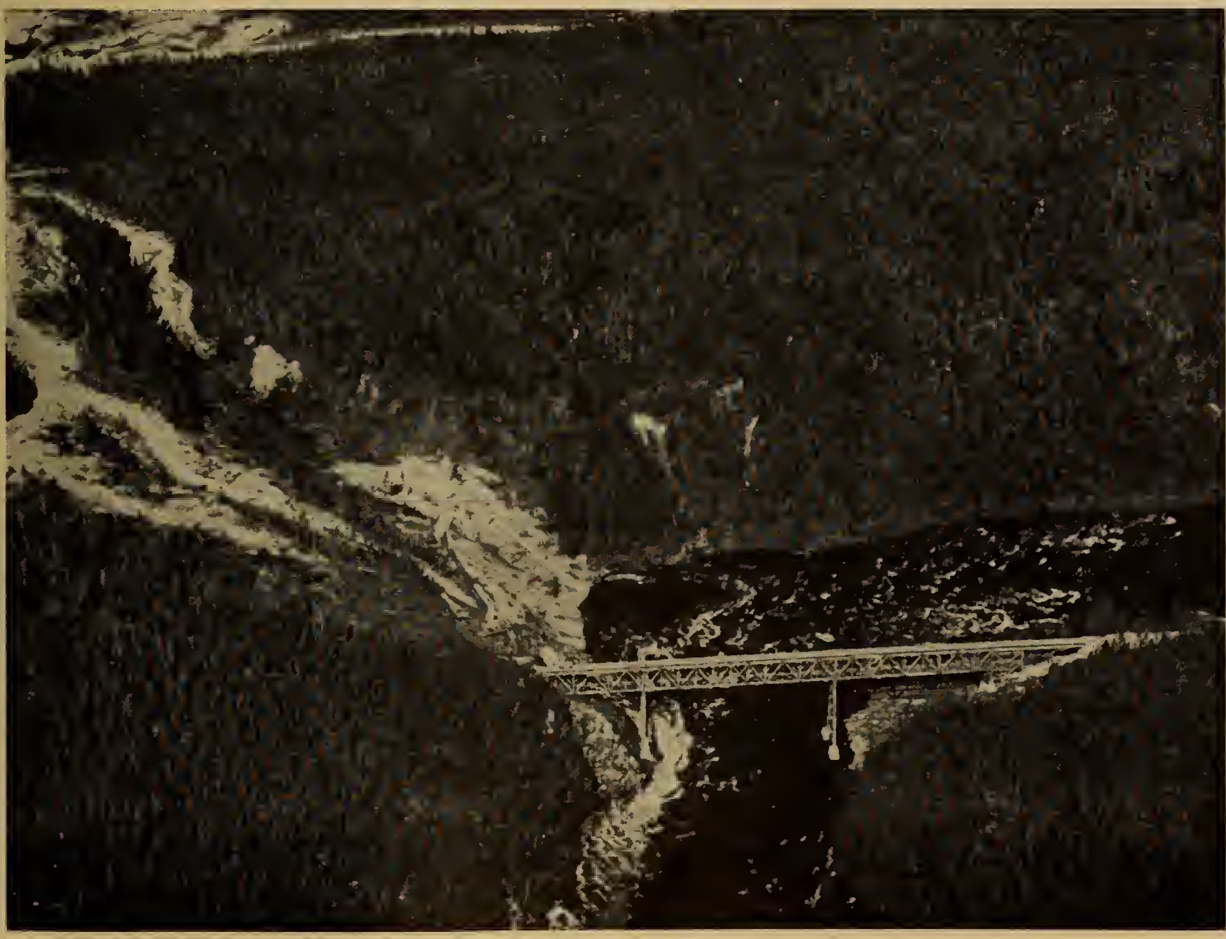
*June 27:* We explored the shores of Molson's north-east arm and found the terrain to be the same as we had seen on the previous afternoon. I noted it seemed to have the same characteristic along a low valley to the north, that might allow the railway route to avoid the muskeg along the river and to cross the Evening River some two or three miles east of its mouth on better ground.

We returned to camp, loaded up and started down the rapid. Running this rapid we came to a 5-foot drop, which we avoided by a short portage. We continued down, lining and running it alternately, to the lower end. This rapid falls 14 feet in a distance of ⅓ mile. A mile farther on we took a riffle of 2-foot drop. Again wet to the waist, we dried out at the noon fire. Leaving our lunch place we continued down the Ashuanipi River through a maze of channels and finally arrived at a widening where a south-east wind was strong enough to force us to land for two hours until it subsided somewhat. At 18.00 we were at the foot of a half-mile-long rapid having a 10-foot drop. Fifteen minutes later we came to another rapid of 17-foot drop down which we lined the canoe. Having made 20 miles that day, we stopped and made camp at 19.30 on the west bank of the river where we could see Evening Hill some ten miles directly east of us. The topography had changed little from that of Molson Lake, and earth work would run about the same cost per mile. Although we travelled 20 miles, we had come but 11 miles in a straight line. Sand flies were bad.

*June 28:* Leaving at 7.20, two hours later we came to a rapid of 6-foot drop. At noon we came out on Menihek Lake and stopped for lunch when the Stranraer plane appeared. We immediately launched the canoe and paddled in a circle to attract attention, but got no response although it passed directly overhead. We continued north along the east side of Menihek and at 14.30 the same plane appeared on the southbound course. Again we signalled but got no response. Our gasoline and food supply were now getting low, none having arrived as promised. We camped on the east shore about 3 miles south of a point opposite the mouth of the McPhadyen River and at approximately railway mileage 294. The drop between Molson and Menihek is estimated as 60 feet making the elevation 1,480 feet.

*June 29:* We were on our way at 7.00. The topography along the east shore, which had continued much the same from Molson Lake, changed to a ridge 100 feet high close to the shore, but with good alignment. Breaks occurred occasionally. The material ran from sandy slope to boulder covered hillsides; some solid rock would have to be considered also due to the large angular boulders hereabouts. Swampy flats were noticed where points ran out in the lake, but the hillside inland kept to a fairly straight course. This topography continued to within eight miles of the outlet of Menihek Lake. We camped 3 miles south of lake outlet.

*June 30:* At 7.00 we were on our way, having had our thirteenth and last straight meal of porridge. There now remained odds and ends of food such as macaroni and dessicated cabbage—water soaked. We arrived at the first rapid of Menihek Lake outlet, made a cache of surplus equipage such as tent, stove, empty grub box, etc., and portaged our canoe around the 8-foot-drop rapid. We next came to Slate Rapids where the river was 1,150



**Moisie River Bridge at Mile 12 (Rodrigrey).**

Waterfall at Mile 69.

feet wide and where the railway should cross to the west side of the river. The drop at Slate Rapids is 22 feet, down which we lined the canoe. Some 5 miles farther on we came to the head of Marble Lake, estimated elevation 1,445 feet, where we landed and cut a portage across three-quarters of a mile to Astray Lake. This saved some 20 or 25 miles of water route. We camped half-way across our portage for the night. The sand flies were bad here.

*July 1:* We had everything across the portage by noon and left the north end by paddle, as the motor was out of order. We became wind bound and camped on an island on Astray Lake at Lat. N 54° 34′, Long. 66° 34′ W. It came on to rain so we sheltered under a small tarp, and managed to keep dry, more or less. No attempt was made to estimate the elevation of Astray Lake, but it would be about the same as Marble Lake.

*July 2:* It was still raining, so we tried to fix our outboard motor with no success. At 9.00 we left, but could not buck the heavy wind. We landed and Ferguson took the canoe along the shore to fish, but got out of shelter and was blown down to the end of the bay. At dark the wind was still high, so we camped there for the night.

*July 3:* We had breakfast and were on our way by 4.45 and made good progress until 11.00, when we stopped for lunch at the south end of the main body of Lake Petitsikapaw, where a westerly wind was blowing so hard we dared not breast it. We turned easterly with the wind and made camp at 13.00 at Lat. N 54° 33′, Long. 66° 28′ W.

*July 4.* The high wind fell during the night and at 3.20 we were on our way making good progress toward the west shore of Petitsikapaw Lake till 5.30, when we came to North-West bay, where the rising wind got a full sweep. We started across the mile and a half of water, quartering the canoe into the wind, and by paddling when we were not baling, we managed to make headway, though very little, in the direction chosen. Our progress was due to the wind blowing against the side of canoe. We reached directly across from our starting point. Now in shelter we made better headway. At 8.00 we poled up a fast channel flowing from the east. This was evidently a wrong turning, as in an hour we could not recognize our position. However, we kept working north and eventually came to the narrow channel where there is excellent fishing. This channel empties out of Iron Arm. A rapid of 8 foot fall occurs here and here we upset our canoe. All our baggage floated down the swift current to the lake below. We righted the empty canoe and gathered our bedding with some difficulty, and returned to the scene of the upset, partly dried out our stuff and hung it on a line to finish, as it was a fine night. We stayed there till morning under the tarp, awakened in a drizzling rain, and found our stuff as wet as ever. We left our wet goods there and the motor at the bottom of the channel. We cut a portage through to the good water above and took the canoe over to Iron Arm, which we left at noon. With only eight miles to go to beach the canoe, we walked 2 miles over a 200-foot ridge, where we hoped to be able to signal Hollinger Camp. They heard us shouting across a mile of distance and picked us up by plane, which they taxied across the lake. We landed at Hollinger Camp about 18.30, with no food left and with only six matches.

## The Route

From Point aux Basques, Mile 0, near Seven Islands the line rises over a sand and muskeg flat to Mile 9, then passing over a rough 2 miles comes to the south end of Moisie Canyon where it follows the west bank with some tunnelling to Mile 14, and then crosses the Moisie to the east bank on a 250-foot steel bridge 50 feet above low water. It then follows the Moisie to Mile 28, where it enters the valley of the Nipissis and Wacouno, following up past Wacouno and St. Patrick Lakes to the St.-Lawrence-Ashuanipi divide at Mile 145. Here it enters Labrador territory, thence down the valleys of the Summit and Embarrassee Rivers to Ashuanipi Lake at Mile 180. Keeping to the east side of Ashuanipi, it follows down that drainage past Whitman, Molson and Manihek Lakes, where at Mile 328 it crosses

Moisie Canyon looking north.

to the west side of the Ashuanipi River at Slate Rapids at Lat. N 54° 28′, Long. 66° 37′ W. From Slate Rapids the line continues in almost the same direction to a crossing of Howells River about where it enters Astray Lake. Skirting the second bay of Astray, it follows up the drainage of Wishart Creek to an unselected northern terminus in the vicinity of Lat. N. 54° 44′, Long. 66° 42′ W at about Mile 350.

#### Grading

Commencing at Pointe aux Basques, the first 9 miles will be light work of 25,000 cu. yd. at an estimated cost of $1 per cubic yd. Miles 9 to 12 will run 35,000 cu. yds. of other material at $1.50 per cu. yd. The canyon section, all solid rock, should cost $2,000,000, Miles 11 to 14. Miles 14 to 90 would run 20,000 cu. yd. of solid rock and 20,000 cu. yd. of other material per mile. From Mile 90 to Mile 140 the quantities may be taken as 35,000 cu. yd. per mile at $1 per cu. yd.

North of the height of land, terrain becomes rough and broken to Mile 175, and will run 20,000 cu. yd. of solid rock at $3 and 20,000 cu. yd. of other material at $1.50 per cu. yd. For the next 105 miles to Mile 280, the average grading quantities may be taken at 10,000 cu. yd. of solid rock at $3 and 20,000 cu. yd. of other material at $1.50 per cu. yd. Beyond Mile 280 to Mile 334, the grading will average 30,000 cu. yd. per mile at $1.50 per cu. yd. For the final 16 miles of this line west of the Ashuanipi River, which was reconnoitered as an area, the grading may be taken as 40,000 cu. yd. per mile at a cost of $2.50 per cu. yd.

This covers the original grading quantities as presented with the 1945 report to my principals. At that time it was expected that the yearly outbound shipment would be 2,500,000 tons of ore, which would warrant no more than a cheaply built line with 10 or 12 degree curves, light ties and rails, and no elaborate signal system or high maintenance charges. Now (1953) the anticipated yearly output is said to be ten times that amount, which changes the whole construction picture. I might say, however, that the foregoing grading quantities had a contingency cost of 20% added. No guarantee was given that the terminal facilities at tidewater would be satisfactory, nor was the cost of this figured in the total estimate presented.

The possibility of water power development at the outlet of Menihek Lake was mentioned, as well as the easy storage of the vast amount of water in the many lakes of the Ashuanipi drainage.

**Side hill work along the Moisie River.**

The technique of railway reconnaissance can only be acquired through years of experience in railway location and construction. In estimating yardage quantities it is wise to go over a mile or so of the country, measure the required yardage in that mile, and, proceeding, estimate plus or minus amounts from the measured mile for each change of terrain encountered.

Aerial reconnaissance can be very deceiving. From the air, long sections of broken country resemble level prairie. Wide rivers look like narrow streams and so on. Nothing looks the same from the air as it does from the ground. The distance is shown by the time elapse recorded.

#### Grades

From the north end to the height of land the grades should not exceed 0.4% against loaded trains. The inbound grade should not be in excess of what would allow the same power that hauls the loaded train out, to take the empty cars back. This may require a pusher grade between Mile 64 and Mile 74, which only an instrumental survey can decide.

The route given is not claimed to be the only possible one or even the best. It is submitted as being a direct line of reasonable construction cost and fairly representative of what the cost would be of building a railway in this country.

It is recommended, if building the railway is decided upon, that considerably more preliminary exploration be done. This would apply particularly to the section which includes the height of land area between Quebec and Labrador, with a view to finding the lowest possible summit as well as easier work.

This twenty days ended the reconnaissance of what is now the Quebec, North Shore & Labrador Railway.

My recommendation for further exploration was followed, and the following summer in August and September, thirty-five days were spent, using canoe and plane. Two canoe men, Johnnie Mercier and Win Wright, gave excellent service, as did C.P.A. Pilot Johnny Dart. Valuable information was secured, as well as discovering Livingston Pass through the Labrador Highlands at Lat. N. 52° 07′, Long. 55° 42′ W.

Birds noticed in the Labrador Highlands were canaries, kingfishers, hawks, gulls, swallows, partridge, whisky jacks, plover, a small black duck white under its wings, and the Canada goose.

Some black bear were seen as well as two woods cariboo.

The timber is tamarack, birch and poplar with spruce predominating. Near the south end some sizable sticks were noticed that might be used for tie timber and at odd spots farther north six or eight inches at the butt would be a big tree, however, no attempt was made to survey this phase. √

# Welding Research
## in
# British Merchant Shipbuilding

*by*

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This is the substance of the Adams Lecture, delivered before the American Welding Society at its Cleveland meeting, October 19, 1953.

It draws an excellent picture of the state of British research into welding as applied to shipbuilding investigations, many of which are equally applicable to riveted ships and to other similar structures. The extent of the work described will be a revelation to many and serves to show that British shipyards, with the support of Government agencies, the Classification Societies and others interested, do not intend to be left behind in shipbuilding, in which they have always been regarded as probably the World's leaders.

The use of welding in the building of merchant ships has steadily developed in Great Britain, but the change-over from riveting has been less abrupt than in the United States. Widespread and extensive modifications in shipyard layout and equipment have been effected in recent years. Figures 1-4 show representative examples of British welded construction for various types of merchant craft. These developments afford ample proof of confidence in the progress made possible by welded design in producing ships of improved performance and efficiency.

The very rapidity of the welding revolution in world shipbuilding has inevitably brought problems in its train, some unforeseen and distressing. Defects have been disclosed in certain welded ships, specially among those built during the war years. There have been tragic instances of hulls broken in two. Faults of less severity have included local fractures from hatch corners and at other discontinuities, these proving particularly troublesome at tanker bulkheads; and corrugations have developed in the bottom plating of transversely-framed dry cargo ships. In some cases, workmanship, welding and construction methods have proved unsatisfactory.

These deficiencies must be viewed in proper relation to the massive records of satisfactory service given by very large numbers of welded ships. They, nevertheless, present a challenge which has been vigorously met by extensive research and study, ranging from the properties of materials to all features of general and detail design and by constant vigilance throughout the building processes. As a result, the modern welded ship represents a great advance over her older sister, and has been released from the influence of riveted tradition.

These problems have permitted of no restricted national treatment; they are the concern of all maritime nations. This is exemplified by the exchange and co-operation which has been maintained since 1943 in welding research undertaken on one side of the Atlantic by the United States Board of Investigation and its successor, the Ship Structure Committee, and on the other side by the Admiralty Ship Welding Committee. This collaboration has proved of real benefit and has been enriched by many personal contacts and friendships.

This paper outlines some aspects of welding research affecting shipbuilding undertaken in Great Britain during recent years. The temptation has been resisted to include reference to other important spheres of research in which welded construction is incidental, but not a basic factor in the investigations.

#### Brittle Fracture in Mild Steel

The vital importance of adequate notch toughness at service temperatures in mild steel for welded shipbuilding was brought to light as a result of thorough investigations undertaken in the United States and in Great Britain, following failures in certain welded hulls built during the war years in the United States. No satisfactory explanation of all the features characteristic of these fractures was found "until the importance of notch brittleness in mild steel was realised. It was then evident that notch brittleness of some of the steel used in ships which had failed was a major factor in causing the trouble"(1).

Shipbuilders and classification societies were thus confronted with an unforeseen and complex problem calling for urgent remedial action. They enlisted the collaboration of steelmakers and metallurgists and research was intensified in many directions. As a result, much progress has been made and amendments to material specifications have been introduced, which have proved their effectiveness in screening out unsatisfactory material in welded ships built since the war.

Yet there remains much to learn; with the unremitting demands for heavier rolled material, especially for large tankers, it is imperative to continue research—and as a top priority.

The scope of the investigations in the United Kingdom can here be reviewed only very briefly. In 1945 Professor J. F. Baker prepared for the Admiralty Ship Welding Committee a "Statement of the Problem" and, at the suggestion of the Committee, a conference was called at Cambridge by the British Iron and Steel Research Association in October of that year(2). This was attended by a number of eminent experts; valuable ideas emerged and research interest was broadened. It was recognised that the phenomenon of brittle fracture, while by no means new, had assumed the greatest practical importance with the advent of the welded ship.

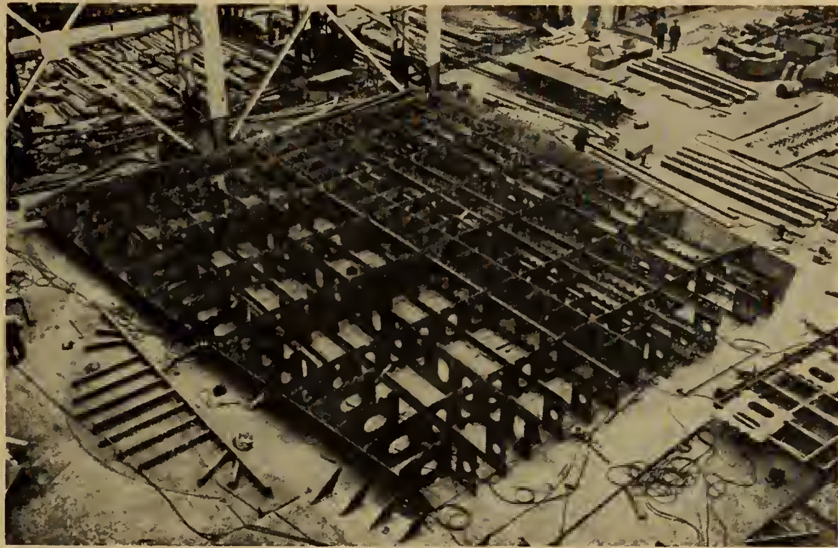

**Fig. 1. All-welded longitudinally framed double-bottom structure of cargo liner; three units; combined weight 71 tons.**

Attention was first directed to the chemical composition of the material which had failed. These steels complied with established test requirements, with which were associated control of sulphur, phosphorus and also, indirectly, of nitrogen, as recognised in normal good steel making practice. But the carbon content was high and the manganese unusually low. It was pointed out by Barr(3) that on the basis of impact tests over a range of temperatures, an increase in carbon tended to raise, while an increase in manganese tended to lower, the temperature of transition from ductile to brittle fracture. From this developed the recommendation that within the limits of composition determined by tensile requirements for mild steel, the ratio of manganese to carbon content should be of the order of about three to one, this also ensuring better weldability. This recommendation, translated into a specification requirement for plate material over ½ inch in thickness, effectively barred from further acceptance low manganese steels such as were produced in America and in some continental countries under wartime conditions. It was, nevertheless, realised that this additional control of analysis provided only a partial safeguard.

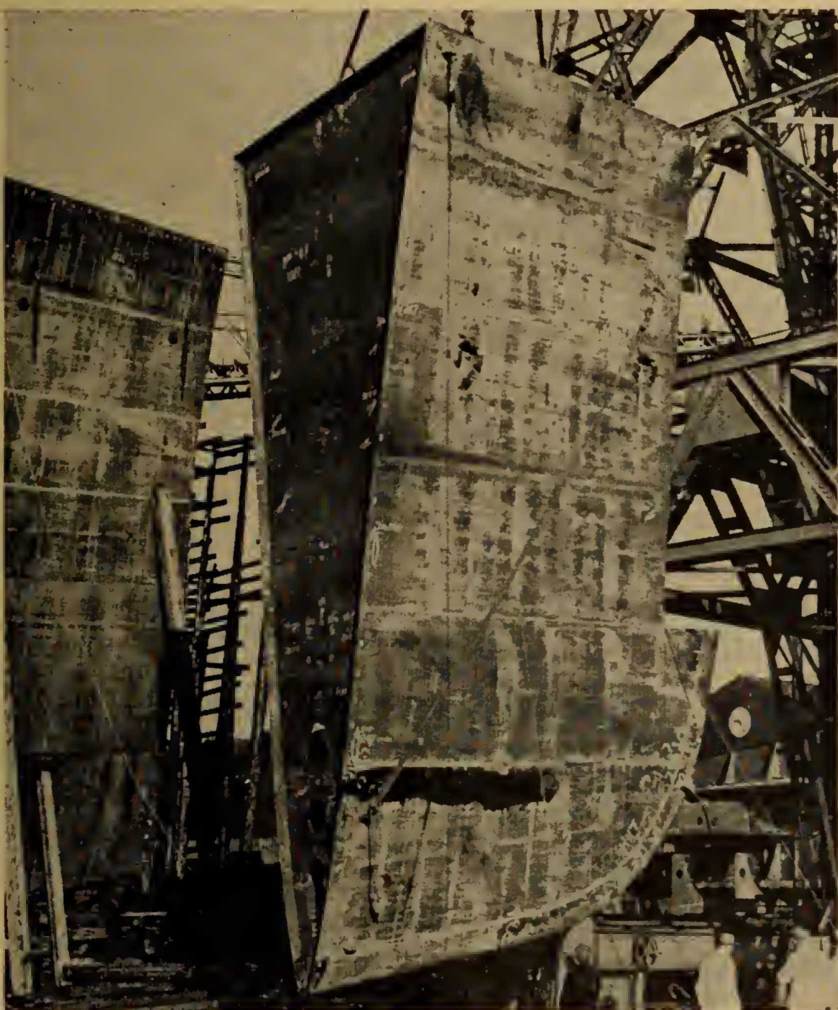

**Fig. 2. A 50-ton welded bow unit for passenger liner.**

Emphasis then turned to the structure of the steel. This is influenced by steelmaking practice in all its stages, including variations in composition, deoxidisation, mechanical treatment, temperatures of working, rates of cooling, directional effects, heat treatment after rolling and the thickness and volume of the finished product. B.I.S.R.A. set up an ad hoc committee to carry out a survey of the general level of notch ductility in British-made semi-killed ship plates. Following a pilot survey, a wider investigation has been completed on plates from five manufacturers. Triplicate Charpy V-notch impact tests at 0°C were made on about seven hundred plates, and the general level of notch ductility for thicknesses ranging from ½ to 1¼ inches from each works has been assessed by statistical analysis of the results. This has

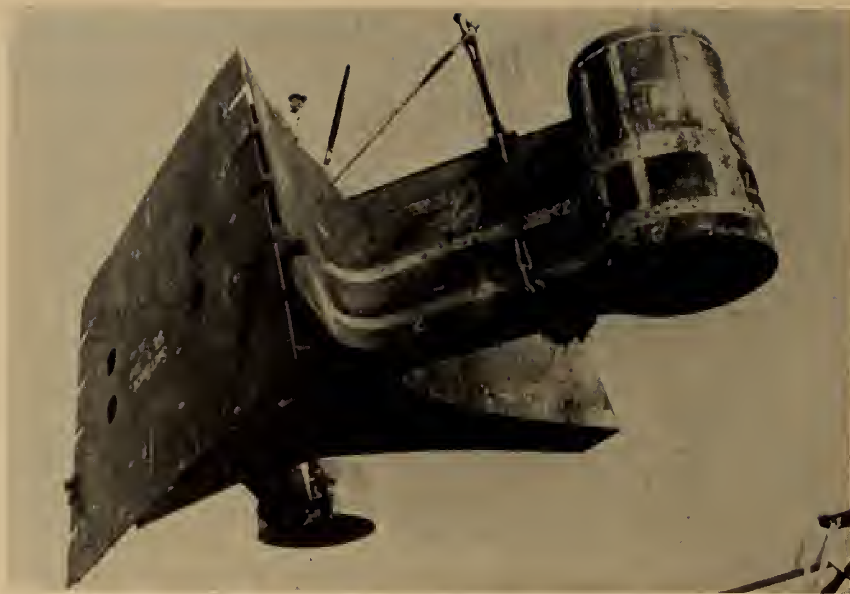

Fig. 3. Welded fabricated stern unit with shaft brackets carrying 42,000 shaft hp. Weight, 46 tons.

confirmed the known trend for notch ductility to decrease with increase in plate thickness. It has further disclosed differences between plates of equal thickness made by different manufacturers, the reasons for which are now being sought through a close examination of conditions of manufacture in each works(4). A study is also being made by B.I.S.R.A. of the effects of welding practices and of the susceptibility of mild steels to strain ageing.

Results have recently been published of a further investigation(5) on plates rolled in two mills, the first object being to determine the effect of plate thickness and production variables on the Charpy V-notch transition temperature for semi-killed steels, and the second to determine the general level of notch ductility of special qualities of mild steel. The general decrease of notch ductility with increasing thickness is attributed to higher rolling temperatures and slower rates of cooling. Some advantage is, therefore, to be expected from normalising the thicker plates. For the special quality steels, the effects of killing with the addition of silicon or of aluminium, and normalising, in addition to increasing the manganese-carbon ratio, have been compared; it would appear that to obtain a plate of high notch ductility at really low temperatures it is necessary to adopt a low carbon high manganese steel, normalised and killed with aluminium, although the latter greatly increases production costs (Fig. 5). It is clear also that special control of rolling and finishing temperatures has most beneficial effects, though this may give rise to practical difficulties.

The relation between laboratory tests and service failures has presented difficulties apparent from the early stages of investigation. Numerous forms of test pieces and methods of assessing notch ductility have been developed. Two types of test are being used in the United Kingdom to simulate service conditions and for the purpose of obtaining fundamental information on the conditions of initiation and propagation of fracture. Both use a full plate thickness, an impractibility in standard impact testing. In 1945 Tipper developed a simple notch tensile test bar for determining transition temperatures and to relate fracture appearance to ductility as measured by reduction in thickness(6). This test was the first developed in the United Kingdom which reproduced the characteristics of brittle fracture found in welded ships. The test has provided good correlation with service casualties, but it is desirable that the width of the test bar should not be less than two and a half times the thickness of the plate in order to obtain a sharp transition in the fracture appearance at a given temperature. Robertson has evolved a test in which a crack is initiated by impact; either a constant transverse stress is applied to a plate in which there is a temperature gradient or, alternatively, the material is maintained at a constant temperature(7, 8). Correlation between impact, Tipper notch tensile and Robertson tests is fairly satisfactory in assessing the temperature at which the change in properties occurs. Numerical agreement is, however, impractical due to the different criteria adopted.

The effect of dimensions in testing also renders comparison difficult between different forms of test. The magnitude of initiating discontinuities and of cracks in service must vary between wide limits, but the propagating fracture appears to have typical and constant form, when once established. In the small types of test specimen end effects form a large part of the fracture, thus masking its natural propagating form(9).

Interpretation of fracture surface markings has recently received attention by Boyd(10). He shows that the process of propagation of brittle fracture in a plate consists in the formation of a succession of disc-shaped cracks originating within the body of the material ahead of the main fracture front (Fig. 6). The envelope of the radiating fractures is parabolic, and the calculated orthogonal trajectories of the fracture fronts show good agreement with the inclination of chevron patterns measured on natural fracture surfaces. The theory can also account for the chevrons having the same shape in plates of different thicknesses and leads to the conclusion that the work done in propagating a fracture is a material constant, a finding in agreement with Robertson's conclusions.

A method has been devised for

Fig. 4. Welded 28-foot double-chine towing launch; lifting weight, 4 tons.

measuring the energy absorbed in creating unit surface area of a crack, by recording the temperature wave released when the local plastic work is converted into heat as fracture proceeds(11). This approach has indicated that for given materials and temperatures, the surface energy has stable minimum values.

The Admiralty Ship Welding Committee has given much attention to the choice of the most suitable test and criterion for assessing notch toughness. In the present state of knowledge, the Committee considers that it is desirable to select a single standard test to be used for quality control, and for this purpose recommends general adoption of the Charpy V-notch impact test(12). This proposal is in line with the practice of the National Bureau of Standards in its casualty investigations and has been endorsed by the International Institute of Welding. It has, however, been found that the methods by which the V-notch are machined can significantly affect the impact values, and more rigid specification of conditions for impact testing is therefore being considered. A great step forward would be achieved if an internationally accepted form of test were agreed upon. This should in no way hamper the development or use of other types of test for special or research purposes and it is hoped that such investigations will throw much needed light on the mechanism of fracture in steel.

More fundamental researches are also in hand. These include work on pure iron and pure iron alloys, which has been carried out by the National Physical Laboratory supported by B.I.S.R.A.(13). This has shown that the lower the content of certain elements in iron, the more significant do small amounts become, particularly in the presence of one another. Various studies are being made of fracture stresses in iron and other metal crystals(14, 15).

The Rules of Lloyd's Register were amended in 1949 to require for ship quality plate over ½ inch in thickness, a manganese content not less than two and a half times the carbon content. This provision, similar in effect to the American Bureau Class 'B' Specification, has involved little change in established practice since the war in the steel making world.

For main structural parts exceeding 1 inch in thickness in welded construction, the Society has further required that the properties and processes of manufacture of the

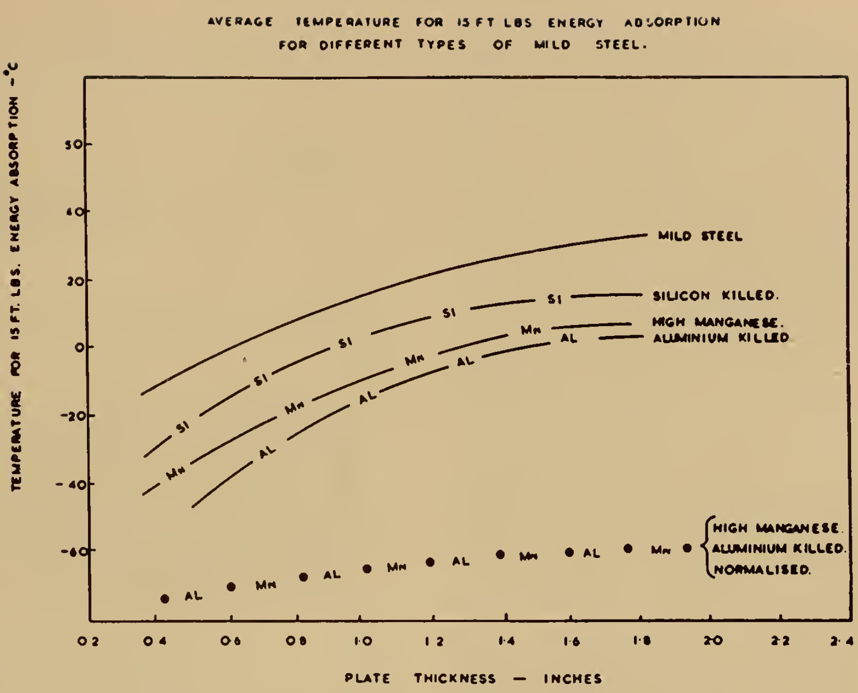


**Fig. 5. Comparison of mean-level of notch ductility for various qualities of mild steel plate rolled in one mill.** *(West of Scotland Iron and Steel Institute)*

steel used are to be specially approved for the purpose. This approach differs from that under the American Bureau Class 'C' requirements, no detailed specification for the heavy material having been laid down. Steelmakers in any country are invited to submit for approval a type of steel which they can readily and consistently produce and which, in their opinion, has adequate notch toughness in thicknesses greater than 1 inch. They are required to furnish full details of the proposed process of manufacture, including deoxidisation and rolling practice, limits of composition and details of any heat treatment. In accordance with the proposed process, plates are rolled in several thicknesses from actual casts. From these plates, notch bar impact tests are carried out over a range of controlled temperatures. From the data so furnished, the Society is able to assess the suitability of the material relative to other accumulated data. If considered satisfactory, approval is given on the understanding that the steelmakers maintain substantially the same analysis and process of manufacture and provide verification by periodic check impact tests. Routine notch testing from production is, however, not required by the surveyors. Steels so approved now number over 40 from 11 different countries. They represent a wide variation in manufacturing practices from semi-killed "run of the mill" to elaborate and costly types based on full-killing, grain control and special heat treatment. The system permits initiative and encourages development suitable to individual manufacturing conditions without imposing a stereotyped specification, but approval is based on direct assessment of notch toughness determined by physical tests over a range of temperatures. It is nevertheless envisaged that with increasing knowledge and experience further safeguards and modifications in requirements may be developed.

There remain outstanding problems in this field still unsolved. Among these are the determination of a suitable agreed criterion for the measurement of notch toughness which must be correlated with service requirements for ships' structures; and a more thorough understanding of the metallurgical effects controlling notch toughness, particularly its reduction with increased thickness and for steels of acceptable weldability. Technical answers are needed to these problems in order to attain the objective that only materials shall be used which are of adequate and consistent quality for their duties, at an appropriate cost.

#### Residual or Locked-up Stresses

How do we now regard locked-up stresses, which for so long were widely held to be mysteriously responsible for welded ship failures? In 1948 a study was made at the Engineering Department, Cambridge(16), of stresses in butt welded mild steel plates, especially when welded under severe restraint. This showed that high locked-up stresses, generally reaching the yield point, occurred in the immediate vicinity of the weld, even where no reaction stress, i.e., restraint, was present. It was demonstrated, moreover, that the magnitude and distribution of residual stresses could be greatly changed by small departures from established procedures, thus throwing doubt on the generally accepted belief that residual and reaction stresses could be controlled, provided correct welding procedures and sequences were followed. It emerged that cracking was due to lack of ductility in the weld metal on cooling and it was therefore necessary to follow well established practices in order to limit the amount of plastic deformation required of the weld metal.

Other theoretical and experimental work led to the conclusion that residual stresses could have no influence on the static carrying capacity of a structure provided the material behaved in a plastic manner, and provided that residual stresses did not result in elastic instability. Under certain conditions the presence of residual stresses must be considered to reduce the load factor for elastic instability(17).

It has also been shown that where no notch is present, high reaction stresses could not of themselves produce brittle fracture at temperatures below the transition temperature of the material. In more recent experiments(18), spontaneous fracture has been produced in specimens in which a severe notch was present, associated with high locked-up stresses, the material having been cooled to below its transition temperature. Wells has offered an explanation for this type of failure(19). He considers that, provided a notch is present before the weld metal cools, work hardening can take place at the bottom of this notch to raise the average residual stresses to the fracture strength of the material, thus initiating a brittle fracture which would then propagate at steadily diminishing average stresses depending on the crack length, under the influence of residual stresses alone, even if these were comparatively low.

It would seem, therefore, that residual stresses cannot be ignored in material which is notch brittle. Their potential danger can best be eliminated by ensuring a sufficient degree of notch toughness at service temperatures.

The Admiralty Ship Welding Committee has recently amplified its earlier findings on locked-up stresses in the following terms(12):

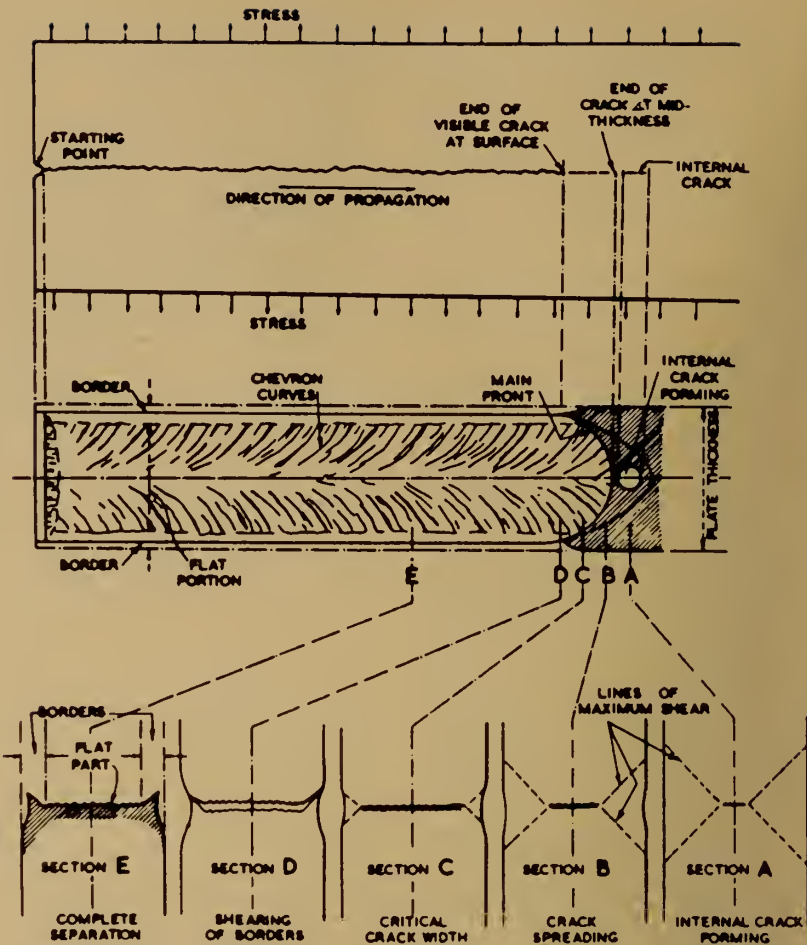


**Fig. 6. Features of plate fractures.** *(Engineering (10))*

(a) Regardless of the procedure, sequence of welding, or restraint, every welded structure, unless stress relieved, contains locked-up stresses which locally reach the yield point of the material.

(b) Continued researches have so far not revealed evidence that these locked-up stresses have adverse effects on the strength or reliability of welded ship's structures, provided that the material, including the weld, is in a notch-tough condition at the prevailing temperature.

(c) It is important to appreciate that undue restraint during fabrication may lead to cracking during or shortly after welding and unless such cracks are found and dealt with they may lead to serious failures in service.

### Aluminium Alloys and their Welding

Aluminium alloys are of great interest as structural shipbuilding materials, alternative to mild steel, though their use has naturally been restricted. Guidance in the choice of suitable alloys for marine purposes has been provided in the tentative requirements published by Lloyd's Register in 1947. These rules cover limits of compositions for both non-heat-treatable and heat-treatable alloys of the aluminium-magnesium and aluminium-magnesium-silicon types, the minimum physical properties required being 0.1 per cent proof stress, 8 tons/sq. inch; ultimate strength 17 tons/sq. inch, and elongation, 10 per cent on 8 inches. Much research has been carried out in Great Britain to improve the weldability of these alloys. While welding difficulties due to the corrosion resistant oxide film have been overcome by the inert gas processes, basic metallurgical factors are also involved, namely, gas reactions, cracking tendency, loss of alloying elements, loss of strength and reduction in corrosion resistance.

Gas porosity due to hydrogen picked up by the molten metal during welding occurs especially in the heat affected zone adjacent to the weld and is generally more troublesome in the aluminium magnesium alloys than in other types. Investigations by the British Non-Ferrous Metals Research Association(20, 21, 22) have suggested appropriate remedies. To eliminate hydrogen pores, which may also occur due to moisture held in the surface oxide film, the metal should be thoroughly cleaned before welding and electrodes or welding wire stored in dry conditions.

The Aluminium Development Association has systematically studied the factors affecting cracking of welds under the inevitable conditions of restraint(23). It has been found that in general a higher percentage of alloying elements in the filler metal, plus additions of grain refining elements, particularly titanium and boron together, greatly reduce the risk of cracking. In arc welding aluminium-magnesium alloys the loss of magnesium may be offset by using filler metal containing a higher proportion of this element than the parent metal.

In the heat affected zone the local increase in temperature results in significant reduction in strength of the heat-treatable alloys and to a lesser extent of the non-heat-treatable, when welded in the cold-worked condition. The heat affected zone may also exhibit some loss in corrosion resistance due to the redistribution of the constituents consequent upon heating to temperatures around the solidus. The metal may be susceptible to intercrystalline corrosion which is not normally observed in non-heat-treatable alloys containing less than about 4 per cent of magnesium.

There is now much experience in Great Britain in the production of aluminium-magnesium alloys; the most acceptable plate composition, taking into account all the above factors, appears to be a nominal 4¼ per cent magnesium alloy. This has been standardised as NP.5/6(24) and is now in wide commercial use. Latitude in range of composition permits manufacturers to select the most suitable for their production methods, and the desired mechanical properties may be obtained by varying the degree of cold working.

Alloy NP.5/6 possesses a good combination of strength and ductility. It can be hot worked with reasonable ease, readily formed cold in the shipyard, and local re-heating does not seriously affect its properties. Its welding characteristics are satisfactory and weld efficiencies exceeding 90 per cent are commonly obtained. With filler metal of the same basic composition (or nominal 5 per cent magnesium) resistance of the weld metal to corrosion is of the same order as that of the parent plate.

The British Welding Research Association has co-operated with the Electrical Research Association in work to study the electrical requirements for arc stability and the characteristics of welding circuits required for successful arc maintenance.

The experience of E.R.A. on the fundamental physics of heavy-current, high-voltage arc discharges has provided useful basic knowledge on the welding arc. This has been of particular value in leading to a full understanding of the electrical requirements of the Argon-arc welding process, and has resulted in the development of a simple electronic device which enables the welding of aluminium by this process to be successfully achieved at an open circuit voltage of 40 volts, r.m.s. using any type of welding transformer, and without any other form of arc stabilising device(25). Under certain conditions, through the use of a series capacitor, this figure has been reduced to 30 volts, r.m.s. The device (Fig. 7) provides a damped unidirectional pulse of about 250 volts peak lasting a few microseconds only, which is automatically timed to be injected at the beginning of each reverse polarity half-cycle. This ensures the re-ignition of the reverse polarity arc, and so, in practice, permits a reduction in the open circuit voltage to a value of the order of twice the arc voltage. As the short duration surges injected are of comparatively low voltage, radio interference, which always occurs with the commonly used spark injector, is completely eliminated. If touch starting is impracticable, then the low voltage surges can be readily converted into timed high voltage sparks to initiate the arc from cold, but once the arc has been started, the unit automatically reverts to the low voltage surges for arc maintenance. This device is of comparatively recent development, but it is anticipated that considerable use will be made of the equipment, which is now in the commercial stage. This would reduce the size and cheapen the cost of welding transformers, make welding safer, improve the power factor, and give better quality welding.

Work of a similar nature is also in hand on the characteristics of the inert-gas, metal-arc process. Criteria have been formulated for both alternating and direct current which will ensure a considerably greater degree of arc self-adjustment than is obtained in present practice. The criteria can be met either by suitable design of new welding plant or by the addition of auxiliary equipment to existing plant.

A detailed account of these investigations will be published in the near future.

#### Full-Scale Structural Tests on Welded and Riveted Ships

The Admiralty Ship Welding Committee has undertaken a programme of full-scale tests to throw light on the relative structural behaviour of welded and riveted ships. This programme developed in two stages; the first in still water, and the second under service conditions at sea. We were fortunate in Great Britain in having available certain classes of tankers and dry cargo ships practically identical in design, form and structural arrangements and of both welded and riveted construction. It is unlikely that such an opportunity will again occur.

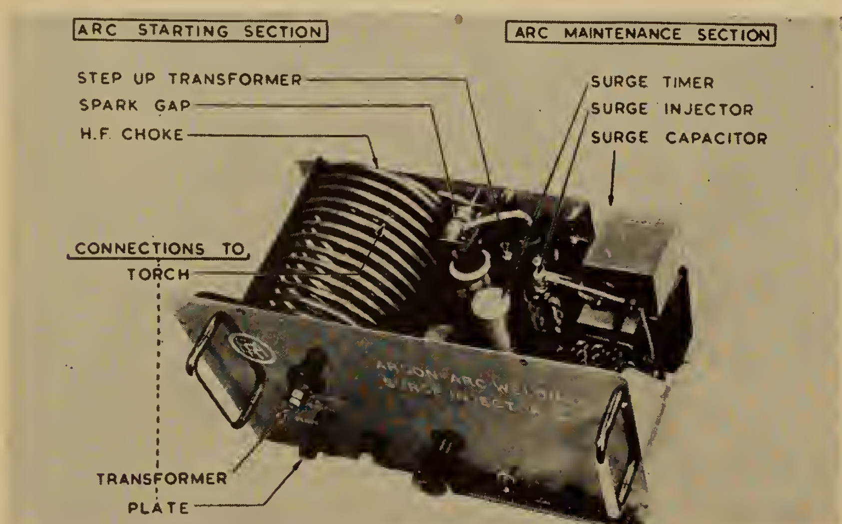


Fig. 7. Surge injector for argon-arc welding at low voltage.

In the first stage, two 12,000-ton (dead weight) tankers, the "Neverita" and "Newcombia", the one welded and other almost entirely riveted, were submitted in still water to a range of loadings applied by changes in ballasting of different tank spaces(26, 27). A large number of gauges were fitted to measure bending strains in addition to direct strains, and hence to derive heart of plate stresses. The gauges were arranged over a main section of the hull girder and also at selected positions to study local bending effects in plating panels and concentrations at discontinuities. Hull deflections were assessed by several methods.

The tests showed, over the rather severe range of bending moments applied, no significant differences for the two ships in general stress distribution and deflection in the main hull girder; the results corresponding, within limits of experimental error, to those predicted from conventional beam theory. No evidence was found of rivet slip nor support for a commonly held belief that welded ships are stiffer. High local stresses were observed at some positions, due to local bending of plating panels and to concentrations at openings and other discontinuities.

The tests also showed that longitudinal framing members contribute effectively with their associated plating under stressing due to longitudinal bending moments. This has provided valuable information in determining scantlings for longitudinal strength in tankers. It indicates that some variation is permissible between the relative areas of plating and longitudinals, which jointly provide the required sectional area of material in the bottom and top flanges of the hull girder. This variation, which is of great practical value in the choice of longitudinals, must be subject to limitations imposed by other considerations, both in actual plate thickness and in the scantlings of longitudinals. It is also important that adequate continuity and fixity be provided for the longitudinals in way of transverse bulkheads, and this is relatively easy of achievement in welded construction. Lloyd's Register Rules for Tankers, which were completely revised in June, 1950, and formulated for direct application to welded design, incorporate tabulation of main scantling requirements on the above basis.

With the experience from the above and other static tests, and following a "pilot" sea-going voyage in the Tanker "Niso"(28), the A.S.W.C. programme was then extended to the second and more ambitious stage of measuring stresses at sea. It was recognised that simultaneous recording of strains and deflections in a complex ship's structure in the constantly changing conditions at sea presented immense difficulty and that such records without accurate knowledge of the corresponding applied forces would be of little scientific value. An indirect approach to the problem was therefore adopted. The sea trials were planned primarily to determine the forces acting on the hull, a few strain gauges being fitted around the midship section for checking purposes only. Effort was concentrated on the provision of suitable equipment designed for synchronous recording, from which a complete evaluation of bending, twisting and shearing actions on the structure due to the sea at any moment could be deduced. Only one ship was required for these trials. Complementary to the measurements of forces at sea, the stress response of the two similar welded and riveted ships was to be determined in still water, when subjected to various conditions of loading. In the final stage, the results from the still water trials would be applied to the loads derived from the sea trials, in order to estimate the probable maximum stresses at sea for both the welded and riveted ships, the ultimate object of the tests.

For these trials the ships selected were two 10,000-ton dry cargo ships, one the welded "Ocean Vulcan", built in California, the other her riveted prototype the "Clan Alpine" built in Great Britain.

For the sea trials, the "Ocean Vulcan" was fitted with equipment specially designed to permit the determination of all forces acting on the hull at any instant. This included instruments for measuring direct wave pressure and instantaneous water line; accelerations; wind forces; angles of roll, pitch and yaw; ship's speed; engine speed and shaft torque; also longitudinal stresses at a section near midships. Altogether some seven hundred wave profile indicators and one hundred other instruments were installed, all arranged for remote synchronised reading at a central recording panel by photographic exposures twice per second.

The equipment was operated by a small experimental crew during eight round voyages in normal North Atlantic trading over a period of seventeen months, some two hundred days being on the open ocean. The weather experienced was of varying severity and full gales were encountered.

The complementary still water tests were made on the "Ocean Vulcan" and "Clan Alpine" in the River Fal under a large range of conditions. Loading was applied mainly by water ballast and for this purpose main bulkheads were reinforced to permit the holds and in some cases the 'tween decks to be filled; a special pumping system also being installed. The ranges of hogging and sagging moments and conditions imposing severe trim, torsion and heel called for most careful control during the whole period of tests to ensure the ship's safety. Comprehensive readings were made of direct and bending strains at main sections of the hull, at local discontinuities and openings, and in certain plating panels, together with records of the hull deflections.

The experimental work under this programme was completed early in 1948. Analysis of the immense volume of records has presented a lengthy and formidable task, which has been brought to completion under the supervision of F. B. Bull who, as leader of the experimental party, had been associated with the tests since their inception. A series of reports has been completed(29-33) and early publication is expected.

The detailed report(31) on the "Ocean Vulcan" sea trials, which has recently been published, includes a review of previous work on ocean waves and strain measurement at sea. The basic assumptions underlying the trials are discussed, the instrumentation described in detail, and also the methods adopted in reducing and presenting the results.

The main conclusions from these sea trials may be summarised as follows:—

The greatest recorded range of vertical longitudinal bending moments was 190,000 ton-feet corresponding to a stress range of 8 tons/sq. in. at the top of the sheerstrake amidships. From theoretical considerations the sagging moment constituted about 55 per cent of the total. This stress range is of course additive to the still water stresses on the hull.

The above range of bending moment was associated with waves 35 feet high and between 600 and 700 feet long. The greatest range of bending moment amidships occurs when the length of wave approximates to that of the ship, and according to oceanographic data the maximum height ever likely to occur for a wave of 416 feet, the ship's length, is about 35 feet. Under such conditions the maximum range of vertical bending moment would not exceed 260,000 ton-feet corresponding to a stress range at the sheerstrake of 11.0 tons/sq. in.

Horizontal longitudinal bending moments caused stresses, in some conditions, of similar magnitude to those due to concurrent vertical bending. The maximum range observed was 80,000 ton-feet corresponding to a stress range of 2½ tons/sq. in. at the sheerstrake amidships, and such ranges occurred when the ship's course was between 20° and 50° to the wave front. When longitudinal and vertical bending moments were in phase the stress range on one sheerstrake or bilge was very different from that on the other side of the ship(34), (Fig. 8).

Torsion moments were small and had little effect on the stresses in the hull girder.

Water pressures were closely in agreement with those predicted from the trochoidal theory. It was shown that for this ship in a seaway, dynamic terms in the determination of vertical longitudinal bending moments amidships tend to cancel each other. In consequence a reliable estimate of these bending moments for any particular wave length and height in head or following seas can be made from the assumption that the ship is in static equilibrium on the wave, provided the Smith correction is applied.

The relation of these conclusions to the detailed analysis from the still water tests of stress response in the welded and riveted sister ships is likely to throw strong emphasis on the effects of local stress concentrations.

It is hoped that this work, when finally available for critical study, will be found to have contributed usefully to our knowledge of the "way of a ship in the midst of the sea". While the A.S.W.C. is undertaking no further ship structural investigations, these figure prominently in the research programme of the British Shipbuilding Research Association.

Opportunity was taken during the structural trials on the "Ocean Vulcan" and "Clan Alpine" to carry out vibration tests on these two ships as part of the B.S.R.A. programme to develop new and to improve existing methods of calculating critical frequencies of ships' hulls and to obtain information on the effects of loading, depths of water and other conditions(35).

Vibrations were excited by a machine specially designed by Lloyd's Register mounted on the poop of each ship in turn. Records were obtained of critical frequencies and vibration profiles in various modes of vibration under widely different conditions of load distribution and displacement, and also in the case of the "Ocean Vulcan", in normal loaded service condition.

Among other results the tests showed that the critical frequencies in the two forms of construction were closely in agreement, when free from the influence of restricted depth of water. The welded ship, however, tended to have larger vibration amplitudes suggesting that structural damping is greater in the riveted ship.

### Test on Structural Components

Systematic full-scale testing of ships' structural members has been carried out since 1938 on a specially designed machine installed at Messrs. Colvilles Glengarnock Works. This work, originally undertaken by the Institute of Welding staffed by the British Corporation, under J. L. Adam, has been directed by B.S.R.A. since 1945, the experimental team now being provided by Lloyd's Register.

Comparative tests have been made on many varieties of single span mild steel specimens, 16 feet in length, both riveted and welded, consisting of one or three stiffeners connected to plate panels 24 or 72 in. in width, and subjected to lateral load, either uniformly distributed or simulating a pressure gradient. Stiffeners have ranged between 6 and 12 in. in depth, and include many different forms of rolled sections, and also flanged plates. The tests have explored the effects of various types and sizes of stiffener end connections and of the rigidity in attachment to the base structure. Aluminium alloy specimens with different forms of extruded sections have also been tested. Five detailed reports of these investigations have been published (36–40).

Results have clearly shown the advantages to be derived from the improved fixity of welded compared with riveted construction. This fixity significantly reduces both stress and deflection in welded stiffening members. At bulkheads, for example, in which the whole structure, including stiffeners, end brackets and boundaries is welded, it has been found that the strength modulus may, in general, be reduced by 15 per cent and even larger reductions in stiffness permitted. In deciding suitable reductions from riveted standards, it is most important to assess the effectiveness of "backing up" behind the stiffener ends.

Through analysis of the test data, working codes of practice have been formulated for deriving appropriate scantlings under a wide variation of particular conditions, e.g., span-depth ratio and type of end stiffener connections. With this experimental background, much saving in structural weight has been achieved, with proved efficiency in service.

The real improvements in design made possible through these investigations have necessarily been confined to structural components with single-span stiffening and under lateral loads only. A second machine has therefore been developed by B.S.R.A. for the testing of larger specimens subjected to axial as well as to lateral loads and for the study of continuous beams having one or two elastic supports in their length.

Lateral loads are applied through six 50-ton hydraulic rams adjustable for uniform or graded pressure over the test length of the specimen and

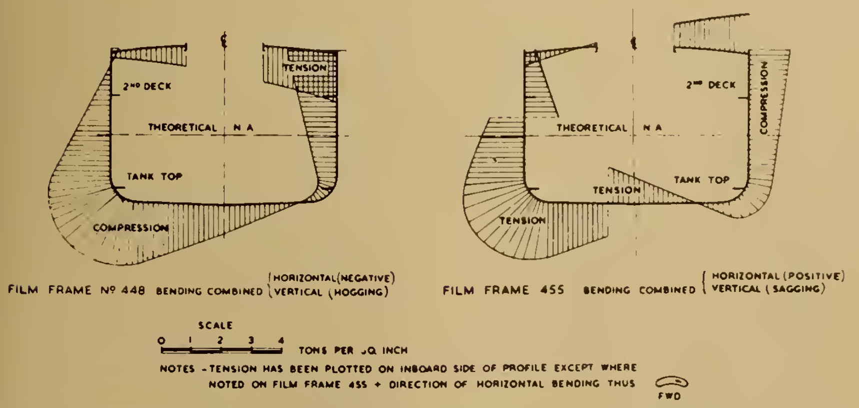


**Fig. 8. Examples of longitudinal stress distribution under combined horizontal and vertical bending moments.** (*Institution of Naval Architects* (34))

distributed uniformly across its width by levers or push rods. Axial loading is applied by three 200-ton, double-ended rams sufficient to develop an average stress in the size of units contemplated of the order of 8 to 10 tons/sq. in. tension or compression. Arrangements are incorporated for intermediate elastic supports to the specimen, dividing its span into two or three equal or unequal parts. Tie rods connect across girders on the test specimen to elastic couplings on the base plate of the machine. These couplings consist of high tensile, light alloy, leaf springs whose stiffness can be widely varied. This material has been chosen in preference to steel to take advantage of its low Young's modulus and consequent saving in bulk and weight.

This second machine is now in operation. Its versatility will permit methodical testing of specimens including vertically stiffened or corrugated bulkhead panels fitted with horizontal girders, stiffened panels of shell and deck plating and pillars subjected to side loads.

Many welded dry cargo ships have developed corrugations in the bottom plating between floors, an unforeseen defect which has necessitated awkward and costly repairs.

The bottom plating of these ships is slightly distorted during construction at the line of the transverse floors, due to thermal contraction at the connecting fillet welds. These deflections, though small, have evidently provided sufficient initial eccentricity to permit progressive unfairness and corrugation in the plating panels in service under repeated compressive loading combined with hydrostatic pressure.

This apparent sensitivity to what might have been considered a tolerable degree of unfairness in the plating is evidence of the increased compressive stresses to which the bottom structure of the modern cargo ship is subjected.

For better understanding of this defect, a series of tests has been undertaken to observe the difference in behaviour under compression of similar panels of plating in riveted and welded specimens representing full scale sections of ship's double bottom, and the effects of fitting fore and aft stiffening to the welded panels. This programme has been carried out by Lloyd's Register on behalf of B.S.R.A.

Five specimens have so far been tested, each 10 ft. wide by 7 ft. 6 in. in length and 3 ft. deep, constructed with four solid floors and bounded by two continuous longitudinal girders. For symmetry under test the top and bottom plates in each specimen have been made of the same thickness. Two specimens were riveted and two welded, each pair being of the same scantlings. Workmanship was to good shipyard practice. One welded specimen was subsequently reinforced at the test centre line by intercostal fore and aft stiffeners welded to the top and bottom plating and to the floors. The programme is being continued with other thicknesses of plating and alternative forms of panel stiffening.

Testing was carried out in a 1,250-ton machine at Messrs. Dorman Long's Middlesbrough Works. From these tests, the following general conclusions may be drawn. The deflection in plating panels between floors before loading in each case was larger in the welded than in the riveted specimen. The degree and pattern of initial deflection in the welded panels exerted major influence on their behaviour and load carrying capacity—the greater the initial deflection, the earlier the collapse of the panel. Failure of the welded specimens commenced when strain on the plate surface reached the yield point, but redistribution of the stress due to plastic flow in the panels enabled these to withstand a still greater load. Welding of the floors provided angular restraint at the plating boundaries, with consequently only a gradual increase in panel deflections. On the other hand, fixity at the floor connections to the riveted panels was slight or absent and the panels buckled suddenly. The efficiency of the plating panels, i.e., the ratio of the actual load carried by the deflected panel to that which would be carried by the same panel with a uniform stress equal to that at the longitudinal edges, remained high in the riveted panels under edge forces of the order likely to be experienced by a ship at sea. For welded panels the efficiency dropped under load, but due to restraint at the floors did not decline thereafter within the limits of the stresses imposed. Permanent set was observed in the welded specimens at a lower load than in the riveted. The fitting of an intercostal stiffener forming a panel breaker at the test centre line of a welded panel having substantial initial deflection (thus reducing the proportions of the panel boundaries from 4:1 to 2:1) restored the load carrying capacity of the panel, so that it was at least equal to that of an unstiffened panel with slight initial deflection.

Other investigations now in hand indicate that where transverse forces, corresponding to hydrostatic pressure, are applied to a series of plated panels subject to alternating loads in their plane, a build-up of plastic deformation can take place in a panel under what are normally straight elastic conditions.

Service experienced and experimental data have resulted in the requirement by Lloyd's Register of increased bottom plating thickness and fore and aft double bottom stiffening in transversely framed welded dry cargo ships.

Facilities for testing full-scale structures in Great Britain have recently been greatly extended by the completion of a special frame at the Naval Construction Research Establishment, Rosyth. This is in the form of a large box with internal dimensions of 69 ft. length, by 33 ft. width and 39 ft. height, a hinged door being fitted at one end for insertion of the test specimen (Fig. 9). The walls are of strong cellular construction designed so that the test specimen can be loaded by a series of 500-ton hydraulic rams which can be arranged at angles up to 45°. At each end forces of 2,000 tons can also be applied horizontally. This test rig is primarily intended to study the design of warship structures, but will also be available, provided defence requirements permit, for investigating merchant shipbuilding and other problems.

#### Fatigue Testing

In contrast to aircraft, there is little evidence that fatigue strength represents a basic criterion in the design of ships' structures. There are conflicting views on the form of test most suitable to reproduce the fluctuating loads to which hull components are subjected.

The resonance vibration method, which is also being adopted by the British Welding Research Association for testing other full-scale structures, has been applied in a series of fatigue tests on welded specimens consisting of a steel plate 10 ft. long and 2 ft. wide, stiffened by two toe-welded angle sections(41). Various welding and constructional details representative of shipbuilding practice were incorporated. A main feature of the work was to determine the effectiveness of different forms of reinforcement to butt welds in the angle stiffeners. It was found that under fatigue conditions these reinforcements tended to reduce the strength due to the discontinuities introduced and that the most effective connection was formed by direct butt welds of high quality.

Fatigue tests are particularly searching in assessing the effects of faults in welded joints and their possibilities are being explored in relation to acceptable radiographic quality. Exploratory tests undertaken by the Naval Construction Research Establishment on defective butt welds(42) have led to the development of a progressive programme by B.W.R.A. In the first instance, butt welds in ½ in. and 1¼ in. thick mild steel will be tested. Control tests are to be carried out on the plain plate material and the butt welded specimens will be prepared, both by manual and automatic arc welding, with square butt V, X and U edge preparations. Before investigating defective butt welds, the fatigue strength for two million cycles for each type of weld will be determined from specimens showing the highest possible radiographic quality.

This work will be undertaken in the large Losenhausen machine installed in the B.W.R.A. fatigue laboratory at Abington. This machine is designed for an alternating load range of 100 tons, which may be applied anywhere within the limits of 100 tons compression and 100 tons tension, on specimens up to 6 ft. in length.

#### Welding and Inspection

Methodical and informed supervision is essential to maintain good standards of workmanship in all stages from the preparation of material, in the actual process of welding and in the control of procedure and sequence. Shipbuilders now possess a wealth of experience supplementing the guidance circulated by the Admiralty Ship Welding Committee(43, 44) and the classification societies.

In Great Britain with its uncertain climate, control is greatly simplified when the work is carried out under cover. Automatic welding by submerged arc processes is rarely used on open berths. These have been important factors in the development of prefabrication in large units and panels, for which extensive changes in shipyard lay-out and lifting equipment have been made.

In welding long joints at the berth, such as those connecting large units, special precautions must be taken, particularly in thick shell and deck plating. To avoid risk of cracking, the heat gradient between the hot weld deposit and the mass of cold parent material should be reduced as far as possible. This is best ensured by the use of large deposits, and prewarming in cold weather is essential. There are still many advantages in fitting some longitudinal riveted joints in the larger welded ships.

Fig. 9. Testing frame for full-scale structural components.

Low hydrogen or basic coated electrodes possess valuable qualities, particularly in their resistance to cracking and high impact values at low temperatures. Their welding characteristics differ from those of other coated electrodes generally used for mild steel and with these welders need to become familiar. Special precautions are necessary to keep the welding rods dry and in some types there is a tendency to fuming. The merits of these electrodes are well recognised by shipbuilders and their use is being extended, especially for restrained conditions of welding.

Among the various methods for nondestructive testing(45) radiography has proved a most valuable shipyard technique for the control of welders, in the checking of procedures and for the examination of critically placed or restrained joints. A marked trend in the United Kingdom is towards the use of radio-active isotopes in place of X-ray apparatus. This has received great impetus through the production of these isotopes for industrial purposes at the Atomic Energy Research Establishment, Harwell. While isotopes of tantalum or cobalt are suitable for heavy work such as castings and forgings, iridium 192 which gives less intensity of radiation, has characteristics best suited for examining welds in ship's plating. This isotope is cheap, has a half life of about seventy days, and gives a good level of contrast, though the exposure time is naturally much longer than with X-ray. Precautions to protect personnel against exposure are thorough, but not restrictive.

#### Structural Design

For successful detail design of all parts of welded hulls, sharp discontinuities or notch effects in the contour or disposition of the material must be avoided to all practical limits. This is an established principle, but it is evident from experience that some local discontinuities which may lead to trouble have not yet always been sufficiently recognised. The eye of the designer and draughtsman must be specially trained to detect and to "smooth out" possible localities of concentration at which acceptable "average" design stresses may be greatly exceeded.

In general practice, well rounded hatch corners are now arranged in dry cargo ships and in tankers earlier undesirable details of framing structure and of bulkhead stiffening ending on "soft" plating have been eliminated. A fabricated sternframe is now designed with easy contours at its junction with the main hull at the oxter.

Over recent years significant changes have taken place in the general design of merchant ships. The modern dry cargo carrier is of finer form than the older deep sea tramp. The three-island coal burning type has been replaced by the two-deck or shelter-deck oil burner. There is consequently a trend towards increased weight, with decreased bouyancy at the ends. This is further accentuated in some of the faster cargo liners which also carry cargo in long forecastles and poops. Hogging moments in the loaded condition consequently tend to be more severe than those in cargo ships of a generation ago, for which sagging in ballast was the more critical condition(46). In many welded ships the resulting compressive stresses in the bottom plating have led to the development of corrugated plating between transverse floors, a defect to which reference has already been made. The tensile stresses in the strength deck call for most careful design, particularly at hatch corners and other openings. Experience and experiment clearly indicate the advantages in the modern dry cargo ship of framing the bottom and strength deck longitudinally over the midship half length. This arrangement, which also considerably reduces steel weight, is being increasingly adopted and is in line with the now universally recognised system of framing in ocean-going tankers.

In modern tankers, due to progress in general design, the ratio of tank length to ship length has been significantly increased. Loading can consequently be spread over a greater proportion of the ship's length with a beneficial reduction in sagging moments. The ample tank capacity available provides good flexibility in cargo distribution, but this must be carefully controlled, especially in the big ships, to avoid undesirable stressing in service. The important influence of judicious cargo distribution in minimising structural damage is increasingly recognised both for dry cargo ships and tankers and guidance to owners has been made widely available in recent years(47).

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# A New Concept
## in
# Modern Office Building Construction

*by*

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*A paper to be presented before the 68th Annual General and Professional Meeting of the Engineering Institute of Canada at Quebec, May 14th, 1954.*

Defining the types of office buildings to which it applies, this paper covers briefly the history leading to the development of a new concept in office building heating, cooling and air conditioning. The application of this new idea to two modern office buildings is described and illustrated. In order to present a complete account of these buildings, brief descriptions of the remainder of the electrical and mechanical equipment of each building are also included.

Like almost everything else, office building design and construction is constantly changing. These changes do not take place as rapidly as they do in other fields, nor are the new developments in office building design and construction nearly as striking, or even as noticeable, as elsewhere. Yet in the last twenty or thirty years, office buildings have undergone very appreciable changes, so much so that the requirements of a modern Canadian office building are now following definite new trends.

While the term "office building" may be applied to any building which houses one or more offices, the office buildings to which this paper is intended to apply are those large towering office buildings erected by their owners for their sole ultimate occupancy, such as those for the large insurance firms, for public utility companies or for other large corporations. They may also be those for occupancy in part by their owners and in part by numerous high class tenants, such as the large head office buildings erected by banks, trust companies or the like.

Certain large multistorey speculative office buildings, designed for exclusive or discriminating tenants, such as medical buildings, dental buildings and the like, may be treated practically as falling into the same class as the buildings mentioned. The remainder of the speculative buildings are intended for diversified tenants and various occupations, and are generally of cheaper construction. Because these are speculative undertakings, they are usually designed and built to minimum standards, and neither the designers nor the builders can afford to experiment with or adopt new, untried methods, materials or equipment. Consequently, this type of building does not fall within the purview of this paper.

It might be mentioned that speculative buildings are frequently erected with a minimum of financial resources and expenditures. For that reason architects' fees are kept to a minimum and consulting engineers fees are either kept very low or, in many cases, are not incurred at all. Thus the architects and such engineers as are retained for such work cannot afford to devote time to developing new ideas, or even to studying and passing on newly conceived ideas presented by others. They must therefore, of necessity follow well established construction practices, and must use materials and equipment with which they are familiar.

On the other hand, large office buildings are usually erected for owners with ample financial resources. Such owners want their own buildings mainly for their own use and convenience, but also for the publicity and prestige of fine, up-to-date and imposing buildings. These owners are able to afford the better architectural and engineering services, and are willing to have their architects and engineers investigate new methods, new materials and even try out entirely different concepts of design and construction.

In fact some owners are anxious to have their designers create striking and even dramatic constructional features, in order to obtain still greater publicity. As a result, the owner of the modern office building coming within the scope of this paper is the one who usually takes the lead in adopting new ideas, and in establishing them as a new standard for others to follow, even in the construction of other types of buildings.

### The Trends since the Early "Thirties"

Twenty-five years ago, when the author entered private practice as a consulting engineer, the electrical and mechanical equipment of office buildings appeared to have reached a common standard. Yet shortly thereafter, new inventions and new developments began to appear in this field. Those interested in recalling the developments in heating practice taking place about that time are referred to a paper presented by the author before the Montreal Branch in April 1932. But to recapitulate here, it may be of interest that twenty-five years ago, the unit heater and the convector were just being introduced.

About that time, individual, self-contained thermostatic radiator control valves were being commonly adopted for entire buildings. These have since proved to be unsatisfactory when so used, and have gradually gone into disrepute. Steam heating systems had just undergone a great change with the introduction of orifice plates in radiator valves, and with the development of a number of automatic control systems for controlling entire heating systems or sections of a large system.

With the advent of these controls, zoning the heating systems in large buildings then began to appear. Automatic humidifiers started to make their appearance. Radiant heating had been introduced into Canada by the author about that time, but was not to be adopted to any extent for another fifteen years or more. Air conditioning for human comfort, as opposed to air conditioning for industrial processes, had still to be introduced into Canada. As far as electrical equipment is concerned, the commercial fluorescent lighting units were then unknown, and were not commonly accepted for another decade or more.

In the last twenty-five years, Canada has gone through a great economic depression, a World War and the Korean war, emerging as one of the leading nations of the world. As a result, within the last five years, in Canada, office buildings of the type covered by this paper have increased in number, in size and probably in quality. The most predominant feature has been increasingly better and more comfortable office accommodation, with low operating and maintenance costs, and this without excessive construction costs.

Better accommodation is provided by more flexible and more convenient office arrangement, and by better facilities for telephone service and wiring for portable lamps and electrical office equipment of all kinds. More comfortable office conditions are now being furnished by better and more accurately controlled heating, better lighting, the common adoption of acoustic treatment, the more common acceptance of year-round air conditioning, or, at least, of much better mechanical ventilation.

It should be mentioned that better accommodation and greater economy is also being supplied by the more general use of insulation in the walls and in the roof construction, as well as by the use of new materials and different techniques with the older materials. It is not the purpose of this paper, however, to deal further with the architectural features of office buildings. It is restricted to the engineering features of modern office buildings.

In recent years great advances have been made in the engineering features of modern office buildings. The proportion of the building cost spent on the work designed by electrical, mechanical and structural engineers has gradually increased. As an example, in the last twenty-five years the cost of the electric work has risen from about 3½ per cent of the total cost to almost 10 per cent and the cost of the mechanical trades has gone from about 11 per cent to between 20 and 22 per cent. The introduction of light, insulated cladding in large panels in place of the traditional stone or brick exterior curtain walls will undoubtedly still further advance this trend.

Incidentally the complexity of the engineering work has increased very greatly, but before dealing further with the engineering of new office buildings, consider for a moment some of the developments which have taken place in recent years, and which have led up to present-day practice.

### Development of Radiant Heating

Having been interested in the subject for some years, though unable to obtain any technical data, the author made his first radiant heating attempt in a portion of a building in the spring of 1929. Before this system could be tried out elsewhere, the depression put a stop to practically all new building construction and so to further design of this system. A second small installation was made in the thirties but the advent of World War II prevented further installations.

During that war the author collected all the technical data available on radiant heating from England, the United States, France and Switzerland. Towards the end of hostilities, the author and his firm decided to concentrate on radiant heating and for this purpose entered into an agreement with the firm which not only pioneered and developed radiant heating and cooling in England, but had also built up what was practically a world-wide organization to promote and install it.

Starting in August 1944, the author's firm designed radiant heating installations for a variety of buildings, taking greater care with and expending much more time on the designs and supervision of the installations than the fees ever justified. The first important lesson learned from this was that radiant heating coils embedded in floor slabs were not nearly as satisfactory nor as economical as radiant heating coils embedded in the ceiling construction.

Thus ceiling type radiant heating installations were installed in, and proved successful in, a variety of buildings of all kinds and sizes. Then, after having proved the advantages of radiant heating in a few small office buildings, the author's firm was retained to design the electrical and mechanical services of a new head office building for the Dominion Textile Company in the spring of 1946.

It was decided to incorporate radiant heating and cooling combined with air conditioning in that building. At first it was intended to utilize pipe coils embedded in the ceiling plaster for the radiant heating and cooling. When the Dominion Textile Company decided to install acoustic treatment on the ceilings throughout the building however, it became apparent that such treatment would seriously interfere with the radiant heat emission from or absorption by the ceiling plaster.

### Aluminum Panels

Before the engineering drawings had proceeded very far, the Company decided not to proceed with the construction on Victoria Square, but to defer it until a more suitable site up-town in Montreal could be purchased. The work for this building was thus held in abeyance for about two years, during which time aluminum panels fabricated from perforated aluminum sheet came to the author's notice. These panels combined radiant heating and cooling with highly efficient acoustic treatment, and also provided for ventilation or air conditioning.

These panels had been invented by Gunnar Frenger of Norway, and in the summer of 1948 he provided us with a number of his panels for testing. In September 1948, the author's firm set up a research installation for testing the performance of these aluminum panels, both as radiant heating and cooling panels, in order to verify the Norwegian performance data. As a result of these tests, when early in 1949 we were instructed to proceed with the design of the new Dominion Textile Building on a site on Sherbrooke Street, it was decided to abandon pipe coils embedded in the plaster ceiling, and to adopt aluminum radiant heating and cooling panels.

About the same time, the engineering work for two large hospital additions was awarded to our firm, with the understanding that this system would be adopted in portions of them. Finally, about midsummer 1949, we entered into a contract for the electrical and mechanical engineering work of the monumental Manufacturers Life Insurance, Head Office Building in Toronto.

#### Extruded Panel Combines Services, Saves Air

Because of its extremely large size and because Charles S. Leopold, consulting engineer of Philadelphia, had then a pilot installation of radiant cooling in operation in New York, the author's firm retained Mr. Leopold to work as an associate on that project. Mr. Leopold and others in the United States had developed an extruded aluminum panel for radiant heating and cooling, which was being manufactured in the United States.

At the time this extruded panel had been developed further than the Frenger panel. Because of this, and due to the fact that the extruded aluminum panels had been proven by the pilot installation referred to, extruded panels were adopted for the Dominion Textile Building, the two hospitals and finally for the Manufacturers Life Building. The extruded aluminum panels used in these buildings were made in Canada. They are similar to those made in the United States, but differ slightly in the manner in which the copper pipes are embedded therein.

During the development of the design of the Manufacturers Life Building, Mr. Leopold suggested the idea of combining the radiant cooling panels with the fluorescent lighting units. Mr. Leopold and the author then developed the practical application of this idea, and incorporated it in the drawings. In this application the author originated the idea of utilizing instant start fluorescent lamps and of operating them at lower current rates than standard, to reduce the surface brilliancy of the tubes to the level where neither louvres nor diffusing glass is required to eliminate objectionable glare.

It should be pointed out that all or most of the sensible heat can be provided by direct radiant heating panels, while the sensible cooling can, for the most part, be done by radiant cooling. It follows that by combining radiant heating and cooling with air conditioning, the quantity of conditioned air can be reduced very appreciably. Thus instead of circulating the usual 1 c.f.m. to 2 c.f.m. per square foot of floor area required with conventional air conditioning, this system requires between 0.25 and 0.40 c.f.m. per square foot of floor area. It also follows that the air ducts and the air conditioning equipment may be reduced in size correspondingly and even the building may be made smaller.

Moreover, radiant heating and cooling combined with air conditioning provides a much greater flexibility in maintaining comfort despite variations in load, than is possible with the conventional air conditioning systems. Also office partitions may be moved without requiring any changes to the heating, cooling, ventilation and lighting installations. Thus was one of the most outstanding concepts of office buildings developed. The practical application of this development is best illustrated by reviewing the actual details of a few modern office buildings.

#### Dominion Textile Building

The new Head Office Building for the Dominion Textile Company Limited, designed by H. Ross Wiggs, F.R.A.I.C., architect, is a free-standing, eight storey building, having a two storey penthouse and a single storey basement. The building was erected on property which presently provides a large open parking space which can in future be used for the addition of a large wing. An exterior view is shown in Fig. 1.

The design and construction of the building are such that it takes into account not only the company's present needs, but endeavours to anticipate future needs of the company for a long time. It was designed so that, if needed, a future wing could be added to the rear of the building, converting the plan of the building into an H-shape. Inside the building the principle of flexibility has been paramount, and

**Fig. 1. The Dominion Textile Head Office Building.**

**Fig. 2. Typical installation of radiant panels under windows in Dominion Textile Building.**

care has been taken to provide for any possible office rearrangement made necessary by growth, new developments or rearrangement of offices.

The building has a structural steel frame. The floor system consists of precast aerocrete slabs, having a 3 in. fill of vermiculite concrete over these slabs to accommodate a system of steel underfloor ducts for electrical and telephone services. Plaster ceilings occur in the main entrance lobby, the executive offices, in all elevator lobbies, and wash rooms. The ceilings in all other office areas consist of perforated steel pans having mineral wool pads set on top of them, thus giving highly efficient acoustic treatment.

Like many other really modern buildings, this building is equipped with a radiant heating system. This installation goes a step further, however, in that the radiant panels are used not only for radiant heating in winter but are utilized as radiant cooling panels in summer. In fact, this was the first large office building constructed in North America having all of its offices equipped with radiant heating and cooling panels used in combination with year round air conditioning.

The radiant heating and cooling panels are extruded aluminum panels, exposed faces of which are smooth but have copper tubing embedded in annular projections on their backs. In winter, warm water is circulated through the copper tubing, with the result that the aluminum panels emit radiant heat. In summer, chilled water is circulated and the panels then absorb heat mostly by radiant heat transfer. The aluminum panels were extruded in Kingston, Ontario, finished to exact size and had the tubes inserted and expanded into them in Montreal. The radiant panels were installed under the windows, with one panel per bay, extending under two or three windows as required, as shown in Fig. 2. A section through the panel is shown in Fig. 3.

The radiant panels are connected to four separate zones, one being the north-west zone, the second the south-west zone, the third the south-east zone and the fourth the north-east zone. Each zone is provided with its own steam-heated convertor, circulating pump, and its own pneumatic controls. The latter are controlled by means of an electronic recorder-controller, actuated by means of a temperature-sensing element attached to the inside surface of the glass in a window of the zone controlled. The installation of the four convertors, circulating pumps and pneumatic controls is shown in Fig. 4.

The boiler room is located in the basement west of the garage, and contains two large steel, low-pressure steam heating boilers for heat-

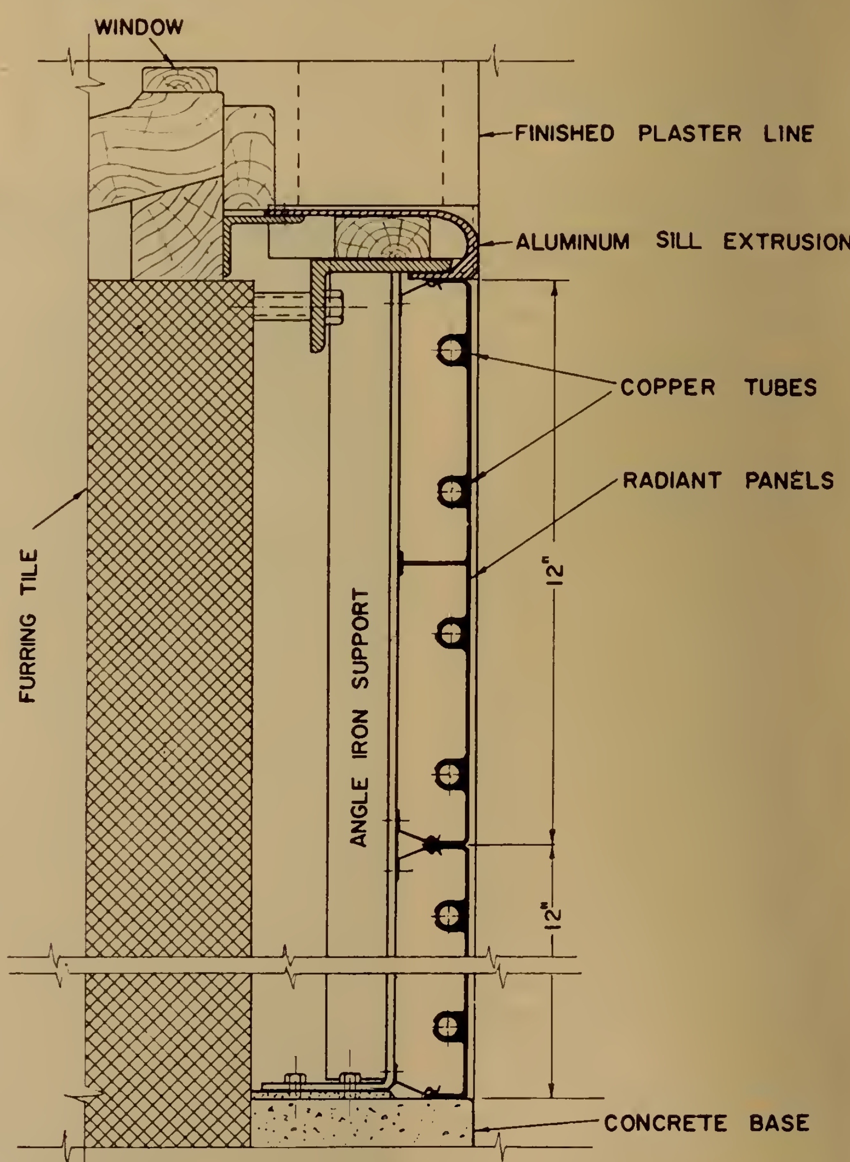


**Fig. 3. Section through radiant panels of a typical sill panel installation in Dominion Textile Building.**

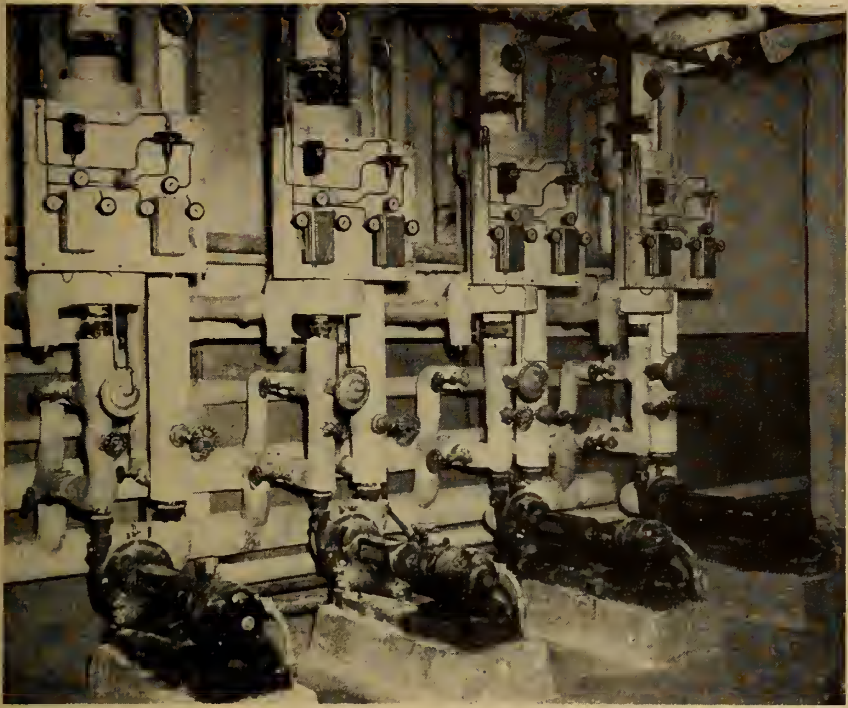

**Fig. 4. Installation of convertors, circulating pumps and pneumatic controls.**

ing the building, the domestic hot water, the ventilation heat load and provides steam for the cafeteria in winter. A small domestic type steel low-pressure steam heating boiler was provided to heat the domestic hot water, and to provide steam for the cafeteria in summer. The three boilers are oil fired, the two larger boilers being equipped with fully automatic horizontal rotary cup burners designed to burn No. 6 or bunker C heavy fuel oil, while the small boiler burns light furnace fuel oil, also automatically.

A centrifugal refrigerating unit is also installed in the boiler room, to chill the water for cooling the radiant panels in summer and to chill the water for the cooling coils in the air conditioning units. This unit has a capacity of 208 tons of refrigerating when operating at 5,300 r.p.m., when chilling water from 48.3° F. to 40° F., and when supplied with cooling water at 85° F. The cooling water is circulated through a forced-draft cooling tower located in the penthouse on the roof. Figure 5 shows the refrigerating unit with the cooling water circulating pump in the foreground.

#### Air Conditioning and Ventilation

The building is equipped with seven complete year-round air conditioning systems and a number of supply or exhaust mechanical ventilation systems. The air conditioning installation, like the radiant heating and cooling, is divided up into a number of systems or zones. As the sun moves around the building the temperature of the air supply in each system can be thus varied to suit the varying sun load and to suit the shading from the adjoining buildings.

For this reason there are four general air-conditioning systems, divided up slightly differently to the radiant heating and cooling installation. There are two systems along the south-west wall, one being along the front or north portion of that wall, and the second along the back or south section of the wall and about one-half of the south-east wall. The third system takes care of the offices along the north-west wall as well as those on the north half of the north-east wall. The fourth system looks after the south half of the north-east wall, as well as the east third of the south-east wall.

These four systems in general provide the air conditioning for all floors from the ground floor to the seventh floor, inclusive. An exception is the testing laboratory on the seventh floor, which has its own air conditioning system and refrigerating compressor moved from the previous building. The executive offices on the eighth floor have a separate air conditioning system, while the auditorium, the eighth floor has a separate system as well. The seventh air conditioning system is that for the cafeteria and kitchens in the basement.

Separate mechanical ventilation systems, designed to either exhaust only or to supply and exhaust air, are installed for such purposes as kitchen exhaust, toilet exhaust, transformer room supply and exhaust, and boiler room supply.

The fresh air for most of the building is drawn in on the tenth floor. There is a second fresh air inlet located at the fifth floor, which provides the fresh air supply for the cafeteria air conditioning system,

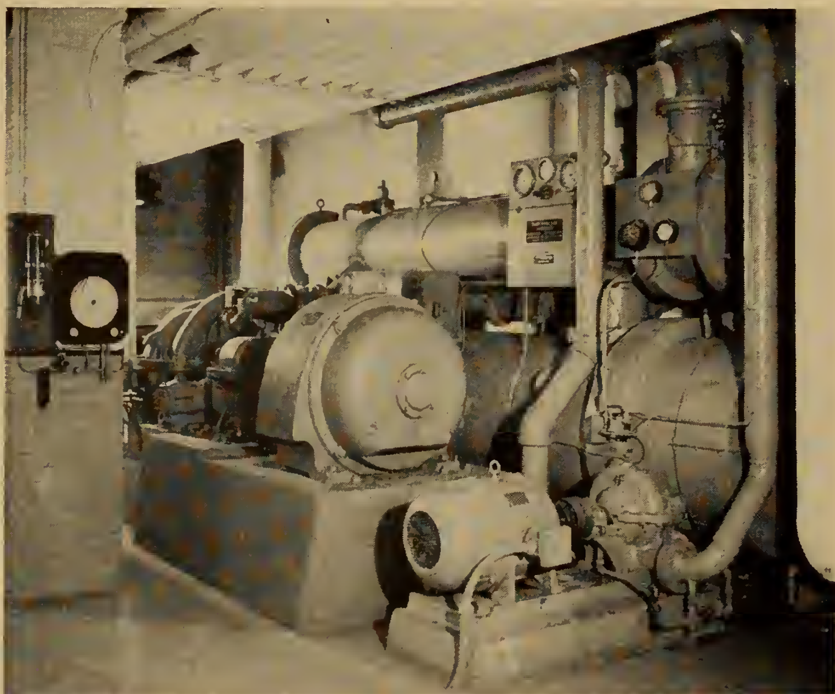

**Fig. 5. 208 ton centrifugal refrigerating unit in Dominion Textile Building.**

and for the ventilation system for the boiler room, garage and transformer room.

The seven air conditioning systems, with the exception of the cafeteria system, each consists of successively, an electronic air filter, a cooling coil, an air washer, reheating coils and a supply fan with the necessary control dampers, controls, etc. The unit for the cafeteria is the same as the above, but is not provided with an electronic air filter. Each of the systems, including the cafeteria systems, is also provided with a recirculation fan for recirculating about 90 per cent of the conditioned air circulated by the supply fan.

The air from the central air conditioning units is circulated through insulated metal ducts to circular ceiling diffusers, located about six feet away from the inside surface of the exterior walls, and spaced two diffusers per bay. For approximately each two supply diffusers there is provided one return grille. The return grilles are installed in the ceilings, and are placed 12 to 18 feet closer to the centre of the building than the supply diffusers.

The air supplied to the offices is in excess of that recirculated, so that the difference is mechanically exhausted to the atmosphere or finds its own way out to the atmosphere through windows, doors, etc. In this building the air to be exhausted flows from the offices into the corridors, where it flows to the toilets and coat rooms, from whence it is exhausted through the roof to the atmosphere.

### Automatic Temperature Control System

The system of automatic temperature and humidity control is just as ingenious as the unique heating and cooling installation. The subdivision of the radiant heating and cooling panels into four zones facilitates the control of the panels, according to the variations of outdoor temperature, wind and sun load on the various exposures. Also, the use of seven different air conditioning systems is an important aid to adequate temperature and humidity control in each area in the building.

The automatic regulation of the radiant panels is accomplished by an electronic master controller, activated by a temperature-sensing element secured to the inside surface of the window glass. The master resets one submaster aquastat, which in turn controls the temperature of the water in the panels when heating is required. It also resets a second submaster aquastat which controls the water temperature during the cooling season. This control, for both heating and cooling, produces results difficult and expensive to obtain with conventional regulation by room thermostats.

Fig. 6. Tabulating room in Dominion Textile Building showing radiant panels, diffusers and lighting units.

The automatic regulation of the seven air conditioning systems is equally interesting. Here, four master outdoor thermostats, two for each season, reset the submaster thermostats which are associated with several of the air conditioning systems. Those submaster thermostats, and other duct thermostats for each system, operate modulating steam valves, during the heating season, on the preheating and reheating coils.

During the cooling season, those instruments are automatically shifted to operate cold water valves on the cooling coils. Also, during both seasons, several automatically operated dampers are controlled to properly pass the air through or around the heating and cooling coils, in order to secure immediate response to the demands of the controlling instruments. Automatic humidity control for each system is accomplished, during both heating and cooling, by a humidistat in the air washer discharge. These humidistats operate valves which determine the moisture content of the air leaving the washer.

Construction of the Dominion Textile Building was started in May 1950, and was substantially completed in October 1951. Thus its equipment has now been used through three heating seasons and two summer seasons. In that time it has clearly demonstrated the great advantages of radiant heating and cooling, combined with air conditioning, due to this system's closer temperature control, greater comfort and reduction in drafts compared with the more conventional air conditioning installations.

### Manufacturers Life Building

The Head Office building of the Manufacturers Life Insurance Company, located in Toronto, was built in two stages. It consists of the original six storey building, with a new twelve storey addition erected right up against the rear of the original building so as to form a completely integrated single building. The original building was designed by Sproatt and Rolph, architects, and was completed in 1925. The new addition was designed by Marani and Morris, architects, together with Wallace and Carruthers as structural engineers, the author's firm as consulting electrical and mechanical engineers and Charles S. Leopold as associate consulting engineer.

The architects and engineers were instructed to design the new addition to blend in with the original portion, to maintain the feature of large, clear open floor spaces and to provide maximum flexibility of office arrangement, efficient operation and low maintenance costs. Additional requirements were good lighting, acoustic ceilings and year-round air conditioning. Furthermore, the design of the new addition had to be such that by renovating the original building in the same manner, the offices in both would be the same.

The completed building has a central core, surrounded by clear office space having 50 foot clear spans. The central core contains the elevators, wash-rooms and spaces for the vertical air ducts, plumbing stacks, and the heating, cooling and electrical risers. All floors have a clear ceiling height of 9 ft. 4 in. with a floor to floor height of 13 ft. 4 in.

Construction of the new addition was commenced in June 1950, shortly before the outbreak of the Korean war. Because of these hostilities and the resulting intense defence construction, considerable delay occurred in the erection of the new addition. As a result, the new addition was not completed and occupied until October 1952.

The staff then moved from the original building into the new portion and the original portion was rehabilitated. This was accomplished by removing its entire interior finish, as well as all of the existing electrical and mechanical services. The original portion was then furnished with the same electrical and mechanical services as the new portion, and was provided with the same interior finish. Like the new portion, it was also supplied with storm sash.

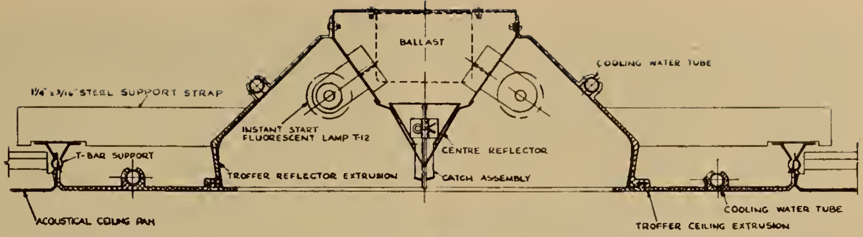


**Fig. 7. Section through luminaire for Manufacturers Life Building showing water-cooled reflectors and ceiling extensions.**

Like the Dominion Textile Building, the Manufacturers Life Building is equipped with a radiant heating and cooling system, combined with year round air conditioning. However, the latter differs from the former in that greater advantage has been taken of the radiant heating and cooling functions, with a corresponding reduction in the relative size and complication of the air conditioning equipment. In addition, the Manufacturers Life installation makes use of water-cooled fluorescent lighting units, and has radiant panels both in the ceilings and under the windows. As a result of the combination of these features with acoustic treatment it was necessary for the author's firm to plan and develop the entire suspended ceiling system.

The ceiling system combines radiant heating and cooling, recessed fluorescent lighting, acoustic treatment, and concealed sound or paging loudspeakers as well as diffusers and ducts for the supply of conditioned air. Of all these elements, experience had shown that the location of the radiant heating and cooling panels is not particularly critical. Neither is the location of the air supply diffusers and of the acoustic treatment. On the contrary, the location and spacing of the luminaires is fairly exact if uniform light intensity is to be obtained over the entire floor area.

Besides this, the placing of the luminaires was limited to a large extent by the window spacing. Finally, the spacing of the loud speakers for the sound system must be moderately uniform. Combining all the elements into a ceiling pattern which would be reasonably uniform in arrangement and of good appearance in large open areas, yet be adaptable and flexible enough to accommodate partition changes without these affecting the lighting, heating or cooling, or the ventilation, required very careful development of its component parts and precise planning of the whole.

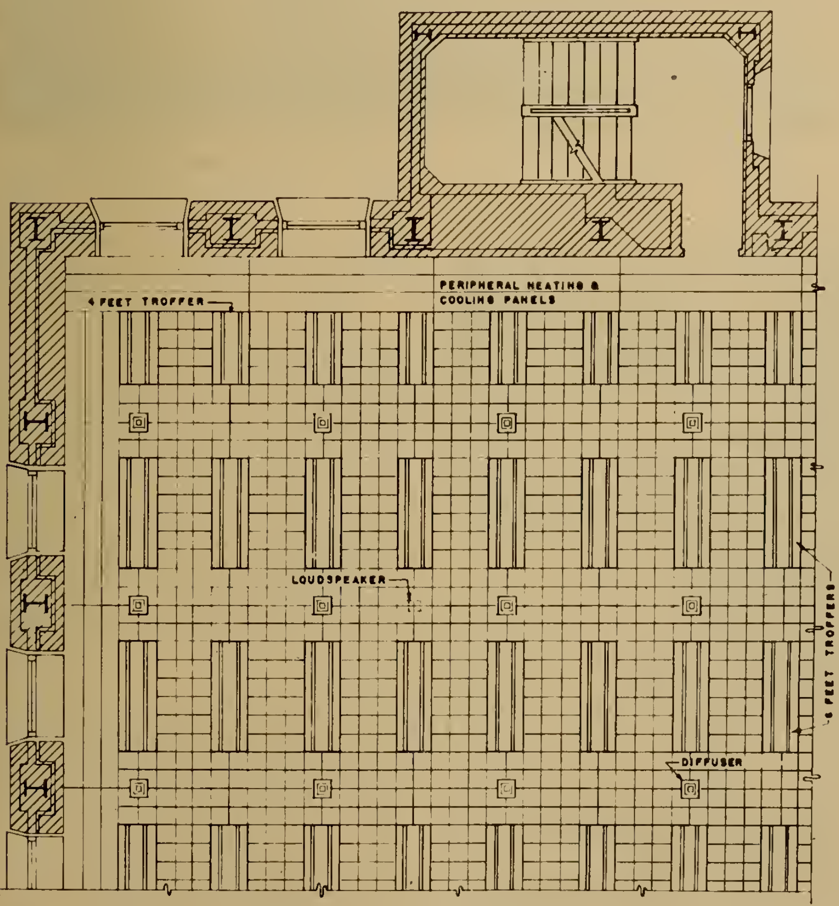


**Fig. 8. Reflected plan of corner of ceiling showing positions of peripheral panels, troffers and diffusers.**

### Ceiling System

In planning the ceiling system it was necessary, first to decide on the type, size and spacing of the lighting units and on the lamps for these units. It was decided to adopt recessed fluorescent luminaires, without louvres or glass panels, but equipped with instant-start fluorescent lamps so as to give the highest possible efficiency with lowest operating and maintenance costs. In order to obtain uniform lighting and an attractive pattern, it was found necessary to place the luminaires in rows on five foot centres, since the windows are on five foot centres.

Then, except along some exterior walls, in a few places surrounding the centre core and a portion of the original building, it was found that six foot units on ten foot centres best suited the floor plan. Where six foot units could not be utilized, the luminaires were reduced to four foot units. All these units are two-lamp units, using the same diameter fluorescent lamp in the two lengths.

After the exact positions of the luminaires had been fixed, a band of extruded aluminum radiant heating and cooling panels, generally three feet wide, was placed around the perimeter of each ceiling. These were for the purpose of supplying radiant heat to offset the heat loss through the walls in winter, and to provide radiant cooling to absorb the heat gain through the walls in summer. Following this, the location of the conditioned air supply diffusers was fixed by placing them in line with and between the ends of the luminaires, thus placing them on ten foot by ten foot centres.

In such large floor areas as occur in the Manufacturers Life Building, the heat given off by the occupants and the heat produced by the lamps can readily be taken care of in areas adjacent to exterior walls, but it is usually a problem difficult of solution in the large interior spaces. In this case, the problem was solved simply and effectively by the development of a luminaire having water-cooled reflectors to absorb the greater part of the heat emitted by the lamps and their ballast and water-cooled flat ceiling extensions forming part of the unit, to absorb the heat given off the occupants in its vicinity.

A section of this luminaire is shown in Fig. 7. The luminaire, including its two ceiling extensions, is exactly two feet wide with its edges turned up and so shaped that they can be inserted into and securely held in the T-Bar supports, which hold up the perforated steel acoustic ceiling pans. The remainder of the ceiling was then filled in with perforated steel acoustic pans, each 12 in. by 24 in. Each of these was covered with a pad of acoustic material, except those pans immediately below the loud speakers for the sound system. A reflected plan of a corner of the ceiling is shown in Fig. 8.

In addition to the radiant panels around the ceiling perimeters, a radiant panel is placed under each window. These sill panels provide radiant heating in winter and radiant cooling in summer, having been designed to offset primarily the radiation from the windows to the occupants in summer and from the occupants to the windows in

**Fig. 9. Typical window installation in Manufacturers Life Building.**

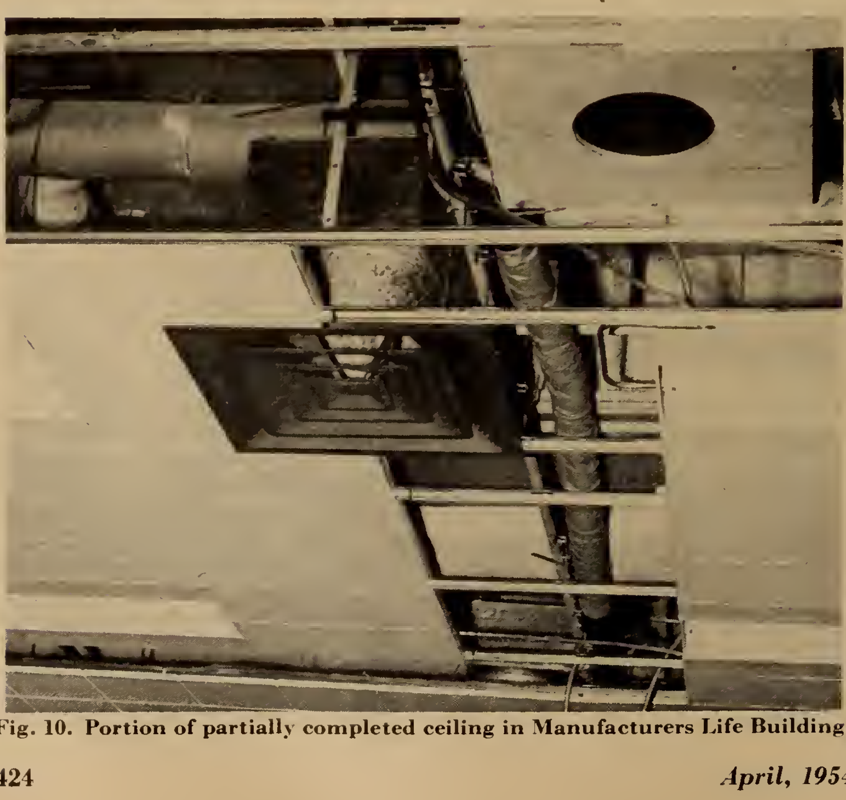

**Fig. 10. Portion of partially completed ceiling in Manufacturers Life Building.**

winter. The extruded aluminum stools fastened to the sill panels together, with the latter, serve in winter to offset the formation of down-drafts from the windows. Fig. 9 is a view of a typical window installation, showing the peripheral panels at the top of the picture and the sill panels below the windows.

The cooling coils in the luminaires were connected generally in series of four units and then connected all to one circuit. The coils in the peripheral and sill panels were connected in separate circuits, and then zoned according to the orientation of their adjoining exterior walls.

A portion of a partially complete section of the ceiling is shown in Fig. 10. In the lower portion of the picture, the six-foot luminaires may be seen on the left, the four-foot units on the right and the square diffusers between the troffers. At the top of the picture, the cooling water connections to the luminaire panels may be seen, as well as a loud speaker for the sound system.

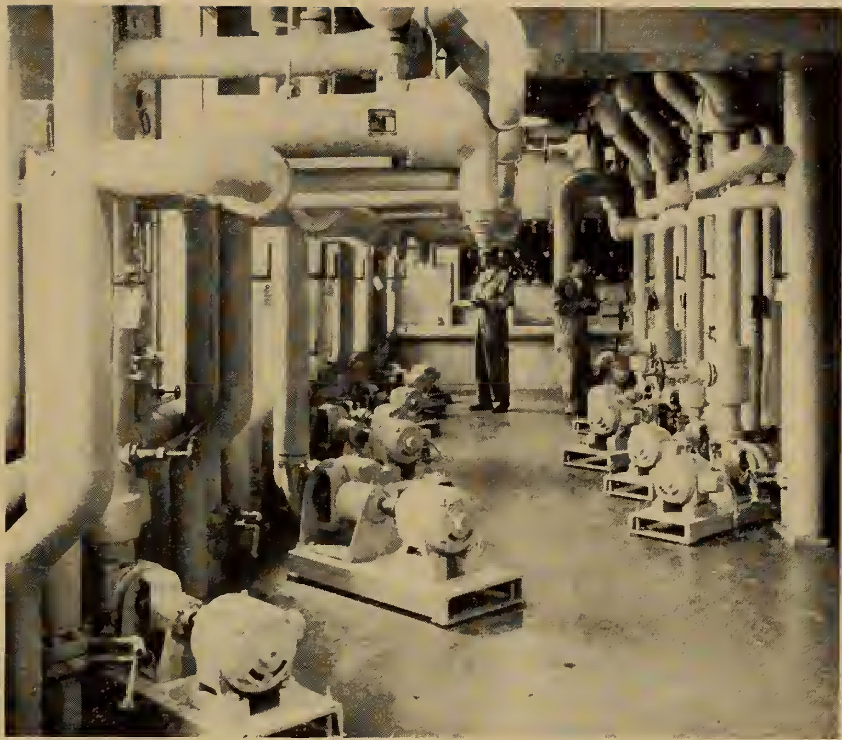

**Fig. 11. Heat exchangers, pumps and control valves on 11th floor equipment room of Manufacturers Life Building.**

### Air Conditioning System

The conditioned air-supply system is typical of any other first class air conditioning system for a large office building, with a few notable exceptions. The air circulated through the areas having cooling panels is only a small part of that which must be circulated in a conventional system. In general it amounts to about 0.4 c.f.m. per square foot of floor area in the interior part of the building, and between 0.6 c.f.m. and 1 c.f.m. per square foot of floor area along its perimeter.

Also the conditioned air in these areas is supplied at both a constant temperature of between 62°F. and 66°F., the year round, except during the night and for a short period each morning before the building is occupied, the air is kept at constant humidity the year round, except in those few places where booster-heaters are installed in the supply air ducts.

The entire radiant heating and cooling system and the conditioned air systems are controlled automatically by means of an elaborate and extensive control system. This is a pneumatic system, except for a few controls which are available only in electrical instruments, while appreciable use has been made of recorder-controllers. Each sill panel zone is controlled by a thermocouple held tightly up against the inner surface of the glass in the inside window. The windows are all double casement windows throughout the building.

The temperature of the water in each of the peripheral panel zones is controlled in summer by means of a solar compensator, which is a photo-electric cell mounted behind a plate of blue glass in a weatherproof box. One solar compensator faces east, one south and one west. In winter these panels are now controlled by the window compensators. The temperature of the water in the interior zone, which contains the troffer cooling, is controlled by means of a lighting load compensator, in turn activated by a current transformer connected to one of the main lighting feeders.

The boilers and the large refrigerating unit for the air conditioning are installed in a separate service building. The boiler plant consists of three oil-fired water tube boilers, each having a continuous rating of 7,500 lb. of steam per hour and operated at 30 lb. pressure. The refrigerating unit for the air conditioning is a single

*(Continued on page 430)*

**Fig. 12. Finished ceiling system of cafeteria in Manufacturers Life Building.**

# Fire Protection Aspects of Building Design

*by*

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Canada's fire losses are still too great. The better utilization of fire protection engineering by those directly concerned with the construction and maintenance of buildings is urged. An introduction to the application of the art of fire protection to building design is given, with additional remarks concerning the need for better construction specifications, better testing of materials for their ability to withstand the effects of fire, and better supervision of building construction, with fire protection in mind.

In 1952 the entire Canadian labour force worked nearly 14 hours to pay for recorded fire losses, most of which were needless. When one allows for unrecorded and indirect fire losses, it is safe to assume that each reader of this paper wastes almost a week annually working to pay for losses incurred by disregard or faulty application of the science of fire protection.

### Perspective of Fire Protection

Fire protection should be viewed in its true perspective. It has many times been said that fire protection is over emphasized by those in fire protection work. Rather, the authors of this paper feel that fire protection is not sufficiently emphasized by management and engineers. In the United States, 200 manufacturing and mercantile establishments are destroyed by fire each day (1).

Table I records losses in the United States in 1951 and 1952, the last two years for which figures are available, for six types of occupancies. The data are not available for similar losses in Canada.

Study of the data for 1951 and 1952 (4,5) with respect to cause reveals that sparks on roofs caused fires which resulted in losses of 23 million dollars and that the misuse of flammable liquids started fires that resulted in losses of 106 million dollars. These two hazards were selected because they are two of the most completely studied in fire protection engineering. Standards exist, which universally applied, should make fires of this nature a rarity.

In the last ten years, 974 people have died in major fires in Canada and the United States where highly combustible interior finish was the principal cause of fire spread (3). This figure does not include the uncounted and tragic number who perished by ones and twos in substandard housing. Many of the 974 persons were trapped in buildings which up to the moment of the fire were considered safe and well designed by all but the fire protection fraternity.

When considering fire protection, care must be taken to recognize and evaluate all the losses involved when fire strikes. Table II outlines some of the indirect losses revealed in a recent study.

The financial aspect of fire protection is not always viewed in its true light. Added fire protection is not considered justified by management unless it pays for itself by reductions in insurance rates in a few years time. If one considers fire insurance as a form of depreciation allowance against destruction by fire, it will be found that this new form of depreciation may approach and sometimes exceed depreciation for wear and obsolescence.

**Table I: Estimated Fire Losses in the United States for Six Occupancies (4,5)**

| Occupancy | 1951 | 1952 |
|---|---|---|
| Warehouses | $ 28,000,000 | $ 45,000,000 |
| Manufacturing establishments | 172,750,000 | 153,600,000 |
| Piers, inc. shipyards | 12,000,000 | 14,400,000 |
| Railroad properties, including rolling stock | 12,040,000 | 10,200,000 |
| Bulk oil storage, refineries | 18,300,000 | 16,500,000 |
| Power plants, pump houses | 6,450,000 | 3,730,000 |

### Scope of Fire Protection

The science of fire protection has been divided into four general fields of endeavour (11):

1. The prevention of the outbreak of fire.

2. The early detection of fire.

3. The prevention of the spread of fire from the area in which it originates.

4. The extinguishment of fire.

Because of the broad scope of fire protection, the authors have confined this paper to a review of the means of achieving these four objectives in the design of a new building, thereby providing an acceptable degree of protection against the ravages of fire. However, the importance of occupancy and maintenance of a building must be kept in mind at all times. A building, though safe when newly built, may become hazardous through changing occupancy and use.

### Characteristics of Fire

Prior to considering the means of achieving fire protection, a brief study of fire will be advantageous.

Fire has three basic characteristics, namely: involvement, intensity and interdiction.

"Involvement" is the volume or area of material which is involved in the fire. Within an unrestricted area, variation of involvement is governed by the rate of flame spread, the area of the exposed combustible surface and the movement of air currents. Extension of the fire to adjoining areas is controlled by the fire retardant qualities of walls, ceilings and floors, and is the paramount consideration in standards of fire resistant construction. The spread of fire from building to building is governed by the same factors as the spread between areas, with the spacing between building and the nature of roof covering materials as added factors.

On the subject of major scale involvement of large groups of buildings, Neale (8,10) states: "while fortunately the number of serious conflagrations seems to be decreasing, many of our cities still have the potentialities, and it only needs something unusual or something to go wrong at the wrong time to produce one."

The second characteristic of fire is "intensity," which is governed by the amount and nature of the combustibles involved. The severity of fire damage in any given area is related to the intensity, and therefore to the combustible content, of the area. The combustible content is usually determined by the nature of the materials and equipment present in the building, rather than by the materials used in the construction of the building itself. For example, files and furnishings usually contribute more to a fire than do walls, ceilings, floors, and other structural members.

For the third characteristic of fire, we have chosen the military term "interdiction". In this instance, it is the capability of fire to make an area uninhabitable. This capability of fire is responsible for its life hazard to occupants of the building and for its hampering effect upon the efforts of fire fighters. Such conditions are caused principally by smoke and gases liberated or produced. They can be lessened by adequate ventilation, which, unfortunately, accelerates fire spread or involvement.

### Tools of Fire Protection Design

In preparing for the possible onset of fire, the engineer has the following tools at his command:

1. Awareness of hazard.
2. Control of combustibility.
3. Fire barriers.
4. Explosion venting.
5. Alarm devices.
6. Extinguishing systems.
7. Co-operation with fire service.

#### Table II: Summary of Indirect Losses by Fire (9)

| Type | Details | Duration |
|---|---|---|
| Loss to community. | Income to workers. Taxes from property. Other income derived from business being located in community. | Continues until plant is rebuilt. May be permanent if business fails or relocates, both highly probable. |
| Loss of current sales. | Expansion to income is cut off, as well as present income. | Continues until sales volume recovers. |
| Inability to prove insured loss. | Inadequate record protection and incomplete records make loss difficult to prove, especially for finished goods. | |
| Destruction of irreplaceable objects. | Fire may destroy strategic materials, historical objects, and equipment of types which are not replaceable. | |
| Loss of drawings, jigs, etc. | Includes drawings and jigs owned by customers. This loss increases, because of delay in replacement. | Continues until plant resumes full production. |
| Building income loss. | Cost to tenant of seeking new quarters, cost to owner of lost rentals and, usually, lost tenants. | Continues until building is rebuilt and rerented. |
| Jeopardy to property of others. | Owner of building lost by fire may be held responsible for losses to property of others involved in fire. | |
| Loss due to continuance of fixed charges. | Interest on borrowed capital. Salaries to key executives and employees. Normal overhead. | Loss continues until full operation is resumed. |
| Loss in sale of equipment. | Forced sale price may not equal salvage value set by adjusters. | |
| Loss of credit. | Restricted income reduces credit. Insurance payments may be seized to cover old liabilities, preventing use for rebuilding. | Continues until former financial position is restored. |
| Loss of customers. | Inability to recover former customers forced to buy from another source. | Semi-permanent. |
| Loss of sales force. | Reduced income or inactivity may cause sales force to seek other employment. | Continues until plant resumes full production. |
| Loss of cumulative power of advertising. | Advertising programs may be extensive and useless if unable to deliver product as demand results. | Continues until programs can be stopped or production resumed. |

#### Awareness of Hazard

In most cases, the fire hazard of a proposed occupancy may be well defined and handled by:

(a) Segregation.
(b) Arrangement.
(c) Reduction.
(d) Safeguards.

By means of segregation, highly hazardous material or processes may be placed in a location such that, if they become ignited, material in adjoining areas will not become involved. It is readily admitted that it would be foolish to allow dynamite to be stored in the basement of a public building, but sometimes the suggestion that highly flammable materials be stored or handled in separate, protected areas is resented.

Arrangement is important for two principal reasons. As the National Fire Protection Association poster (7) states, "BIG PILE, BIG FIRE; SMALL PILE, SMALL FIRE". And by arrangement access may be provided to the hazard for extinguishment, and more important, exit from the area may be assured.

The most important method of handling a hazard is by partial or complete reduction. Why tolerate a severe fire hazard ? A hazard may be reduced by careful study of the conditions, followed by corrective steps. Use of a non-flammable, degreasing liquid or solution creates less fire hazard than does the use of a flammable one, even though protected. If a flammable liquid or solution *must* be used, every effort should be made to raise its flash point as high as practicable.

Should it be found necessary to use a hazardous process or material, proper safeguards must be provided. Safeguarding may be achieved by means of suitable manual or automatic fire extinguishing equipment. When such equipment is used, it must be designed to protect a hazard in all its phases. An example of complete protection being overlooked is the recent General Motors fire at Willow Run near Detroit. Although the dip tank at the source of the fire was protected, no protection was provided for the drip pans draining to the tank. This lack of adequate fire protection resulted in catastrophe.

#### Control of Combustibility

No material should be used in the structure or in the furnishings of a building, or be stored inside a building in any quantity, unless its combustibility is known to be acceptable.

The use of noncombustible material for the greater part of the construction and furnishings of a building reduces the chance of fire occurring. Should fire occur, the intensity of the fire within an area, and the danger of its spread between areas, will be greatly reduced.

For a measure of combustibility, use is made of the Fire Hazard Classification of Building Materials (8), which is based on three ratings:

(a) Flame spread.
(b) Fuel contributed.
(c) Smoke density.

A knowledge of the rate of flame spread is of prime importance in places of public assembly, where the potential hazard from panic may exceed that from fire many times over. The use of materials with abnormally high flame spread was the major factor in the large death tolls in the fires which occurred in the Cocoanut Grove night club in Boston and in the LaSalle Hotel in Chicago several years ago.

Fuel contributed is a measure of the amount of heat produced as the flame spreads along the surface of the material.

The importance of smoke density lies in the severe panic effect that smoke has on building occupants. Should the smoke contain toxic fumes, the effect upon the occupants may nullify all the advantages of decreased flame spread.

#### Fire Barriers

Regardless of the care and skill used in minimizing hazards and controlling combustibility, fires will result.

Fire barriers are used to break up a building into compartments, each of which is capable of confining a fire for a definite predetermined period. A fire is, as a result, isolated in one fire area. Although a passive form of fire defence, effective fire barriers have been the greatest single factor achieved to date in the control of fire losses.

The effectiveness of a fire barrier is determined by its fire retardant classification, which may be defined as the time interval for which a fire barrier will maintain its integrity, without structural failure, against the transmission of heat or flame under standard fire test conditions. The severity of fires has been studied thoroughly, and using the results gained, the standard fire test has been evolved.

In considering fire barriers, two elements of design must be kept in mind, parapets and openings. In many cases, fires which would normally be stopped by a fire wall, spread beyond the wall along combustible roof decks. Fire walls should, therefore, be extended above the roof as parapets whenever combustible roof decks are employed.

Another major weakness of many plans for fire barriers is found in the protection of the openings. A building is constructed for some useful purpose, for the achievement of which door-ways, vertical shafts, conveyor-ways, air conditioning ducts and many other openings are provided from fire area to fire area. These must be adequately protected.

A full study of protection of openings is beyond the scope of this paper. However, three points should be mentioned:

(a) Where fire doors and shutters are normally in the open position, provision must be made for dependable, positive closing in the event of fire.

(b) Doors in exit-ways should be capable of being readily opened after automatic closure, to permit evacuation of the area.

(c) Care should be taken to ensure that the frame and hardware carry the same fire rating as the door.

Published standards (2) for protection of openings are available, which if followed, provide an acceptable degree of protection.

In cases where solid forms of closure cannot be provided, some success has been achieved in the use of water sprays to protect openings in fire barriers.

#### Explosion Venting

In certain hazardous processes, accidental explosions may be anticipated within an enclosed area. It is necessary in the design and construction of a building to give attention to such an eventuality. Exterior walls must be provided which will vent an explosion. To accomplish this, windows that swing open or wall panels that collapse when subjected to a predetermined pressure differential should be installed. To safeguard the remainder of the building, interior walls, floors and ceilings must be of substantial explosion-resisting construction.

#### Alarm Devices

In the determination of reasons for fires spreading beyond control without apparent justification, delay in turning in an alarm was of major significance.

Alarm systems are divided into two classes: Local and Central station. The local systems are generally designed for alerting plant personnel, although they may have an auxiliary connection to the fire department. They may vary from local area alarms to completely supervised alarm systems with a signal receiving station at the plant fire hall or security office. The central station alarm system, which is operated by an outside firm, provides supervised 24-hour protection through employees of the organization operating the central station.

"Supervised" means providing ways of initiating a trouble signal in the event of deterioration or damage to the equipment, which would prevent the transmission of an alarm. This assures immediate detection of trouble. The detection elements of alarm systems in common use are:

(a) Fixed temperature thermostats.
(b) Rate-of-rise devices, actuated by an abnormal rate of temperature rise.
(c) Smoke detectors.
(d) Photoelectric flame perceivers.
(e) Frequency detectors, sensitive to the characteristic frequencies of flames.

In addition, sound detection systems using microphones are under study. These will respond to the typical sound of fire.

#### Extinguishing Systems

Extinguishing systems fall basically into two groups: Area and Local hazard.

The success of the automatic sprinkler system with all its variations in the protection of areas against fire is without peer. Properly designed and maintained, the sprinkler system is almost infallible. Little wonder then, at the faith shown by the weary traveller in the sprinkler protected hotel

"Now I lay me down to sleep,
Statistics guard my slumber deep.
If I should die, I'm not concerned,
I may get wet, but I won't get burned."

For the protection of local hazards especially flammable liquids, the following techniques, among others, are used:

(1) Carbon dioxide systems.
(2) Foam systems.
(3) Water spray.
(4) Combination foam and water spray.
(5) Dry chemical systems.

In general, local protection is so specialized that each individual case must be studied, and the protection designed to fit.

#### Co-operation with Fire Service

When a major scale fire is encountered, the professional fire fighters must attack the fire under conditions brought about by others. Any proposed building design should be studied to determine if accessibility for fire fighting operations is provided.

A fire cannot be fought if the firemen are unable to reach it with their hose streams. If a fire can be hit hard from close in, it can be extinguished more quickly. This cannot be done if the approach is hampered by falling structures and lack of passageways.

### Data Available for Fire Protection Design

#### Insurance Organizations

The rating boards of insurance organizations, of which there are at least ten in Canada, stand ready to provide authoritative data on various aspects of building design. In addition, they back up this data by application of rates based on well documented experience on losses expected. The Dominion Board of Insurance Underwriters in Canada and the National Board of Fire Underwriters in the United States publish standards to aid those interested in providing greater fire protection.

#### National Fire Protection Association

Through its published fire codes, handbook, standards and informative literature, the National Fire Protection Association makes available authoritative data on the suitability of materials, on the hazards of various operations and on standards of design and construction. A list of these publications is available from the Association's Headquarters at 60 Batterymarch St., Boston 10, Mass.

#### Lists of Nationally Recognized Testing Laboratories

In the general fire protection field, the *List of Inspected Appliances, Equipment and Materials*, published by the Underwriters' Laboratories of Canada, and the *Lists* of the Underwriters' Laboratories, Inc., are accepted as authoritative sources of information on the life, fire and casualty hazard characteristics of materials that have been tested and classified by these organizations.

#### Basic Research

As fire protection moves from the field of empiricism toward the realms of science, increasing data are becoming available in the basic literature under the authorship of men connected with such organizations as the National Research Council of Canada, the Joint Fire Research Organization in England and the National Bureau of Standards in the United States.

#### Specifications for Fire Resistant Construction

When architects and engineers specify materials to be used in construction, they specify them carefully from the standpoint of strength. Similar specifications must be used from the standpoint of fire resistance, if the expected performance under fire conditions is to be realized. Concrete blocks of a given size may look alike, but there may be wide variations among them in fire resistance. The fire resistance of walls incorporating such blocks may vary from less than one hour to more than four hours, depending on the design and mix used for the blocks, and, in particular, on the type of aggregate used in them.

Not only is it necessary to specify

Table III: Comparative Performance of Record Containers

| Condition of Contents | Labelled No. | Labelled Per cent | Unlabelled No. | Unlabelled Per cent |
|---|---|---|---|---|
| Condition of Contents: | | | | |
| Preserved | 305 | 88.4 | 178 | 60.5 |
| Heat fire damage | 23 | 6.7 | 70 | 23.8 |
| Smoke damage | 2 | 0.6 | 5 | 1.7 |
| Water damage | 15 | 4.3 | 39 | 13.3 |
| Unknown | ... | .... | 2 | 0.7 |
| Totals | 345 | | 294 | |
| Cause of Destruction: | | | | |
| Door open | 10 | 25.0 | 8 | 6.9 |
| Exposure judged excessive | 19 | 47.5 | 36 | 31.0 |
| Not insulated | ... | .... | 4 | 3.4 |
| Obsolete design or construction | ... | .... | 51 | 44.0 |
| Underwater | 10 | 25.0 | 16 | 13.8 |
| Other | 1 | 2.5 | 1 | 0.9 |
| Totals | 40 | | 116 | |

**Table IV: Comparative Performance of Record Containers Subjected to Excessive Exposure (6)**

| | Preserved | | Damaged | | Total |
|---|---|---|---|---|---|
| Labelled*: | No. | Per cent | No. | Per cent | |
| 1-hr. rating | 69 | 82 | 14 | 18 | 83 |
| 2-hr. rating | 44 | 90 | 5 | 10 | 49 |
| 4-hr. rating | 5 | 100 | .. | .... | 5 |
| Unlabelled | 69 | 65.7 | 36 | 24.3 | 105 |

* No containers failed when exposed to rated exposure or less.

the materials to be used in construction carefully, but the method of assembly is important. Untried methods may result in distortion, cracking or buckling under fire conditions, even though the materials used are acceptable.

### Testing and Inspection in Fire Protection

The necessity for testing and inspection service in fire protection has often been questioned. One answer in their support is to be found in an analysis of the field records of insulated record containers, (6) which were subjected to fire exposure.

Table III reveals that 88.4 per cent of labelled containers, the design of which had been tested by actual fire tests and the construction of which had been inspected, preserved their contents; only 60.5 per cent of those manufactured without outside testing and inspection performed satisfactorily.

When one ignores those causes of damage to the contents which could not be blamed on the container, e.g., door open, and examines the data for containers which had been subjected to excessive exposure to fires, the picture becomes even more startling, as outlined in Table IV.

As noted previously, sparks on roofs are one of the major causes of fire losses. Roofing materials are available which have been tested under conditions simulating actual fire exposure. Production of these listed roofing materials is inspected to ensure continuing compliance with specifications. The spread of fire between buildings would be greatly reduced if the use of these roofing materials, which provide adequate exposure protection, were extended.

### Conclusions

The following conclusions appear to be justified:

1. Although progress has been achieved in the reduction of fire losses in Canada, the cost to the Canadian people is still too great.

2. The art of fire protection offers many solutions to the problem of fire losses. Such solutions are useless unless utilized by management and engineers in the design and maintenance of structures.

3. The same degree of care is necessary in the preparation of specifications for fire protection as is considered indispensable for other aspects of building construction.


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## A New Concept in Modern Office Building Construction

*(Continued from page 425)*

800 ton centrifugal unit, designed to cool 2,000 g.p.m. of water from 51.9°F. to 43°F., when supplied with condenser water at 85°F. An induced draft, spray filled cooling tower is installed on the roof of the service building to cool the condenser water.

### Operating Results

The new portion of the building was substantially complete in October 1952, and the staff occupied it that month. The original building was then rehabilitated and was occupied during the summer months of 1953. Thus the entire building was occupied during the hot spell which occurred at the end of August 1953, when the outdoor temperatures were reported by the Meterological Office in Toronto to have reached 100°F.

During the above periods, even though some adjustments were being made to the radiant heating and cooling and to the air conditioning, the results proved to be fully satisfactory. Little difficulty was experienced in obtaining both a close balance and close regulation of building temperatures. The comfort conditions maintained during the hot spell last summer were exceptionally good.

### Conclusion

While the installation in the Dominion Textile Building and that in the Manufacturers Life Building are basically rather similar, the latter is provided with a relatively much greater radiant panel area and with a relatively smaller and much simpler air conditioning installation. While the system in the Dominion Textile Building is very satisfactory, it is the author's opinion that the installation in the Manufacturers Life Building is still better, and that it has established a new standard in comfort conditioning which will be difficult to exceed. It is to be expected that this type of comfort conditioning will find wide use, and that further applications will lead to both more improvement and simplification of some of its details, including its controls.

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# Modernization of NRC Impulse Testing Facilities

*by*

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The Electrical Engineering Section of the National Research Council has recently replaced its fifteen year old high-voltage impulse generator with a new 1,200 kv. machine, designed and built by the Section's own staff. This is an account of the basis of design and of how some perplexing problems were met and solved. The new generator has already been used in the testing of a wide range of transformers and cables and in some purely experimental work. It is as up-to-date as any in existence.

The National Research Council entered the field of high voltage impulse work in 1938. Then the facilities consisted of a million-volt impulse generator, built by the staff, and a cold cathode, continuously pumped oscillograph for recording the shape of the generated wave. The outbreak of war prevented much use of this equipment until 1945; by then, pronounced advances had been made both in the design of impulse generators and in equipment for recording high speed transient wave forms. It was apparent that the impulse facilities at NRC would have to be drastically improved if the laboratory were to carry out the work for which it was intended.

The original impulse generator was based on Marx' circuit, in which a number of capacitors are charged in parallel and then switched into series by means of spark gaps. When this generator was built, the capacitors most readily available were of the rectangular type and had a voltage rating of only 50 kv., and since d-c power supplies with balanced outputs of ±50 kv. were obtainable, two capacitors were used in series for each stage of the generator.

During charging (see Fig. 1), the spark gaps act as open switches and all the stages of the generator are charged in parallel through the charging resistors, $R_c$. During this period, all the spark gaps, with the exception of the first and last have to withstand the full voltage to which the stages are charged; the first and last gaps, being to ground, have to withstand only half this voltage.

At the end of the charging period, the first gap breaks down to start the switching process. This breakdown can be initiated by some external means, or the gap can be so adjusted that it breaks down at a voltage slightly below that produced by the charging power supply. In the latter case, the breakdown takes place automatically as soon as the voltage across the first stage of the generator reaches a sufficiently high value; this method of operation is known as "uncontrolled", since the exact moment of breakdown is not determined by the operator.

When the first gap of the generator breaks down, one side of the first stage is grounded through the arc and, with the polarities shown in Fig. 1, the other side is raised in potential with respect to ground by one-half the stage voltage. Thus the voltage across the second gap of the generator is increased by 50 per cent in the ideal case; if this gap has been adjusted so that it will only just withstand the stage voltage, this increase is sufficient to break it down. The second stage of the generator is thus connected in series with the first by the arc, producing a large overvoltage on the third gap so that it also breaks down. This process continues until all the generator stages are connected in series. During this period, the high impedance charging resistors act as isolating resistors.

The spark gaps in the generator are usually sphere gaps, since they have to break down quickly when they are overstressed and this type of gap has a short time lag. These gaps have to be readjusted every time the charging voltage is changed since they must only just hold off the charging voltage. In the original NRC generator, each of the gaps had to be manually adjusted every time the charging voltage was changed. This was a long job, requiring the use of four grounding sticks, and even then the operator had to be cautious. It was obvious that the adjustment of all the gaps would have to be carried out together and safely if the generator were to be sufficiently adaptable; with the gaps arranged as shown in the photograph (Fig. 2), this was not easy. In addition, the most recent theory on impulse generators suggested that all the sphere gaps should be in line, so that each breakdown would illuminate the succeeding gaps and thus reduce the time taken for them to break down. It was apparent that the generator would have to be considerably modified to effect the required changes in the gaps.

The capacitor layout also suggested a complete redesign of the generator. The original generator was built with the capacitors on two

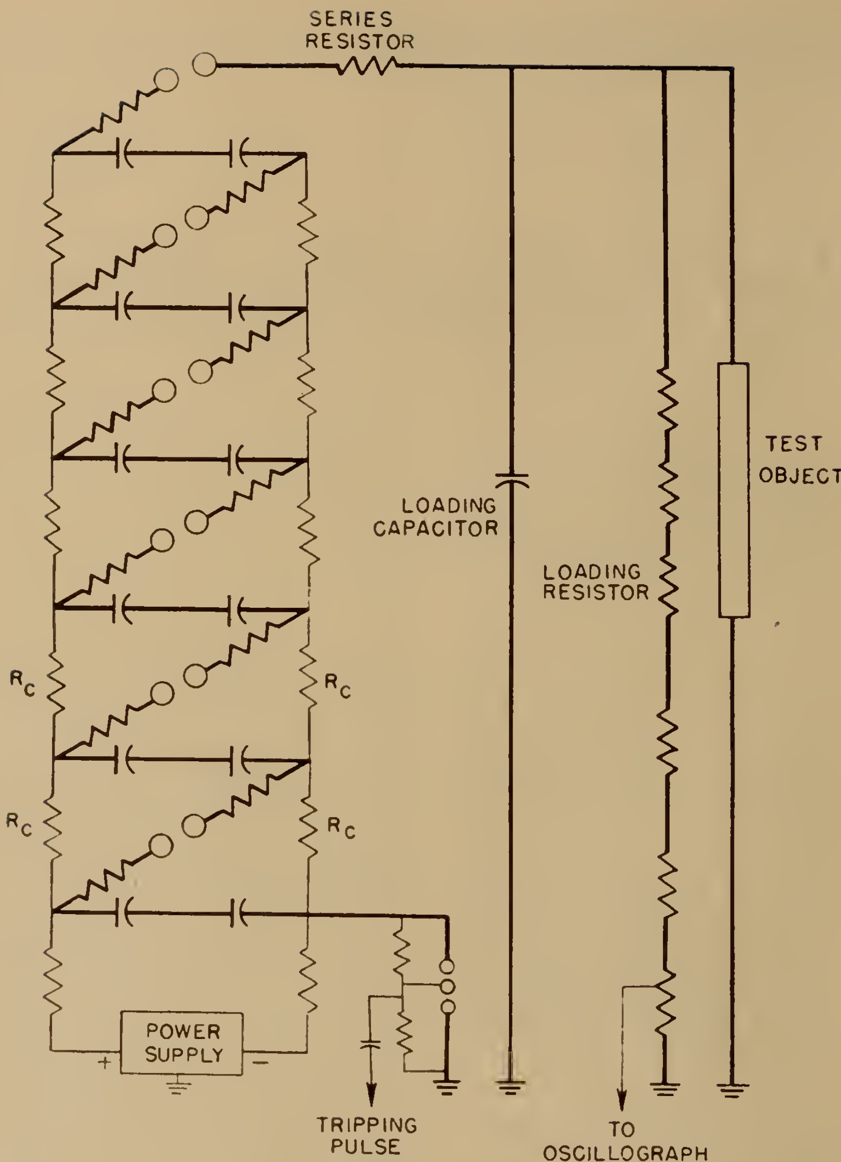

Fig. 1. Schematic of generators.

different levels. The lower level held the first two stages and the remaining stages were mounted on the higher one. During discharge all the capacitors are connected in series and the upper stages of the generator are at high potential, the last stage being at the highest, one million volts. It is imperative that this stage be some distance above the ground to provide the necessary insulation, but with the layout used in the original design, this stage was also distant horizontally from the first stage. This meant a long current path and consequently the inductance of the circuit was large. This made it difficult to generate very steep impulses without getting oscillations on the crest of the impulse wave.

The new impulse generator was therefore designed with the following points in mind:

1. The layout of the generator should be such that the inherent inductance in the circuit would be a minimum.
2. The adjustment of all the sphere gaps should be accomplished simultaneously by means of a motor drive, with remote control.
3. The generator arrangement should be such that the stages could be paralleled in as many ways as possible, so that the generator capacitance on discharge could be varied over a wide range to take care of all types of load.
4. The generator should produce the highest practicable impulse voltage for the space available, with provision for future expansion when space became available.
5. Safety devices should be introduced so that the operation and adjustment of the generator could be accomplished with minimum danger, both to the operating personnel and to others who might be in the vicinity.
6. The capacitors, spheres, and power supply of the old generator should be used in the new one, so that the cost of conversion would be kept to a minimum.
7. The design should be such that all the individual components could be manufactured in a small machine shop.

#### New Generator

Obviously, some form of vertical construction would have to be adopted to keep floor space to a minimum. Three types of construction available are shown in Fig. 3. In the "C-type" the two condensers of each stage form a semicircle and the stages are stacked one above the other. The gaps between stages are located in the open part of the C and run diagonally between the stages. The "figure-of-eight" construction is essentially two C's with their open sides facing and the gaps in the centre. The stages are stacked so that the even numbered stages are on one side and the odd numbered ones on the other; the gaps form diagonal connections across the


Fig. 2. The old generator.

generator so that the discharge path is in the form of a figure of eight. In the spiral type, the condenser layout is the same as for the figure-of-eight, but the gaps are between adjacent ends of the C's, so that the discharge path is a spiral up the generator.

The C-type of construction has the advantage of simplicity and accessibility, since all the sphere gaps are external. It would have been attractive if cylindrical capacitors with their terminals at opposite ends had been available, but with the can type capacitors on hand, this construction would have been wasteful of space because the case of the capacitor is at the same potential at both top and bottom and the space occupied by the capacitor is not available for insulation purposes. With the C-type of construction, this space is lost once every stage, whereas in both the figure-of-eight and the spiral constructions, this space is lost only once every two stages. Since the height of the capacitor was nearly equal to the space required between stages for insulation, the C-type of construction would have resulted in a generator nearly twice as high as that required by either of the other two.

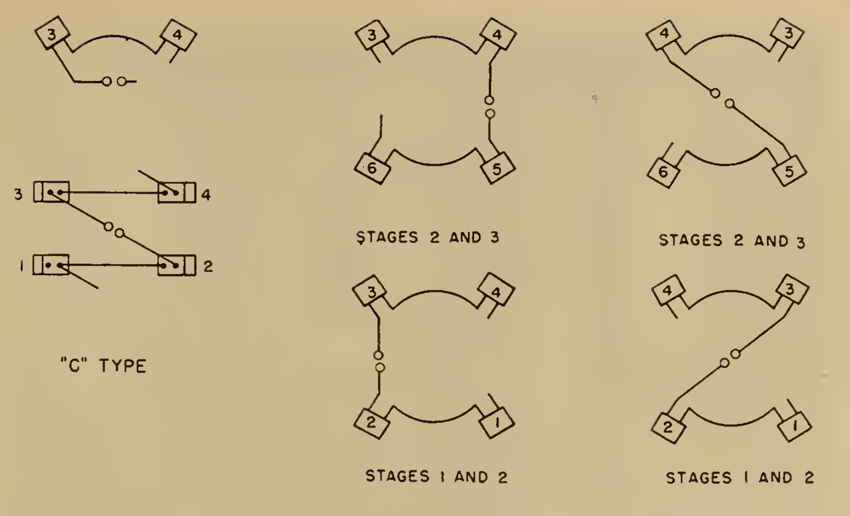


**Fig. 3. Three possible types of construction.**

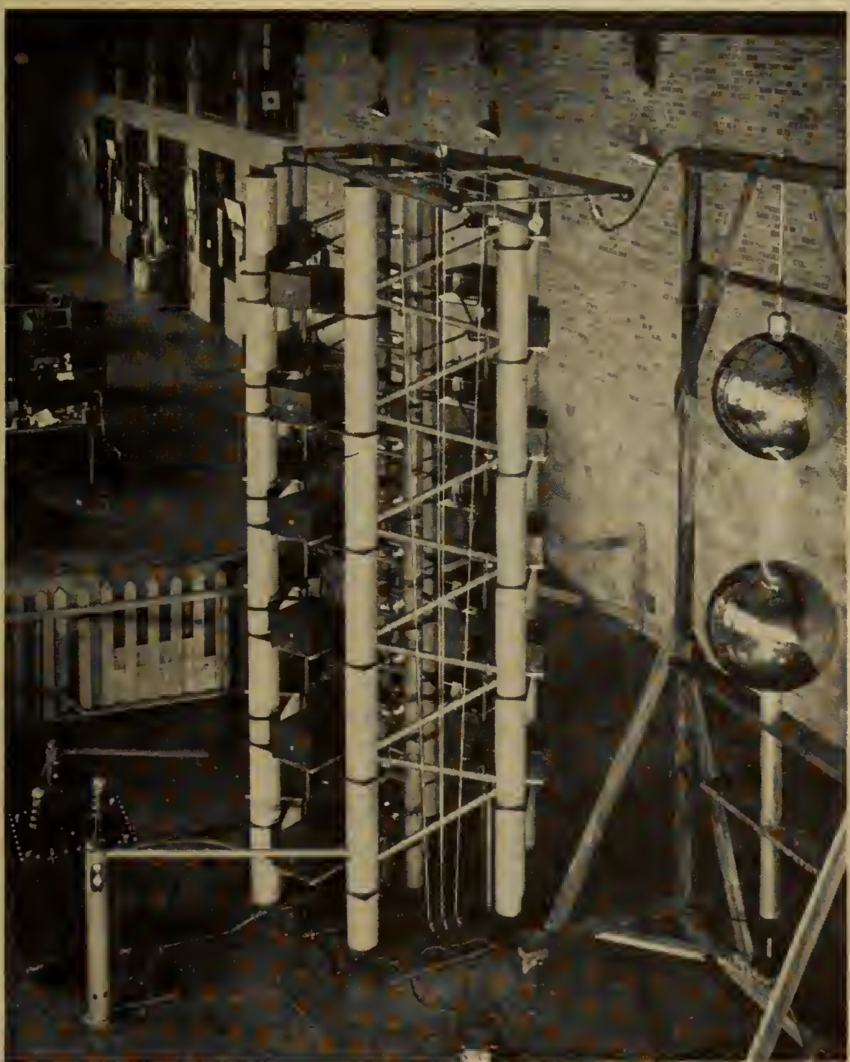

**Fig. 4. The new generator.**

#### Figure-of-Eight Construction

The figure-of-eight construction was chosen in preference to the spiral for two reasons. The spiral construction has a higher internal inductance than the figure-of-eight, because it is essentially a single layer solenoid with a diameter equal to that of the generator, whereas the figure-of-eight construction produces two solenoids, each having only one-half of the diameter of the spiral construction. The mechanical design of the figure-of-eight construction was also the simpler of the two, because it was practical to use only two columns for the sphere gaps, whereas it would have been necessary to use four with the spiral.

#### Electrical and Mechanical Considerations

Having decided on figure-of-eight construction, the design of the generator was governed by electrical and mechanical considerations. Electrically, it was necessary to provide sufficient insulation for the voltages involved and at the same time keep the discharge path as short as possible. Experience had shown that sufficient insulation would be obtained if the spacing of components was based on a design figure of 100 kv. per foot for d-c. voltages, and 100 kv. per 10 inches for impulse voltages. On this basis, preliminary design work indicated that the generator would have a height per stage of approximately 15 inches; since the laboratory height was 27 feet a twelve stage generator was decided upon. This appeared to be the optimum size, since it would enable the maximum number of series-parallel combinations to be used. The resulting generator has a

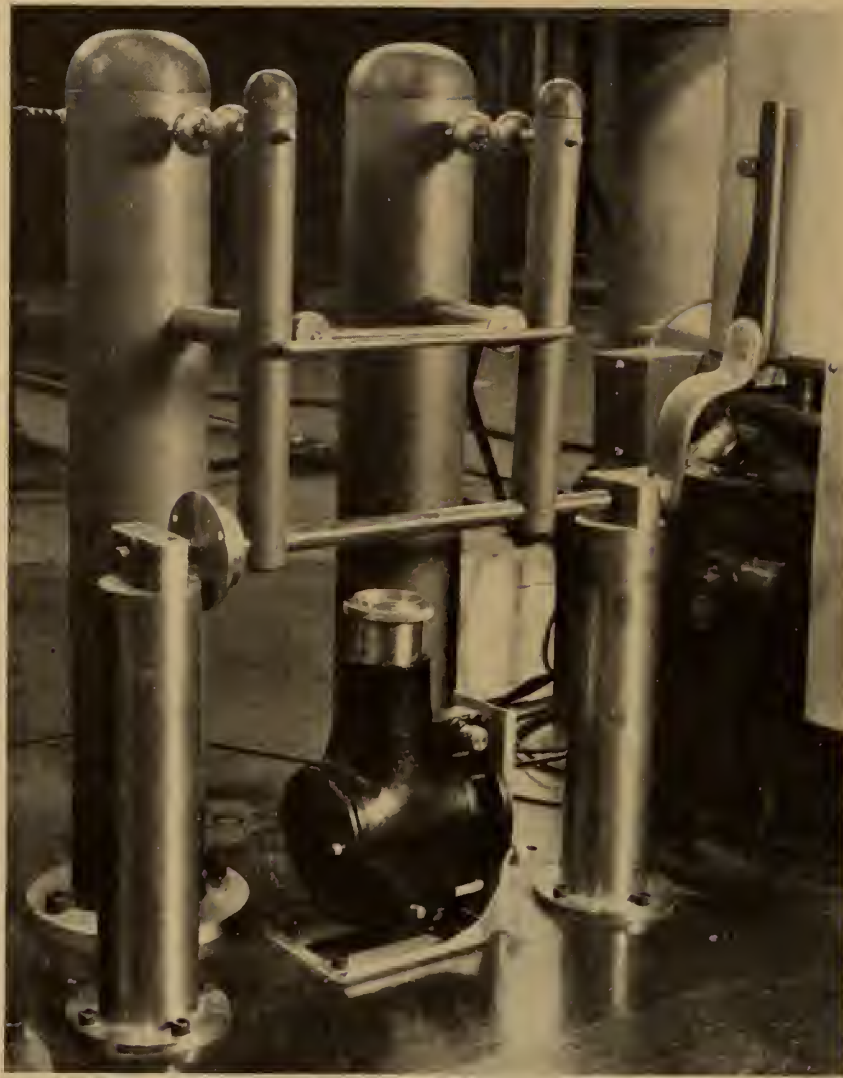

Fig. 5. Tripping mechanism: pin in main moving column at top right.

peak voltage of 1,200 kv., and, since the stage capacity is 0.25$\mu$f, the generator can deliver 15 kilowatt-seconds of energy.

Six columns were used to support the shelves for the capacitors. Four columns could have been used, but this would have required very substantial shelves and columns, whereas with six columns the mechanical strain was eased considerably, since a shelf then has to support only one capacitor. The shelves were staggered so that each capacitor was on a different level, thus producing the shortest possible electrical discharge path and at the same time simplifying the mechanical design. (Fig. 4).

The columns were made of 8 in. bakelite tubes with 1/8-in. walls. Each was built up of short lengths separated by bakelite shelves, 5/8-in. thick. These shelves had shallow circular grooves milled in them on both sides at each end to fit the ends of bakelite tubes of the columns. Holes were drilled through the shelves concentric with the milled grooves, to allow the passage of bakelite tie rods, running from the top of the generator to the base through the centres of the columns. In addition to the tie rods, the weight of the capacitors helped to anchor each shelf to the structure below.

The generator shelves enclose four sides of the generator, but leave two opposite sides open. In order to make the structure stable, diagonal struts were used as braces in the two open sides. These removable struts were made of bakelite tubing and were so arranged that they could be used to accommodate the charging resistors for the interstage connections. By housing the charging resistors in bakelite tubes they were protected from dust, an important consideration since the high voltages involved tend to precipitate dust upon them.

The last major item in the generator design was that of the sphere gap mount. This consisted of two additional bakelite columns installed inside the main generator structure. One of these columns was securely anchored at the top and bottom. The other was mounted in a bearing at the top and on a gear reduction unit at the bottom. The gear reduction unit was coupled to a reversible electric motor, so that the column could be rotated to adjust the sphere gaps by means of a remote control push button station in the generator control console.

Extending from the sphere gap columns at intervals equal to the spacing between stages were bakelite tubes, about 10 in. long. At the free ends of these tubes the spheres were mounted at right angles on short metal stubs, the spheres being connected to terminals on the sphere gap columns through series resistors inserted in the bakelite tubes. These series resistors were hollow and were so arranged that they could be shorted out individually by the insertion of a shorting rod from the column end, thus enabling the total series resistance to be adjusted. This resistance is used to damp out internal oscillations in the generator and also to provide a means for controlling the wave front of the generated impulse. The terminals on the sphere gap columns, which were connected to the appropriate capacitors, were designed so that each sphere gap arm could be connected to the ones above and below it so that the generator could be arranged in various series parallel combinations.

The bottom gap of the generator was different from the rest because it has two special conditions to meet. In the first place, the voltage across it is only half of that across the remaining gaps, because this gap is to ground instead of between stages. In addition, this gap has to control the tripping of the generator, since it is desirable for research purposes to have the generator "controlled".

#### Tripping the Generator

The method adopted for tripping the generator is the split-gap arrangement. In this system the gap consists of two gaps in series, each having only one-half of the gap voltage across it. To trigger the breakdown, a voltage impulse of about 8 kv. is applied to the centre electrode through a small coupling capacitor. This impulse overstresses one-half of the gap, depending on the charging polarity being used, and causes it to break down, putting the full gap voltage across the other half, which then breaks down and grounds one side of the first stage of the generator. During the charging period, the centre electrode is maintained at a potential midway between the two outer ones by means of a high resistance potential divider. This centre electrode actually consisted of two spheres connected together; one could have been used, but by using two the two halves of the gap can be physically separated, which simplifies the design, and at the same time enables the spark across one-half of the gap to illuminate the other half so that the time lag is kept to a minimum.

Since each half of this gap has to withstand only one-quarter of the voltage across all the other gaps, the spheres were made one-quarter the diameter of the main spheres, i.e., 2.5 cm. diameter, and the gap is kept to one-quarter the size of the main ones. In order to keep this 4:1 ratio in the gaps when the moving column is rotated, a special linkage is used to operate the movable spheres of the tripping gap. A peg was inserted in the main moving column which bears against the vertical arm shown in Fig. 5. The lengths of this arm and of that supporting the two movable spheres have been so adjusted that, when combined with the distance of the peg from the centre of rotation, a reduction in the gap opening of 4:1 is achieved.

The initial adjustment is carried out by closing the gaps until the gap indicator meter reads zero, and then adjusting the spheres until a cigarette paper will just pass between them. The gap indicator meter is simply a volt-meter mounted in the generator control console which reads the voltage on the movable arm of a variac geared to the movable sphere gap column in such a way that the variac voltage is maximum when the gap opening is maximum. The drive is spring loaded to eliminate backlash and the variac is equipped with limit switches to prevent the range of the equipment from being exceeded. An ultra violet lamp is also mounted at the base of the generator to irradiate the tripping gap so as to ensure that the time lag in the breakdown of this gap is kept to a minimum.

#### Obtaining the Output

The next problem was to obtain the output from the generator, since the output sphere gap is 16 feet from the floor and consequently not easily accessible. Provision had also to be made to shape the impulse wave generated, to the required 1.5-40 microsecond waveform. This is accomplished by charging a capacitor through a series resistance from the impulse generator to obtain a wavefront of 1.5 microseconds; a shunt resistance, connected across the capacitor, causes the voltage to decay to half value in 40 microseconds. The shunt capacitance required is of the order of 600-2,000 $\mu\mu$f, and consists of the capacitance of the test specimen, augmented if necessary by a loading capacitor of 700 $\mu\mu$f. About one-half of the series resistance is built into the sphere gap arms in the generator and the remainder is located after the last sphere gap.

To accommodate this last resistance, two bakelite arms, 10 feet long, extending outwards from the top of the generator, are used as outriggers for supporting the resistors. Two parallel metal shafts extend from one outrigger to the other, and these are fitted with brass pulleys. One of the external series resistors is housed in a bakelite tube on the top of the generator and is permanently connected between the output sphere gap and the inboard shaft, with provision made for shorting it out if necessary. The other three resistors are housed in a bakelite tube slung between the two shafts by a pair of ropes. These ropes have metallized ends, so that when the resistor is raised into position, its ends are connected to the shafts through the brass pulleys. The ropes run from the pulleys down the side of the generator to spring loaded take-up reels at the base, so that the resistor may be lowered to the floor. Two additional ropes are included, one of which is used for connecting external equipment to the output shaft and the other for supporting the shunt resistor, which is also used as a resistance voltage divider for measuring the output waveform.

The charging resistors are simple, single layer resistors wound with enamelled wire, and have a resistance of 10,000 ohms each. The series and shunt resistances are non-inductively wound and consist of two layers of resistance wire wound in opposite directions on the same former. The resistors in the sphere gap arms have a nominal resistance value of 11 ohms each, while the four remaining series resistors are each of 60 ohms. The shunt resistors are of 300 ohms each, eight of them being used when all twelve stages of the generator are connected in series; they are so designed that they can be arranged in series-parallel combinations whenever such arrangements are used for the generator stages, so that the shape of the wave tail is not altered.

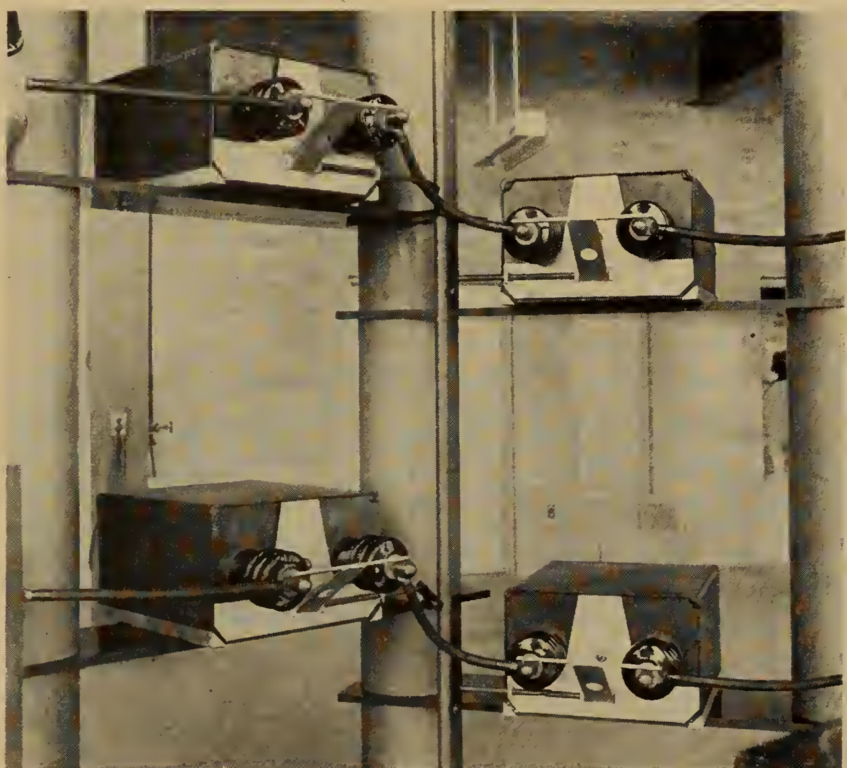

Fig. 6. Shorting devices: capacitors are shorted.

Fig. 7. Control console.

### Safety Features

The major problem involved in making the generator safe to operate was that of rendering the capacitors safe to touch when any work had to be done on the generator itself. This necessitated both short-circuiting and grounding, since the capacitors have a tendency to hold a considerable charge after they have been discharged, and even if shorted, a charge will appear on them after the short is removed. Two methods of discharging the capacitors have been installed. The first consists of a spring-loaded sphere gap to ground from each side of the charging unit. When the generator is being charged these gaps are held open by an electrically operated solenoid, but if the power fails, due to an interlock anywhere in the high voltage area being opened, the sphere gaps close and in so doing drain the charge off the generator capacitors through the charging resistors. These sphere gaps are equipped with interlocks to open the power supply to the charging unit if the gaps close, so that the gaps cannot put a short circuit on the charging unit. The time required for the grounding gaps to drain the charge off the generator is only about 1/25 of a second, so voltages are reduced to a safe value before anyone can enter the generator area.

The grounding gaps do not fully drain the charge from the generator, because the stages consist of two capacitors in series and each capacitor is so constructed that the case is midway in potential between the two electrodes. In addition, there is the possibility that an open charging resistor could cause a residual charge to be left on some of the capacitors. Consequently an additional safeguard has been introduced whereby all the capacitors are simultaneously shorted to their cases by means of a treadle at the base of the generator. To accomplish this, a pair of bakelite rods run vertically up through the generator, one rod being located on each side midway between the two capacitors of a stage. Each capacitor is equipped with a hinged device which allows a shorting bar to drop down across the two capacitor terminals and short them to the case. (Fig. 6). These are actuated by the vertical bakelite rods, and the system is arranged so that the shorting devices automatically fall into place by gravity when the treadle at the base is released. The rods are lifted simultaneously by means of the treadle whenever the generator is to be charged, and the mechanism is equipped with interlocks so that the generator charging circuit cannot be closed while the capacitors are shorted.

### Controls

All the controls for the generator are located in a console which is housed in a protective cage in a corner of the laboratory. This control console, which is shown in Fig. 7, is fed from the 110 volt, 60 cycle mains and supplies all the power required by the generator and the recording oscillograph. The console has two main functions to perform—it acts as distribution centre for the power required and also houses the various controls required to operate the equipment.

The first function, that of distributing power, has necessitated the introduction of various safety features, the most important of which are for the elimination of surges from the power lines. To accomplish this, all the lines entering or leaving the console are protected by thyrite discs, a separate disc being connected between each line and the frame of the console at the point at which the line enters or emerges.

Some of the power distributed by the console is supplied directly from the mains input, but that used for the oscillograph and the primary side of the generator charging unit is first fed through an electronic voltage regulator which stabilizes the a-c. voltage to ±0.1 per cent. With this arrangement, it is possible to preset the output voltage of the impulse generator accurately.

The control of the charging voltage for the generator is accomplished in two stages, one a coarse control and the other a fine one. The regulated a-c. is fed to a 20 ampere variac, which is used as the coarse control. Between the output of this variac and the primary of the charging unit, the secondary winding of a 110/10 volt transformer is connected in series as a voltage booster. The primary of this transformer is supplied from a small variac connected across the regulated a-c. so that the voltage boost can be varied from 0 to 10 volts for a fine control.

The 8 kv. pulse for tripping the impulse generator is generated in an electronic unit mounted in the base of the control console. This unit, which is controlled by a push button on the console panel, generates two pulses, one of which is a low voltage pulse for tripping the recording oscillograph, and the other is the 8 kv. pulse which is transmitted to the generator by means of a high voltage RF cable. The unit for generating these pulses is an elaborate one because it has been found necessary to provide a great deal of shielding and filtering to prevent the generator from injecting high voltage disturbances into the oscillograph tripping cable; in addition, there is a delay circuit which enables the oscillograph to be accurately synchronized with the generator, a necessary provision when very high speed sweeps are used.

The other controls consist of an electric timer, which is used to record the time elapsed during the charging period and which can be used as an automatic control to trip the generator after a preset charging time. In addition, there are the controls for operating the sphere gap adjusting mechanism, and the meters for recording the charging current and voltage and the sphere gap spacing.

Fig. 8. Oscillograph.

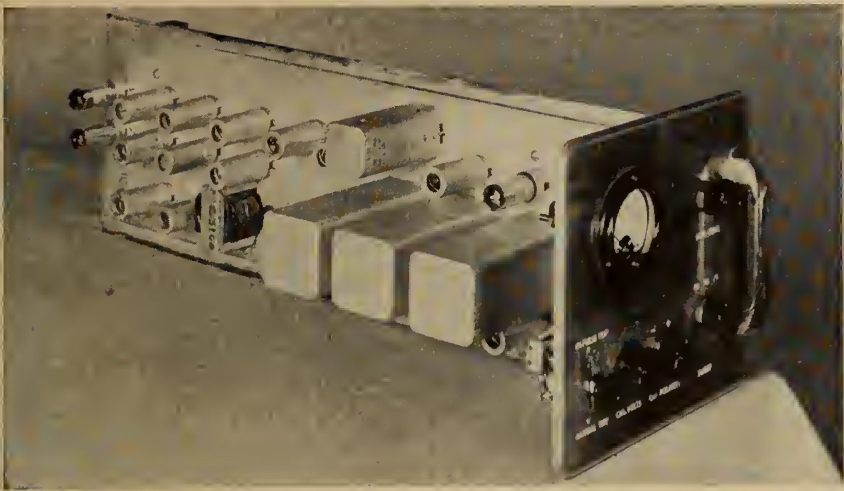

Fig. 9. A 60, 30, 10 microsecond sweep chassis.

### Oscillograph

The original oscillograph was a cold cathode, continuously pumped type, which gave a good record but was tedious to operate. The equipment was also bulky and required a separate shielded cage. Photographs of the wave form were taken by allowing the electron beam to impinge directly on a photographic film, which required the film to be inside the evacuated portion of the oscillograph and consequently, every time the film was changed, the vacuum seal had to be broken. Time was thus wasted in evacuating the oscillograph, and since sealed-off, hot cathode tubes had become available with sufficient intensity to enable the trace to be photographed with an external camera, it was decided to develop an oscillograph for impulse work employing this type of tube.

The tubes selected were the Dumont 5RP type, which employ post-deflection acceleration of the electron beam so that very high photographic writing speeds can be obtained with a high deflection sensitivity. The oscillograph was developed as a two-channel instrument, so that both current and voltage waveforms could be recorded simultaneously. This is especially useful for testing transformers, since current measurement provides one of the most sensitive methods for detecting faults.

The oscillograph was designed with two features in mind. In the first place, the two channels of the scope were to kept as independent as possible, so that different sweeps could be used in each; this would also enable one sweep to be delayed with respect to the other if desired. Since it was difficult to foresee exactly what facilities would be required for future work, the instrument was designed so that all of the sweep and power supply circuits could be easily removed, thus allowing new circuits to be developed as occasion arose and quickly interchanged with those already in the instrument. In this way, the oscillograph was kept relatively simple, yet at the same time could be easily adapted to record any other type of transient desired.

The first sweep chassis developed provided three sweep speeds, which would handle all the routine requirements of impulse testing. These were 60, 30, and 10 microseconds long, and were exponential in shape so that the beginning of the sweep was considerably faster than the end. In this way, both the wave front and the wave tail of the standard 1.5-40 impulse could be studied in detail. This type of sweep requires a complicated form of beam brightening, since the beam had not only to be turned on for the duration of the sweep, but the intensity had to be reduced for the slow portion of the sweep so that the photographic film is not overexposed. The system adopted was to turn the beam on fully for 15 microseconds, and to reduce the intensity after this period on an exponential having the same shape as that of the sweep waveform. An additional circuit was then used to blank the beam completely at the end of the various sweeps used. To keep the instrument simple, the sweep and beam intensifier circuits are mounted on the same chassis so that both can be removed or installed as a unit.

Figure 8 shows the completed oscillograph with a camera mounted over one of the cathode ray tubes and the other exposed. One of the 60, 30, 10 microsecond sweep circuits is shown in Fig. 9. This chassis also houses a special time calibrating circuit which generates a 1 megacycle sine wave in which every tenth cycle is amplified so that the one calibrator can be used for both the fast and slow ends of the exponential sweeps. A typical oscillogram is shown in Fig. 10.

### Use of the Equipment

The equipment has been used extensively for testing transformers and cables for industry and for research purposes. The transformers tested have ranged in size from the smallest rural type to one having a rating of 11,500 kva.; the cables tested have ranged from low voltage 2,500 volt cables to some having a voltage rating of 69 kv. Most of the research so far has been confined to investigating the factors affecting the accuracy of high voltage impulse measurements, with particular emphasis on the grounding of the equipment. In addition, some work has been done on the generator itself, in an effort to understand more fully the exact mechanism by which the switching process takes place. This work has already resulted in a considerable improvement in the operation of the generator and indicates that even more can be accomplished. √

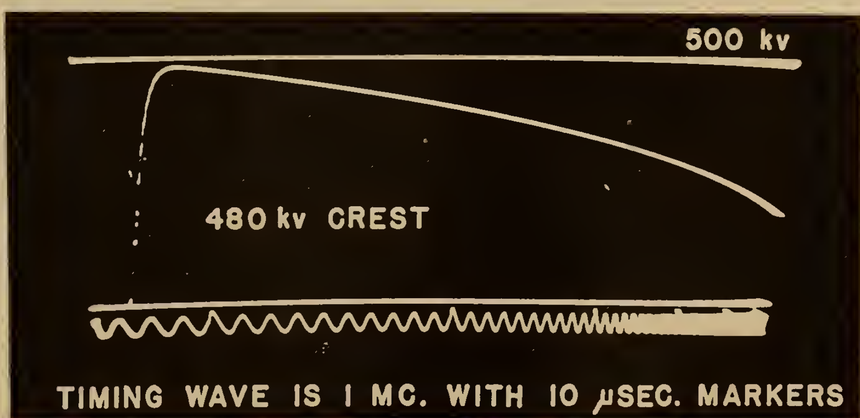


Fig. 10. A typical oscillogram.

# THE ASME BOILER CODE

In the July 1952 issue of *Mechanical Engineering*, the ASME commenced publication in serial form, of a history of events leading up to the present ASME Boiler Code, from the first development of boilers in the 18th Century. This history, continued through some ten issues, was prepared by Arthur M. Green, Jr., of Princeton University.

As a preface to the regular publication in current issues of *The Engineering Journal*, of Boiler Code Regulations, this history has been presented in condensed form. It has appeared in several issues of the *Journal*, of which this is the sixth. Due to the large technical content of this issue, space will allow for only a part of this final instalment. The history will be completed in the May *Journal*.

## VI. Times of National Emergency and War, 1941-1943

Because of increased demand for material for the Armed Services due to World War II, many requests were made for permission to use non-Code materials for pressure vessel construction in the period 1941-1943, especially in its latter years. In February, 1941, a clarification of Para. U-12(c), relating to the use of small cast forged or rolled parts carried in stocks for which there was no mill test, was urgent. It was felt this paragraph should permit a conference between inspector and manufacturer. The paragraph was altered and combined with U-12(a) to permit substitute materials approved by the inspector.

In March, 1941, the chief boiler inspector of California asked permission to use Class A steel for hot water supply tanks, built as ASME unfired vessels. Case No. 732 was reopened and the reply was changed to permit such tanks to be made of Class A steel. In April, requests were made to use SAE-1020 steel in place of S-7 material. In Case 931, the reply stated that, as a temporary expedient, materials covered in 11 named specifications might be used, provided properties of the samples were substantially those required.

In June, 1941, the use of a non-code wrought iron, ASTM A-42-39, was allowed for a fusion-welded unfired pressure vessel. Permission was also granted to use electric-arc, electric-resistance and atomic-hydrogen-welded tubing of S-52 material, with exclusion of grade T- 20, in place of stainless steel. In February, 1942, the Committee reduced the number of test plates required by Paras. P-102(a) and (b) and U-68(a) and (b) under certain restrictions. In February, plates used by universal or strip mills were permitted to be made of steels of four named specifications, during the emergency, while circumferential welds were allowed on headers of superheaters, waterwalls and economisers.

#### Reduction of Factor of Safety

Following a suggestion by two boiler companies that the factor of safety be reduced from 5 to 4 to conserve materials, a Special Committee set up in May, 1942, prepared a reply permitting this reduction with qualifying provisions. The same Special Committee reported the inquiry in June, 1942, asking whether stresses and joint efficiencies of Paras. U-68 and U-69 vessels could be increased over Code requirements in view of the emergency. The reply gave permission for increasing efficiencies under certain conditions, and directed that the Code symbol for such vessels be followed by the letters "NE". This Case was to be effective until annulled. This was approved in June 1942. Emergency Case 968 was again discussed in September, 1942, and changes were made amending the restrictions—Emergency Case 979 was re-opened in February, 1943, and changed to provide a method of determining the thickness of ferrous tubes and pipes for use in the formula of Para. U-20(c).

In April 1943 the Special Committee again considered Case 968 for design of drums and power boilers with higher stress and efficiency, suggesting steps which might lessen the difficulties in Pennsylvania. The revised form of reply was approved for publication with a note that Case 979 would be similarly modified. In June, 1943, Committee members objected to Cases 968 and 979, but after discussion the revised forms of reply were adopted. In September it was announced that publication of reopened Case 968 was held up due to objections, since the reply was not acceptable to Ohio and Pennsylvania as regards the pressure for hydrostatic tests. At this meeting this pressure was changed from two to 1½ times the maximum allowable working pressure.

#### Alternate Rules

The first Alternate Rules, Paras. P-400 to P-409, to incorporate Case No. 968 into the Code, were reported by the Special Committee in October, 1943. These were ordered published as proposed revisions of the Code. In November, 1943, the Special Committee proposed small changes to four of the paragraphs for classification, which were approved. This was approved in October, 1943, and in November the Secretary was directed to prepare proposed revisions for the Codes for Power Boilers, Boilers for Locomotives and Unfired Pressure Vessels for presentation in January, 1944. These rules did not appear in the 1943 edition of Sections of the Code, but were issued as Addenda.

### Emergency Alternate Specifications

In June, 1942, the M. W. Kellogg Co. asked permission to use provisions of an alternate specification for S-56 (ASTM-EA-216-41T) as they were unable to obtain S-56 material. The Committee considered that the provisions of the Alternate Specification met with the requirements of the Code. In September, 1942, two SAE Steels and seven NE bolting steels were approved for bolting material. In December, 1942, Case 981 was reopened and 14 Emergency Alternate Specifications were approved.

In February, 1943, Specifications SA-106-42T for Lap Welded and Seamless Pipe were adopted. In September, 1943, the Committee accepted the American-War Standard, Pressure-Temperature Rating of Cast Steel Pipe Flanges, Fittings and Valves (ASA-B16a5), asked for by the War Production Board because of the economy in the use of steel resulting from the use of the Standard. In November, 1943, it was reported that the general use of the standard indicated its acceptance by various industries, so that its approval by the Committee was unnecessary.

### Designation of Material Specifications

In February, 1942, the Subcommittee on Material Specifications recommended that in the 1943 Edition of Section II the specifications be designated by the "A" or "B" numbers of the ASTM equivalent but without the date, and that those which were not duplicates of ASTM Specifications, or represented a modification, such as S-4, retain their present S number.

### Clad Vessels

In December, 1940, the M. W. Kellogg Co. asked if an integral alloy-lined plate material would be allowed under the Code for Unfired Pressure Vessels, as Case No. 896 relating to the use of stainless materials was too limited. The proposed form of inquiry and reply approved by all the Special Committees, as well as information from references, were before the Committee at the meeting of February, 1941. The urgency of action was stressed. After a long discussion the matter was referred to the Special Committee on Clad Vessels for consideration and conference with interested parties.

Copper clad tubes for vertical boilers were considered in September, 1941, in connection with a request from the P. M. Lattner Mfg. Co. As Case No. 847 referred to such clad tubes of less than 1 inch in diameter, the request was granted. The Subcommittee was requested to prepare a suitable revision for the Code in accordance with its recommendation. In October, 1941, the revision to Para. P-22 in the 1943 edition was reported and adopted.

### Cast and Malleable Iron

The fact that Section II contained only one grade of malleable iron was called to the Committee's attention by the War Production Board in December, 1942. Many fittings used in steam piping were produced by the Cupola Process, and the inclusion of this lower grade was discussed. A Special Committee reported in March, 1943, that Cupola malleable iron was permitted by ASA specification for fittings, and by the Manufacturers Standardization Society of the Valve and Fitting Industry, and that these standards were used in the Code, Table A-11. Hence they recommended an inclusion of ASTM specification EA-20, but that no changes be made in Code requirements for this metal. Specification A-197-39 was adopted. Case No. 997 permitted cast iron cover plates of Para U-37(d) to be replaced by steel heads welded to an American Standard steel bolting ring, when heads were designed by designated formulas.

### Enameled Vessels

The limited nature of Rules for Enameled Vessels, Paras. U-97 to U-109, was brought to the attention of the Committee in June, 1941, by the A. D. Smith Corp. They believed enameling had developed so far that this part of Section VIII should be deleted. The Subcommittee on Unfired Pressure Vessels recommended deletion. The subject of deletion was again considered in January, 1942, and after consultation with manufacturers, this part of Section VIII was deleted by the Committee in March, 1942.

### Fabricated Pipe Bends

As no provision for construction of piping with 90° bends was contained in the Code, the inquiry and reply to Case 96 was proposed in February, 1942, for immediate use after Council approval. In March, 1943, additional paras P-23(j) and U-20(f) based on this case were adopted for the 1943 Edition of the Code.

### New Specifications

New Specifications approved for inclusion in Section II, were acted upon at various times to care for the art of vessel construction. The equivalent Emergency Specifications approved for use as meeting the intent of the Code were not placed in Section II, but manufacturers and designers used them as issued. The numbers of these specifications were as follows; SA-95, 106, 135, 176, 197, 214, 225, 226, 233, 240, 249, 250, 251, 261, and SB-75.

### Weld Metal Tests

In reply to an inquiry as to the way samples of the weld metal should be taken from a U-69 vessel with stainless steel plates, the Committee in February, 1941, advised that the weld metal analysis could be made from drillings from the welds of a finished vessel, adding that operators should qualify on the particular metals for which they would make welds.

### Reduced Number of Test Plates

In March, 1942, Case 961 was approved. The inquiry had sought reduction of the number of test plates under Paras. P-102(a) and U-68(a) and (b). The reply stated test requirements would stand, except when plates were made from one of six designated specifications under six conditions. The greatest reduction then allowed was 1 of 20 required by the Code.

### Interchangeability of Rods

Interchangeability of electrodes was discussed in February, 1941, The Westinghouse Company inquiry regarding Para. UA-31 was referred to the Executive Committee. The inquirer was informed that electrodes were interchangeable. A letter was presented at the May, 1941, meeting regarding the qualifying of operators when a change was made to rods of another manufacturer. The AWS Conference Committee, to whom the matter had been referred, referred the subject to its Committee on Standard Qualification Procedure. The chairman reported in December, 1942, that the difference between two electrodes was not so great as to produce a dangerous situation. The subject again arose in March, 1943. The Subcommittee on Welding and the AWS Conference Committee were in agreement that no change should be made in the Code. It was decided that a letter replying to the inquiry should not be sent. No further action was taken in 1943.

*Part VI to be continued in the May issue.*

# FROM MONTH TO MONTH

**Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers**

## "News of the Associations and the Corporation"

Under this heading a new section will appear in *The Engineering Journal*, starting with the May issue. It has been arranged through co-operation with the provincial organizations. The information will be provided directly by them, or will be extracted from their publications.

It has been the opinion of many members of the profession, that much of the news of the associations is of interest beyond the boundaries of the province. It was with this in mind that the Council of the Institute invited the associations to use the *Journal* as a means of informing engineers in all provinces of their activities. It is a matter of satisfaction and gratification that the associations so readily accepted the proposal. Indeed, it is a clear indication of the increasing desire for co-operation by all individuals and organizations concerned.

The Institute hopes that the new section will develop into an outstanding feature of the *Journal*, and that in some way it will aid in indicating the breadth of our nation, our opportunities and the universality of our interests within the profession.

## Money for Education

Believing that the proper teaching of engineering in the Province of Quebec requires adequate financing of universities, the Engineering Institute presented a brief to the Royal Commission of Inquiry on Constitutional Problems on March 10. The brief is published herewith.

The delegation that presented the brief consisted of I. R. Tait, vice-president of the Institute, J. B. Stirling, past-president of the Institute and chairman of the committee appointed by Council, and the general secretary. The committee which prepared the brief, in addition to Dr. Stirling, consisted of R. DeL. French and J. A. McCrory.

In addition to the brief, the delegation presented some further information along these lines:—

As the practice of engineering was so closely bound to the development of the province, it was possible that at the moment the engineering faculties were the ones for which additional financial support was more urgently needed than any other. If the universities were not able to expand to meet their increasing load, there would be an increasing shortage in engineering graduates.

According to one dean of engineering in Quebec, the salaries paid in Ontario for engineering teachers are $1,000.00 per year and more beyond those paid in Quebec. As well the Ontario professions were not subject to the 5 per cent sales tax and would not be subject to a provincial income tax such as that just established in Quebec. This gave the Ontario universities a great advantage over Quebec in securing and retaining good teaching staff.

The brief reads as follows:—

*To the Chairman and Members,*
*Royal Commission of Inquiry on Constitutional Problems.*

Gentlemen:

The Engineering Institute of Canada thanks the Commission for its invitation to submit a brief. The Institute hopes that this submission may in some degree illuminate one of the problems with which the Commission is faced.

The Institute is the major national professional engineering organization of Canada. Its objects cannot be better set forth than by quoting the statement of its aims which appears on the title page of each issue of its monthly *Journal*.

> "To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

From this quotation it is evident that the Institute is concerned with

### Cover Picture

This view of Quebec City shows the Chateau Frontenac, part of the picturesque "Lower Town", and the St. Lawrence River. The Chateau Frontenac will be headquarters for the annual meeting, May 12, 13, 14, 1954. — *Canadian Pacific Railway Picture.*

the technical side of engineering, with the moral and material welfare of engineers and with the enhancement of their usefulness to the public.

In view of the national importance of engineering education, the Engineering Institute of Canada with a total membership of over 15,000, of whom about 5,000 reside and work in the Province of Quebec, is naturally interested in the welfare and status of the profession of this province. It is concerned that this province shall not suffer from a shortage of engineers and that its three great engineering faculties, L'Ecole Polytechnique, McGill University and Laval University, which have been in the forefront of engineering education in the past, shall be able not only to maintain their high standards, but to continue to develop in line with universities elsewhere and in keeping with the growth of the Province of Quebec and of Canada as a whole.

The phenomenal industrial development of this province during the last decade or so has required the services of more and more engineers. In fact, it is because such services were available that much of the development has taken place. If the province is to continue to progress in this direction, it must be assured of a continuing supply of adequately trained engineers.

A "continuing supply" implies that enough young engineers shall enter the profession here each year to replace those who have died or retired, plus enough to fill the positions made available by expanding industry. "Adeqately trained" means that these young men—and occasional young women—most of whom will be graduates of the three engineering faculties of this province, shall have received educations at least comparable with those which may be obtained elsewhere.

To maintain this supply of engineers it should be possible for any young person of promise and with the requisite academic qualifications to proceed to one of the province's engineering schools, even though having limited financial resources. To some extent this can now be done; both the universities and the province do help a limited number of such students, but more assistance is needed. It is not suggested that the student need be supported in luxury, merely that he be subsidized to the point where he can attend the university, instead of having to forego the opportunity for lack of means.

Training in engineering and in medicine are probably the two most costly to provide. Engineering education requires heavy investment in expensive equipment, which scientific advances frequently make obsolete long before it is worn out, and a high-calibre teaching staff, which must be well paid to be retained. Unless salaries attached to teaching positions are kept reasonably comparable to those paid in industry, the drift of capable teachers to industrial positions will be more marked than it is now, and then the universities will be in real trouble.

It is well known that of late the universities of this province have been unable to balance their expenditures with incomes limited to student fees, the returns on their endowments, etc. It is evident that the days when universities could hope to build up endowment funds from private gifts have passed, largely because heavy taxation has drained off the funds which used to be available for philanthropy. Income on invested funds has decreased. While industry is affording more and more financial assistance to the universities, income from this source is not likely to solve the universities' financial problems and it is uncertain, its amounts naturally depending upon the state of business. Some help may be expected from alumni, but perforce it will always be relatively small. Over and above their incomes from the sources mentioned, the major part of the extra funds needed must come from government.

Therefore, the Engineering Institute of Canada respectfully urges the Commission to study sympathetically the financial needs of the universities of the Province of Quebec to the end that the universities:—

1. May be able to assist more extensively, competent and needy students to acquire training in engineering.
2. May be able to keep the physical equipment of their faculties of engineering at the level of adequacy it should have for efficient teaching and for research.
3. May be able to maintain their engineering staffs satisfactorily, both in numbers and in competence.
4. And that some of those not now teaching engineering may be encouraged to start such courses, particularly for the junior years.

The Institute hopes that financial aid to these universities may be implemented without delay and that it may be guaranteed for as long as required. The needs of the universities are likely to increase steadily and their own ability to raise funds is not likely to improve. Therefore it is desirable that funds should be provided on a regular annual basis in accordance with the needs.

All of which is respectfully submitted to your honourable body by the Engineering Institute of Canada acting by authority of its Council and through its president and its secretary, whose signatures are affixed hereto.

Ross L. Dobbin
*President*

L. Austin Wright,
*General Secretary.*

Montreal, Quebec,
March 10, 1954.

# Correspondence

Dear Mr. Editor:

Am in receipt of your letter of January 14th and wish to thank the Council and yourself for the Life Membership. While I have not taken a very active part in Institute affairs since leaving Edmonton in 1943, I have enjoyed the associations when able to attend meetings. The many contacts I have made with prominent engineers through the Institute have been pleasing and instructive. More interest in contacts and exchange of useful knowledge would be helpful to young engineers, with less emphasis on "Union Affairs". I am glad the Institute leaves the latter to others.

Naturally, I am interested in the "Thirty-five Years Ago" items and was particularly pleased to see an item about my old associate J. G. LeGrand, an accomplished and humble gentleman, who was one of the leading bridge designers of his time. He designed every structure which was erected under his jurisdiction and was bold and original in his ideas. Would not have known that he played a leading part in design and construction of the Verdun fortifications, which played so great a part in the defense of France in the 1914-1918 scrap, if I had not asked him after seeing his plans in the 1922 Edition of the *Britannica.*

R. W. Ross, M.E.I.C.,
Winnipeg, March 6, 1954.

# Centennial at University of New Brunswick

### The Faculty of Engineering at the University of New Brunswick Celebrates Its One Hundredth Birthday

On a wintry day in February, 100 years ago, Prof. McMahon Cregan addressed a class of twenty-six prospective Engineers in the old Arts Building of the University of New Brunswick. This is believed to be the first course in engineering given in any Canadian University, and only a scant half dozen universities in the United States had introduced engineering instruction before that date.

By fortunate coincidence Founder's Day at the university, set by regulation, fell on February 15, 1954, one hundred years to a day, from the date of Prof. Cregan's first lecture. The Engineering Institute of Canada had no small part in the ceremonies. The Founder's Day orator was Dr. John B. Stirling, immediate past president of the Institute, and on behalf of the Institute, Mr. Charles E. Weyman, chairman of the Fredericton Branch, presented a handsome mantel clock, suitably engraved, to the president of the university, Colin B. Mackay.

Laurie Coles, president of the students engineering society, presents key to Dr. J. B. Stirling.

C. E. Weyman, chairman of the Fredericton Branch, E.I.C., presents President C. B. Mackay with an engraved clock.

Dr. Stirling's address was a masterly presentation of the early history of engineering education in Canada. His research into the events which led to the establishment of engineering instruction at the University of New Brunswick, and very soon after at McGill University, brought to light much interesting, and hitherto unpublished historical data.

Sir Edmund Head, Governor of New Brunswick from 1847 to 1854, and Governor-General of Canada from 1854 to 1861, has been recognized by university authorities as the man whose influence in the government of the day, made certain the introduction of engineering education. His support stemmed from his great respect for, and confidence in, his great friend, Dr. William Brydone Jack, then professor of mathematics, natural history and astronomy, and later president of the University of New Brunswick, from 1861 to 1875. Dr. Stirling noted the close connection between the establishment of engineering instruction at the University of New Brunswick and McGill University.

This came about through Sir Edmund Head's introduction in 1853, to William Dawson, then superintendent of education in Nova Scotia, and later esteemed principal of McGill. Dr. Stirling remarked, "Sir Edmund, who by this time was thoroughly indoctrinated by the views of William Brydone Jack, was deeply impressed by Dr. Dawson's views on educational reform . . .". Dr. Dawson, appointed by Sir Edmund Head, became principal of McGill on November 5, 1855. Dr. Stirling concluded this section of his address with the thoughtful observation," . . . it must be highly interesting to this audience to recall that two of New Brunswick's sons by adoption, Sir Edmund Head and William Brydone Jack, had a very marked influence on the institution of engineering in Lower Canada at McGill University".

It is claimed by some that Prof. Cregan's class of twenty-six prospective engineers, revitalized higher education in New Brunswick, and promoted the Act changing Kings College to the University of New Brunswick in 1859. It is noteworthy that Prof. Cregan's lectures were held in the fine stone Arts Building, built in 1828, which still dominates the university campus after 126 years.

Although engineering certificates or diplomas must have been granted between 1854 and 1862, the only one known to exist, is that granted to Henry George Clopper Ketchum in 1862. It is now preserved in the archives of the university, and Mr. Ketchum's name is found on the medal given each year to the civil engineering graduate with the highest standing in his final year.

Most of the early surveying instruments used at the university, are still in existence, and may be seen as museum pieces. A quadrant donated by Mrs. William Odell in 1846 is the oldest. The observatory built by William Brydone Jack in 1851 houses a six inch telescope, which at that time was one of the finest on the continent. A large Troughton & Simms theodolite, used by Dr. Jack in the 1850's, for meridian observations, is still intact. In this collection will be found also the massive and cumbersome theodolite used in running the boundary line between New Brunswick and Maine, following the Webster-Ashburton treaty.

Diplomas in engineering were granted up to and including 1898. In 1899 the first degree in civil engineering was granted. The degree was Baccalaureus in Arte Ingeniaria. (B.A.I.). In 1907 the degree was changed to Bachelor of Science in Civil Engineering. The first degree in electrical engineering was granted in 1910, and last year the university graduated the first class in mechanical engineering.

In 1900 the engineering faculty left the old Arts Building, and moved into the newly constructed Science Building, which is now the Civil and Mechanical Engineering building. We can well note the cost of this fine building in 1900, only $19,000. Forty-five years later, an addition, containing somewhat less floor space cost $90,000, a striking commentary on the increased cost of engineering education.

*(Continued on page 447)*

# 68th

# Annual General

and

# Professional Meeting

of

# THE ENGINEERING INSTITUTE OF CANADA

at

The Chateau Frontenac, Quebec City
May 12, 13, 14, 1954

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## GENERAL COMMITTEE

| | |
|---|---|
| Chairman | Gilles E. Sarault |
| Vice-Chairman | Guillaume Piette |
| Secretary | Roger Desjardins |

## COMMITTEE MEMBERS

| | | | |
|---|---|---|---|
| Entertainment | P. A. Duchastel | Publicity | J. P. Drolet |
| Finance | P. E. A. Vincent | Reception | J. St. Jacques |
| Information | J. H. R. Rioux | Technical Papers | L. P. Bonneau |
| Meeting Arrangements | L. P. Bonneau | Transportation | G. Galibois |
| "Muriel's Room" | Louis Trudel, B. O. Baker | Visits | A. C. deLery |

*Ladies . . . . . . . . . . . . . . Mme G. E. Sarault

***See separate program for ladies' events.**

## See the World's Largest Aluminum Plant and the Great Shipshaw Power Development!

**Special Post-Convention Trip**

**Arvida, Quebec, May 15-16**

The Saguenay Branch E.I.C. and the Aluminum Company of Canada Ltd. extend a cordial welcome to members of the Institute and their wives to visit Arvida at the conclusion of the Annual Meeting. Sleepers will leave Quebec shortly after midnight Friday, arriving at Arvida the following morning. They will leave Arvida Saturday evening for Montreal arriving there 9:55 a.m. E.D.T. — Extra fare, $15.85 plus berths.

***Attention - Members!***

Attendance at social functions will tax all available accommodation. Members are urged therefore to indicate their ticket requirements by completing and mailing advance registration cards well before the meeting. Tickets not paid for **will not be held after 4:00 p.m.** on the day of the function.

Banquet accommodation in the main room (Ball Room) will be guaranteed only to those who send the necessary remittance with their advance registration.

# *PROGRAM

## Wednesday, May 12th

**9:00 a.m. REGISTRATION —**

**St. Lawrence Room**

**10:30 a.m. — Ball Room**

ANNUAL GENERAL MEETING

**2:00 p.m. — Ball Room**

MINING DEVELOPMENT AND ENGINEERING IN QUEBEC

Jean-Paul Drolet, M.E.I.C.,
Chief Technical Information Dvn.,
Department of Mines, Quebec.

**Jacques Cartier Room**

THE IMPACT OF TRANSISTORS ON THE ELECTRICAL INDUSTRY

E. L. R. Webb, Head of Air Force Section, Radio & Electrical Engineering Division,
P. A. Redhead, Research Officer,
National Research Council, Ottawa.

**Committee Room**

7,000 TON FORGING PRESS AT TRENTON, N.S.

Hans Ulmann, M.E.I.C.,
Chief Engineer, Industrial Dvn.,
Dominion Engineering Works Limited,
Montreal.

**3:00 p.m. — Ball Room**

MANUFACTURING PROCESSES FOR A NEW CEMENT PLANT

Bernard Ulrich, M.E.I.C.,
General Manager,
St. Lawrence Cement Co.,
Quebec, P.Q.

**Jacques Cartier Room**

THE APPLICATION OF COMPUTORS TO INDUSTRY

W. J. M. Moore, M.E.I.C.,
Assistant Research Officer,
Radio & Electrical Engineering Division,
National Research Council, Ottawa.

**3:00 p.m. — Committee Room**

DEVELOPMENT OF AN AXIAL FLOW COMPRESSOR

F. H. Keast, Assistant Chief Engineer, Technical
A. V. Roe Canada Ltd., Malton, Ont.

**4:00 p.m. — Ball Room**

LOCATION AND CONSTRUCTION OF THE QUEBEC NORTH SHORE & LABRADOR RAILWAY

B. M. Monaghan, M.E.I.C.,
Assistant Chief Engineer,
Quebec North Shore & Labrador Railway, Seven Islands, P.Q.

**Jacques Cartier Room**

UNDERWATER TELEVISION AND ITS APPLICATIONS

Capt. H. Ross Smyth,
Supervisor, Trials & Operations,
Radio and Electrical Engineering Division,
National Research Council, Ottawa.

**Committee Room**

ELECTRONICS IN THE PAPER INDUSTRY

W. A. Messervey,
Pulp and Paper Application Engineer, Apparatus Division,
Canadian General Electric Co. Ltd.,
Peterborough, Ont.

**6:30 p.m. RECEPTION**

**7:00 p.m. DINNER —**

**Ball Room** — $4.00 per person.

Chairman: Gilles E. Sarault, M.E.I.C., Chairman, Quebec Branch

Speaker: Ross L. Dobbin, M.E.I.C., President, The Engineering Institute of Canada

(Dress Informal)

*Subject to minor changes.

## Thursday, May 13th

**9:00 a.m. — Ball Room**

JOB CONTROL OF THE YONGE STREET SUBWAY

W. H. Paterson, M.E.I.C.,
Chief Engineer,
Toronto Transit Commission.

**Jacques Cartier Room**

MENIHEK POWER DEVELOPMENT, LABRADOR.

L. A. Carey, Jr.E.I.C.,
Resident Engineer,
Montreal Engineering Company.

**Committee Room**

SOME FIRE PROTECTION ASPECTS OF BUILDING DESIGN

W. E. Emmerson, Jr.E.I.C.,
Division Engineer,
D. R. Abbey, M.E.I.C., Engineer,
Fire Protection Section,
Underwriters' Laboratories of Canada, Toronto.

**10:00 a.m. — Ball Room**

INSTALLATION OF ELECTRICAL EQUIPMENT IN THE YONGE STREET SUBWAY

J. Y. Doran, Electrical Engineer,
Toronto Transit Commission.

**Jacques Cartier Room**

HYDRO-ELECTRICAL DEVELOPMENT ON THE CANADIAN SIDE OF THE NIAGARA RIVER

R. L. Hearn, M.E.I.C.,
General Manager and
Chief Engineer,
Hydro-Electric Power Commission of Ontario, Toronto.

**Committee Room**

NATURAL RESOURCES AND THE ENGINEER

J. L. Van Camp,
General Manager,
Canadian Forestry Association,
Inc., Montreal.

**11:00 a.m. — Ball Room**

CARS, SHOPS AND MECHANICAL EQUIPMENT OF THE TORONTO SUBWAY

J. G. Inglis,
Assistant Manager of Equipment,
Toronto Transit Commission.

**Jacques Cartier Room**

CANADA'S SUPER TANKERS

W. H. White, Naval Architect,
R. W. McGilvray,
Chief Engineer, Design,
Davie Shipbuilding Limited,
Levis, P.Q.

**11:00 a.m. — Committee Room**

TRANSMISSION OF THE POWER DEVELOPED ON THE CANADIAN SIDE OF THE NIAGARA RIVER

J. E. Sproule, M.E.I.C.,
Consulting Transmission Engineer,
Hydro-Electric Power Commission of Ontario, Toronto.

**2:30 p.m. — Afternoon Tour**

For all visiting members and guests. Details of this will be announced in the final program.

*There will be no Technical Sessions on Thursday Afternoon.*

### HOTEL ACCOMMODATION AND TRANSPORTATION

All meetings and functions will take place in the Chateau Frontenac unless otherwise noted. Additional room accommodation has been arranged for at the Hotel Clarendon nearby.

Requests for room reservations should be made without delay, using the accompanying reservation card for this purpose. Single rooms are scarce and in most instances it will be necessary to share twin-bedded double rooms. It is better if sharing arrangements can be worked out in advance and indicated on the room reservation card.

All requests for reservations should be addressed to:—

*The General Secretary,*
*The Engineering Institute of Canada,*
*2050 Mansfield Street,*
*Montreal 2, Que.*

Reduced convention fares have been authorized for rail travel in Canada. A special fare certificate will be mailed to you from headquarters if requested on your registration card. This entitles you and members of your family to round-trip tickets at one and one-half times the one-way fare plus twenty-five cents.

Trans-Canada Air Lines have convention rates for parties of ten or more. Your local T.C.A. agent will gladly supply details.

No matter how you travel, be sure to make your reservations now to avoid disappointment.

*All Times are Eastern Daylight Saving*

### REGISTRATION

3:00 p.m. to 6:00 p.m. — May 11th
9:00 a.m. to 6:00 p.m. — May 12-14th
Members $5.00
Juniors $3.00 - Non-members $6.00
Ladies, guests of the Institute, speakers, authors and students — complimentary.

### "MURIEL'S ROOM"

The hospitality of "Muriel" will be extended, as usual, to all registered members, ladies and guests, thanks to the continued co-operation of Canadian industry.

**Registration Badges Must Be Worn**

*PLEASE NOTE*

*Prices for meals include gratuities and provincial tax. Tickets must be obtained in advance and refunds cannot be made less than three hours in advance of any function.*

## Friday, May 14th

**9:00 a.m.** — **Ball Room**

PERIBONKA POWER PLANTS

R. E. Heartz, M.E.I.C., President,
Shawinigan Engineering Company,
Montreal.

**Jacques Cartier Room**

INSTRUMENTING A NYLON INTERMEDIATES PLANT

F. G. Carson,
Chief Supervisor, Maintenance—Instrumentation.
Canadian Industries Limited,
Maitland, Ont.

**Committee Room**

RATIONAL DESIGN FOR BUILDING FRAMES

J. L. de Stein, M.E.I.C.,
Associate Professor,
Department of Civil Engineering,
McGill University, Montreal.

**10:00 a.m.** — **Ball Room**

KITIMAT POTROOM FOUNDATIONS

R. M. Hardy, M.E.I.C.,
Dean of Engineering,
University of Alberta,
Edmonton, Alta.

C. F. Ripley, M.E.I.C., Manager,
Ripley & Associates,
Vancouver, B.C.

**Jacques Cartier Room**

THE DEVELOPMENT OF A NEW CONCEPT IN MODERN OFFICE BUILDING CONSTRUCTION

G. Lorne Wiggs, M.E.I.C.,
Consulting Engineer, Montreal.

**Committee Room**

PHOTOGRAPHY IN ARMAMENT DEVELOPMENT

E. W. Greenwood—Superintendent,
Ballistics Wing,
Canadian Armament Research & Development Establishment.

**11:00 a.m.** — **Ball Room**

DESIGN AND CONSTRUCTION OF ALCAN'S KITIMAT TERMINAL WHARF

W. L. Pugh, M.E.I.C.,
Chief Engineer,
Aluminum Company of Canada Ltd., Montreal.

**11:00 a.m.** — **Jacques Cartier Room**

ARCTIC APPLICATION OF THE HEAT PUMP

J. B. Templeton,
Head, Engineering Section,
Defence Research Northern Laboratory, Fort Churchill, Man.

**Committee Room**

INSTRUMENTATION IN ARMAMENT DEVELOPMENT

E. J. Bobyn,
Canadian Armament Research & Development Establishment.

**2:00 p.m.** — **Ball Room**

TELECOMMUNICATIONS IN CANADA

A. G. Lester,
Assistant General Manager—Toll Area,
The Bell Telephone Company of Canada, Montreal.

**Jacques Cartier Room**

PANEL DISCUSSION — AIR POLLUTION CONTROL

**3:30 p.m.** — **Ball Room**

MANAGEMENT PANEL DISCUSSION

**6:30 p.m.** — **RECEPTION**

**7:15 p.m.** **THE ANNUAL BANQUET** — **Ball Room**

$5.50 per person
(including dance)

Chairman: Ross L. Dobbin,
President of the Institute.

Speaker: Dr. C. J. Mackenzie,
Hon. M.E.I.C.,
Ottawa.

Presentation of medals and prizes and introduction of the new president, D. M. Stephens, and new members of Council.

**10:00 p.m.** **ANNUAL DANCE — Ball Room**

$2.50 per person (dance only).

(Dress optional)

### RECEPTION

There will be an informal reception after the banquet when members and guests may meet the incoming and retiring presidents, the Chairman of the Quebec Branch, and their wives.

CENTENNIAL AT UNIVERSITY OF NEW BRUNSWICK

(*Continued from page 442*)

Much could be written of the years following the inauguration of engineering at the university. Many men have contributed the best years of their lives to the training of young engineers, not only in the Faculty of Engineering, but in the Faculties of Arts and Science. At this time however, it seems proper that our thoughts should turn to those men of courage and foresight, who one hundred years ago fostered our profession. May their fame endure forever.

EARLE O. TURNER,
*Dean of Engineering.*

# Association of Professional Engineers of Nova Scotia

Engineers today enter into activities promoted for community, national and international welfare, Mayor R. A. Donahoe, Q.C., commented at the annual banquet of the Association of Professional Engineers of Nova Scotia, held on January 29, at Halifax.

Mayor Donahoe said the engineering profession was making a vital contribution to the well-being and progress of freedom loving countries. He was introduced by Nelson Mann, president of the Halifax Branch, E.I.C., who along with John E. Clarke, M.E.I.C., newly elected president of the Association, was co-chairman of the annual banquet.

Mr. Clarke, the new president, is divisional engineer, Provincial Department of Highways, Middleton, N.S. Serving the Association with him will be the following officers: vice-president, M. L. Baker, M.E.I.C., associate professor of mechanical engineering, Nova Scotia Technical College; past-president, G. J. Currie, M.E.I.C.; senior civil and hydraulic engineer, Nova Scotia Light and Power Co. Ltd.; secretary-treasurer, J. D. Kline, M.E.I.C.

Councillors of the Association are: V. M. Coy, M.E.I.C.; M. F. Dean, M.E.I.C.; G. H. Burchill, M.E.I.C.; and J. W. MacDonald, M.E.I.C., representing the Halifax area; C. M. Anson, M.E.I.C., Sydney; L. D. Wickwire, M.E.I.C., Liverpool; L. F. Kirkpatrick, M.E.I.C., Amherst; J. R. MacQuarrie, M.E.I.C., Malagash.

Among the guests attending the dinner were Hon. Alistair Fraser, Lieutenant Governor of Nova Scotia, Premier Angus L. Macdonald, Dr. F. H. Sexton, former president of Nova Scotia Technical College, and Dr. A. E. Cameron, president of Nova Scotia Tech.

E. Whitman, chairman of the examining board of the Association reported an increase of 50 members during the past year. Dr. F. H. Sexton, Wolfville, chairman of the professional relations committee, advocated that engineers take an active part in public relations and join in community activities.

A guest of honour at the annual banquet was W. E. Jefferson, former chief engineer of Maritime Telegraph and Telephone Company, and now an Anglican clergyman at his native Granville Ferry. He was presented with a desk set.

## Capital Available

The general secretary has been asked to recommend some manufacturer in Canada who could use to advantage some additional capital for expansion purposes. The amount might be anything up to one million dollars.

The inquirer suggests that he would be interested in an industry that has to do with the manufacture of some form of power equipment — motors, generators, turbines, engines and so on.

If you are interested write to the general secretary marking the envelope "Confidential".

# 1953 E.I.C. Membership Directory

## Errata

(*Continued from March issue*)

With the completion and distribution of our 1953 Membership Directory, a small number of errors have come to light. Naturally, these are very much regretted, but since the work had to be done under pressure against time, a certain number of mistakes were almost inevitable.

For the convenience of all members we are printing below a further list of names as they should have appeared in the Alphabetical Section. For errors in the Geographical Section the necessary correction is simply noted. — EDITOR.

### Honorary Members—Page IX:

**MACKENZIE, C. J.,** J. 1911, A.M. 1914, M. 1920, Hon. M. 1947.

### Alphabetical List:

**BRAKENRIDGE, Chas.,** Consltg. Engr., 3450 West 3rd Ave., Vancouver, AM'15. M'19.

**BROWN, Joseph,** Detroit '43. Wks. Engr., C.I.L., Copper Cliff, Ont. J'48. M'52.

**BULLER, F. H.,** McGill '23. Schenectady '31. Analytical Engr. General Electric Co., 1 River Road, Schenectady 5, N.Y. S'20. AM'31. M'40.

**CAMPBELL, R. M.,** Queen's '48. Mech. Engr., C. D. Howe Co., 1421 Atwater Ave., Montreal. Mail: 6390 Clanranald Ave. S'48. J'50.

**CHOQUET, J. A.,** Ecole Poly. '48. Assoc. Prof., Ecole Polytechnique, 1430 St. Denis St., Montreal. Mail: 10540 St. Charles St., Ahuntsic, Que. S'44. J'50.

**GORING, G. R.,** McGill '39. Mech. Engr., Steel Co. of Can. Ltd., Montreal. Mail: 7272 Somerled Ave. M'45.

**HARTMANN, N. L.,** Stuttgart '24. Dsgnr. Q.H.E.C., Montreal. Mail: 6941 31st Ave., Rosemount, Que. AM'38. M'40.

**JEMMETT, D. M.,** Queen's 13. Prof. of Elec. Engrg., Queen's Univ., Kingston, Ont. AM'21. M'40.

**KRUG, F.,** Pres., International Power Co., 244 St. James St. W., Montreal. M'50.

**McKINNEY, A. D.,** Gen. Sales Mgr., All-Steel Buildings Ltd., Harbour Comm. Bldg., Toronto. M'50.

**SCHENKER, Leo,** London '42. Tor. '50. Resch. Assoc., Univ. of Michigan, Ann Arbor, Mich. Mail: Apt. 3, 415 Nob Hill Place. M'50.

**ZAVITZIANOS, Demetrius,** Athens '48. Fld. Engr., Piggott Constrn. Co., 1250 Bay St., Toronto. Mail: 11 Kingsdale Ave., Willowdale, Ont. J'52.

### Geographical List:

Add under United States of America, Page 196: Newark, N.J., Member, T. E. Smith.

Delete above name from New Orleans, La.

Correct under Winnipeg Branch, Page 179: Norwood (Members) H. S. Beethman.

Correct under Kingston Branch, Page 185: Kingston (Members) D. M. Jemmett.

# The President Visits the Western Branches

**These photos show something of the warmth accorded him, but more pictures will appear later.**

Winnipeg

Above left. The president greets University of Manitoba students. Left to right: L. Austin Wright, G. B. Williams, of the Winnipeg Branch executive, R. G. Nicholls, prize winner; Ross L. Dobbin; G. Newman, president of the student section; R. D. Vopni, senior stick.

Above right. At the McArthur power development. Left to right: H. M. White, President Dobbin, D. M. Stephens, J. W. Sanger, J. R. Rettie, Dr. Wright, Dick Noonan.

Below, a meeting at Pine Falls, Man. Front row, left to right: J. W. Sanger, D. M. Stephens, Don Munroe, Mr. Dobbin, Lorne McLure, J. Saldat. Second row: Roy Fowler, J. R. Rettie, Frank Morton, L. A. Wright, Don Miller, H. W. White, Dick Noonan, Jack Cook, Tom Benn, Al Hayman, Wally Popiel, W. Jonat, Ted Cates.

## Brandon

Above left. The head table, left to right: Mayor J. A. Creighton, Mrs. Koropatnick, the president, Chairman Jack Koropatnick, Jerry Williams, Mrs. Cook, and the president's sister, Mrs. J. A. Creighton.

Above right. From extreme left, and around the front of the table: Len Stevenson, Angus Laughlin, Mrs. and Mr. John Harrison, Miss M. Karnous, William Taciuk, and George Brodie.

Right. The president gets a send-off at the station.

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## Regina

The head table: G. W. Parkinson, P. M. Sauder, of Lethbridge, Miss Mary Young, Dean I. M. Fraser, of Saskatoon, Mr. Dobbin, Allan Tubby, Saskatoon, Stewart Young, Mrs. Robert Reid, North Battleford, E. Mason, Trail; Mrs. G. W. Parkinson, E. L. Smith, Edmonton.

Below left: President Dobbin presents the certificate of honorary membership to Stewart Young. Mr. Young's daughters, Miss Mary Young and Mrs. Robert Reid look on with interest.

At the Regina meeting, J. McD. Patton (left), and L. A. Thornton.

## Trail

The four pictures above are a composite of the head table at the banquet held at Tadanac Hall. From left to right, first row: N. H. Booth, secretary-treasurer; Mrs. W. K. Gwyer, Dr. C. H. Wright, chairman, Trail Committee of Technical Societies, Mrs. E. B. Broadhurst, R. W. Diamond, Mrs. Molly Willis, President Dobbin, E. B. Broadhurst, Mrs. R. W. Diamond, E. Mason, councillor, Mrs. C. H. Wright, Rev. W. Kennedy, president, Trail Ministerial Association, Mrs. E. Mason, Mrs. N. H. Booth and W. K. Gwyer, chairman-elect.

Membership dinner, Trail Hotel. Left to right: W. Lawrie, A. F. Brooks, W. G. Small, J. V. Rogers, K. L. Broe, L. Ayre, T. W. Lazenby, G. C. Laycock, L. Fransen, E. Busby, H. P. Hamilton, F. Jackson.

Luncheon at Nelson. Left to right: N. H. Booth, J. P. Coates, D. Fairbanks, President Dobbin, E. B. Broadhurst, G. Fyke, E. M. Styles, H. T. Miard.

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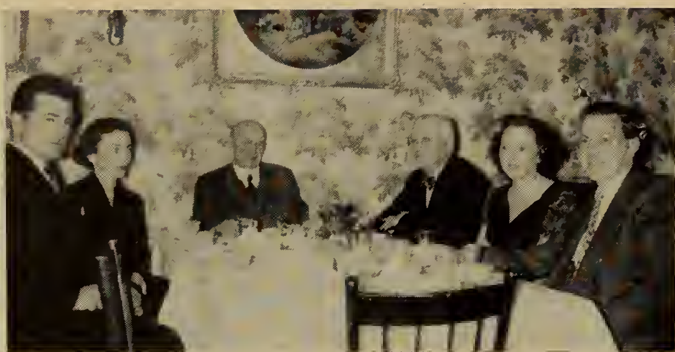
On the opposite page. The president at Kemano. First group: Karl Roestad, Alcan resident engineer, Kemano, Mr. Dobbin, N. L. Hinkson, B.C. International Engineering. Second group: J. R. Goff, W. L. Inglis, Steve Butte, and J. R. Carson, of B.C. International Engineering, and the president (second from right).

## Vancouver Island

The president visited the engineers' school at Chilliwack. Back row: Lt.-Col. Kellough, H.Q., B.C. Area, Vancouver; Lt.-Col. Berry, commanding officer, I Field Engineer Regiment; Major Hough, officer commanding, Trades Training Squadron; Major Ball, chief instructor. Front row, left to right: Eric Hartley, chairman, Vancouver Branch, R. L. Dobbin, Peter Jones, secretary of the Branch, and Lt.-Col. D. W. Cunnington.

Victoria. Below, right to left: A. G. Ballantyne, G. Simmons, of B.C. Engineering Society; R. W. Siddall, Architectural Institute, Mrs. J. A. W. Izard, W. A. Bowman, R. L. Dobbin, Mrs. Bowman.

Victoria. Left to right: Mrs. R. Murray, G. E. Macpherson, Miss Dawn Josephs, Mrs. R. C. Thurber, R. C. Thurber, Mrs. L. C. Johnson, R. Murray.



Victoria. Left to right: G. C. Stewart, Mrs. G. C. Stewart, Col. B. Ripley, E. Jamieson, Mrs. J. G. Ford, Mr. J. G. Ford.

Kemano *(See opposite page for caption)*

## Calgary

The president goes "Western". The branch presents him with a white 10-gallon hat. The rough and ready cowhands are W. A. Smith (left) and H. M. Hunter.

Luncheon meeting. Left to right: K. G. Evans, the president, R. Underhill, and L. A. Wright.

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## Saskatoon

Left to right: Mrs. Weir, Mrs. McAskill, R. L. Dobbin, Mrs. Munro, Mayor McAskill, G. N. Munro.

With the Saskatchewan Council. Front row, left to right: A. Tubby, past-chairman, R. Peterson, J. Jonsson, R. Bing-Wo. Back row: G. N. Munro, chairman, Pres. Dobbin, Dean Fraser, W. G. McKay, W. R. Staples, E. C. B. MacNabb. Standing: W. M. Berry, A. F. G. Carroll.

## Vancouver

In foreground: Reg. G. Smalley. Back of table, left to right: Hugh Ritchie, R. H. Garrett, E. T. Winslow, Maj.-Gen. J. P. MacKenzie, Col. W. G. Swan.

Left to right: A. C. R. Yuil, R. E. Wilkins, Robert Douglas, Richard Walkem, N. C. Sherman.

# *Thirty-five Years Ago*

**Comment on the *JOURNAL* of April 1919**

The April, 1919, *Journal* announced the personnel of the special committee to draft a model engineers' licensing law. It was made up of R. F. Uniacke, Ottawa; Arthur Surveyer, Montreal; A. R. Decary, Quebec; C. C. Kirby, Saint John; C. E. W. Dodwell, Halifax; Willis Chipman, Toronto; N. L. Somers, Sault Ste. Marie; J. M. Leamy, Winnipeg; F. H. Peters, Calgary; R. J. Gibb, Edmonton; A. G. Dalzell, Vancouver; E. R. Gray, Hamilton; and G. D. Mackie, Saskatchewan. Good advice to this committee was given by a correspondent signing himself "The Opposition"— "Messrs. Committee, don't be afraid to talk salaries."

Council looked with a dim eye on a proposal, emanating from Toronto, to establish a Canadian Institute of Electrical Engineers. John Murphy, W. A. Bucke and Julian C. Smith were appointed to deal with this matter and to consider how the Institute could be made "still more attractive for electrical and mechanical engineers". Later *Journals* probably referred to this matter again, but we can say that the proposal came to nothing.

### Higher Salaries

Black-faced type emphasized the editorial announcement that the "Government (proposes) to establish a higher basis of salaries for engineers . . . All the influence we possess should be used in this cause." Also the editor published a schedule of salaries proposed by the American Association of Engineers, ranging from $9,000-$15,000 for chief engineers down to $1,200-$1,440 for tape men. The starting salaries for 1953 graduates averaged about $3,400; to reach that figure under the schedule just quoted one would have had to be in the chief draftsman class.

"An Experienced Transitman" complains in a letter that his salary is only $1,200 a year, and thinks the Institute should do something about it, which, of course, it was doing. Another correspondent rather took the Institute to task for accepting advertisements in its employment section offering what he considered to be inadequate salaries. "Do you not think that the *Journal*, and thereby the profession, is being cheapened in the public eye by this . . . Why not refuse such advertising?" As a matter of fact the Institute has refused such advertisements — many of them.

The text of a memorial to the Prime Minister, Sir Robert Borden, and his cabinet was printed, praying that "the Federal Government recognize the paramount value as a national asset of its highly educated and trained men and utilize to a greater extent men of engineering knowledge and training, especially in an executive capacity on commissions dealing with all affairs where engineering or construction is involved." The intent was clear and laudable, even if the language was a little confused.

The beginning of the Institute's international affiliations were laid by the appointment of H. H. Vaughan, John Murphy and G. H. Duggan as a committee to explore the possibilities of closer relations with the engineering societies of the United States.

### Technical Papers

The longest paper in this April *Journal* was one by J. L. Busfield, "The Mount Royal Tunnel", a detailed description of the work from the inception of the idea until the operation of the first train. Many members of the Institute were associated with this project—S. P. Brown, W. E. Joyce, H. T. Fisher, J. D. K. Stewart and the author himself.

J. A. Burnett's "Locomotive Coaling Plants" was a paper no engineer would bother to write today, primarily because he would have nothing to say. Coal-burning locomotives will soon be so few that they will attract more attention than the biggest diesels do now; most of those remaining will probably be preserved as museum exhibits.

Another and more important paper was "Notes on the Test of a Girderless Floor", by Peter Gillespie and T. D. Mylrea. The floor tested was one of the 12 in the new Eaton factory in Toronto. Notable in the paper was the inclusion of all the experimental data, for "great difficulties were encountered by the writers when attempts were made to check the published results of others who had conducted similar building tests. In some cases, full data as to the structure and a mere summary of the results were given. In others, rather more complete results of the tests were given, but with an entire omission of . . . the structural features." Perhaps there is a lesson here for technical writers, even for our own.

It is papers like that that established the flat-slab floor as a safe and economical one, which has become so commonplace that the ability to design it is a tool of every concrete structural engineer. Although it has been replaced to some extent by other types, the old flat-slab floor is still a competitor.

How many civil engineers of this generation ever heard of "Trautwine"? His engineers' pocketbook was the engineers' Bible when the writer of these notes was a student. This April *Journal* announced the twentieth edition, in which "the rules relating to the ellipse have been modernized, extended and rewritten. A new isogenic chart is shown and the table of azimuths of Polaris have been revised."

E. S. M. Lovelace presented some "Suggested Harbour Improvements for Greater Montreal". He would have built a submerged dam from Varennes to the downstream end of the Island of Montreal, raising the low water level about ten feet and drowning out St. Mary's Current. To pass the dam, there would have been two locks at the Varennes end, each 1,000 feet long and 100 feet wide. Time lost in passing the locks would have been more than recovered by time saved in navigation above the dam. Part of the scheme was a combined railway and highway bridge following the crest of the dam, a river crossing which was badly needed at the time this paper was written. The whole scheme was stated not to be likely to make the flood situation in the Montreal area worse.

Another part of Mr. Lovelace's project was a canal from the St. Lawrence at Montreal to the Richelieu at St. Jean; "it is not proposed to give (the canal) a greater sectional area than that found on the existing canal system on the St. Lawrence River, nor a depth greater than 14 feet."

This paper stirred up more discussion than is often the case. F. W. Cowie, then chief engineer of the old Montreal Harbour Commission, thought Mr. Lovelace was sanguine in expecting his scheme to eliminate

St. Mary's Current and damned the whole project with faint praise. J. A. Jamieson regretted "that Mr. Cowie is so entirely satisfied over our harbour, as this attitude does not look very hopeful for future progress."

Like so many projects advocated by those who have made their study a hobby, Mr. Lovelace's efforts did not lead to any tangible results; however, he probably enjoyed its preparation. A paper of this speculative kind is good for us now and then.

#### The Branches

Council approved the formation of the Niagara Peninsula Branch. It sent a telegram to the Acting Prime Minister supporting the adoption of daylight saving time. The writer finds that he was reappointed to the Board of Examiners and Education, much more active in 1919 than it has since become; only one of his colleagues at that time is still living.

Reports from the Toronto Branch told of a meeting at which the topic of discussion was "What the Institute Can Do". Among the suggestions made were that only those with university educations should be allowed to call themselves engineers, that the Institute should take more interest in public affairs, that each branch should operate an employment bureau, that a fair salary scale for each province should be established and that no member of the Institute should be eligible for office unless he had attended a minimum number of the meetings of his branch each year.

All branches were actively debating the subject of legislation to govern the practice of engineering and a wide variety of views were expressed, ranging from approval of rigid—and probably unworkable—acts, to *laissez faire.* Most branches were also busy at this time instructing their representatives on the Institute's model licensing law committee.

The *Journal* offered its pages free of charge to any ex-service man seeking employment. Perhaps as a straw in the wind, it carried an advertisement for an instrument man for the Algoma Central and Hudson Bay Rly. at $1,800 a year and living expenses, a rather better salary than that complained of by "An Experienced Transitman" in the letter quoted earlier.

The atmosphere of the times was well shown by the tags in unfilled spaces at the bottoms of columns, "Have YOU employed a returned soldier?"

# The ASME Boiler Code

### Interpretations

The Boiler Code Committee meets monthly to consider "Cases" where users have found difficulty in interpreting the Code. These pass through the following procedure (1) Inquiries are submitted by letter to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.; (2) Copies are distributed to Committee members for study; (3) At the next Committee meeting interpretations are formulated to be submitted to the ASME Board on Codes and Standards, authorized by the Council of the Society to pass upon them; (4) They are submitted to the Board for action; (5) Those which are approved are sent to the inquirers and are published in Mechanical Engineering.

The following Case Interpretations were formulated at the Committee meeting January 22, 1954.

#### Case No. 1181

Interpretation of Par. P-112(c)

***Inquiry:*** Paragraph P-112(c) makes stress relief of carbon and carbon-molybdenum steel mandatory in thicknesses appreciably less than those currently permitted under other sections of the Code. May these thicknesses be increased?

***Reply:*** It is the opinion of the Committee that under Par. P-112(c) the following need not be stress-relieved:

(1) Carbon steel in thicknesses less than ¾ in.

(2) Carbon-molybdenum steel with carbon not exceeding 0.20% in thicknesses less than ½ in.

#### Case No. 1182

Special Ruling

***Inquiry:*** Is it permissible to construct unfired pressure vessels of ferrous* material fabricated by fusion welding for service at operating temperatures below −20°F. when the weld filler metal has lower mechanical properties than the base metal?

***Reply:*** It is the opinion of the Committee that weld filler metal having lower mechanical properties than those of the base metal may be used for the construction of pressure vessels, when made of ferrous materials to operate at temperatures below 20°F. with the following provisions:

(1) Materials and design of such vessels shall meet the requirements of Section VIII of the Code with particular reference to the requirements of Pars. UG-84, UCS-65, UCS-66, UCS-67 and UHA-51.

(2) The welding requirements of Section IX shall be met except as specifically exempted in (3).

(3) The room temperature tensile strength of the weld, as determined by the reduced section tensile test made to qualify the welding procedure as prescribed in Section IX, shall be not less than 90 per cent of the minimum specified tensile strength of the base metal.

(4) The stress value to be used for design purposes shall be 90 per cent of the room temperature stress value of the base metal.

CAUTION: It is recommended that the tensile strength of the weld, as determined by the reduced section tensile test be greater than the yield strength of the base metal as given in the mill test reports.

*As used herein ferrous materials include carbon, low-alloy, and high-alloy steels.

#### Case No. 1173

Special Ruling

***Inquiry:*** Will unfired pressure vessels fabricated by fusion welding under the applicable rules of Section VIII, 1952 edition, meet the intent of the Code if the base material is a nickel-molybdenum wrought material, which is now under consideration by the appropriate ASTM Committee, having the following composition:

| | |
|---|---|
| Molybdenum per cent | 26.00 to 30.00 |
| Iron, per cent | 4.00 to 7.00 |
| Vanadium, per cent | 0.20 to 0.60 |
| Silicon, max., per cent | 1.00 |
| Phosphorus, max., per cent | 0.04 |
| Sulphur, max., per cent | 0.03 |
| Manganese, max., per cent | 1.00 |
| Chromium, max., per cent | 1.00 |
| Carbon, max., per cent | 0.12 |
| Cobalt, max., per cent | 2.50 |
| Other, total, max., per cent | 0.50 |
| Nickel | Remainder |

***Reply:*** It is the opinion of the Committee that the nickel-molybdenum alloy described in the Inquiry may be used for the construction of unfired pressure vessels according to the applicable rules of Section VIII, 1952 edition, subject to the following conditions:

(1) The mechanical properties of the material are not less than given in Table 1.

(2) Fabrication is by fusion welding using filler metal complying in composition with the base material.

(3) The welding requirements and applicable paragraphs of Section IX, 1952 edition, apply except that the tensile strength of the reduced section specimen shall be not less than the specified tensile strength of the base material.

(4) Fusion welded butt joints shall be examined radiographically for their full length as prescribed in paragraph UW-51 when the plate or vessel wall thickness at

**Table 1. Mechanical Properties of Material**

| Thickness Inches | Tensile Strength p.s.i. | Yield St. p.s.i. 0.2 per cent offset | Elongation in 2" per cent minimum |
|---|---|---|---|
| up to 3/16......... | 115,000 | 50,000 | 45 |
| over 3/16 to ¾..... | 100,000 | 45,000 | 40 |
| over ¾ to 1½...... | 90,000 | 45,000 | 35 |

the welded joint exceeds 3/8ths of an inch. All fusion butt joints regardless of thickness shall be examined by the fluid penetrant method.

(5) The following maximum allowable stress values are used in applying the design rules where reference is made to Table UNF-23:

Metal temperatures not exceeding, degree F.

| 100 | 200 | 300 | 400 |
|---|---|---|---|
| 22,000 | 20,000 | 20,000 | 20,000 |

or

| 500 | 600 | 650 |
|---|---|---|
| 20,000 | 20,000 | 20,000 |

(6) In view of the fact that this alloy does not undergo a marked drop in impact resistance at low temperatures, no additional requirements are specified for temperatures down to −325°F., (See Par. UNF-65.)

(7) The joint efficiency factors, inspection and testing comply with the applicable paragraphs of Section VIII, 1952 edition.

(8) The minimum thickness after forming of any plate subject to pressure shall be 3/32". (See Par. UG-16(c) for permissible undertolerance.)

(9) Bolting materials shall comply in composition with the base material or one of the grades of steel bolts listed in Table UCS-23. The allowable stress values for nickel-molybdenum alloy bolts shall be as follows:

Metal temperatures not exceeding, degree, F.

| 100 | 200 | 300 | 400 |
|---|---|---|---|
| 8,000 | 8,000 | 7,600 | 7,200 |

| 500 | 600 | 650 |
|---|---|---|
| 7,000 | 6,800 | 6,800 |

**Add non-mandatory appendix:**

Heat treatment including stress relief of welded vessels is neither required nor prohibited. When maximum corrosion resistance is required, it may be advisable to heat treat in such a manner as to place all carbides in solution. For such service it is recommended that the vessel be heated to the range 2,100 deg. F. to 2,150 deg. F. and held for not less than 1 hour per inch of thickness. Quench all parts of the vessel uniformily and as rapidly as possible in water or air. The material should be cooled through the range from 1,800 deg. F. to 1,100 deg. F. in not more than 10 minutes. In order to avoid incipient fusion and the consequent decrease in corrosion resistance. heating above 2,150 deg. F. should be avoided.

(2) Welding techniques that will preserve the corrosion-resistant properties of the alloy should be used. In general, welding should be performed using stringer bead techniques with little or no weaving of the welding electrode or rod.

## Proposed Revisions and Addenda to Boiler and Pressure Vessel Code

As need arises, the Boiler Code Committee entertains suggestions for revising its Codes. Revisions approved by the Committee are published here as proposed addenda to the Code to invite criticism.

In the following the paragraph numbers indicate where the proposed revisions would apply in the various sections of the Code.

Comments should be addressed to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.

### Power Boilers, 1952

***Par. P-23.*** Revise title to read Thickness of Headers and Piping, also revise paragraph (g) to read:

When a steel pipe or header is pierced with tube holes, the maximum allowable stress in the ligaments in pounds per square inch shall not exceed the values given in Table P-7 and the maximum allowable pressure shall be computed using the formula in this paragraph with the value for S multiplied by the ligament efficiency factor E,(P-192 and P-193) or weld efficiency factor E, (P-102) whichever is lower, and otherwise in accordance with the rules in Par. P-180(c).

***Table P-15.*** Proposed revision, Table P-15 is available from the Boiler Code Committee.

***Par. P-180(c).*** Delete the last sentence of the second paragraph.

Replace the last paragraph with the following:

Inside backing strips when used at longitudinal welded joints shall be removed and the weld surface prepared in accordance with Par. P-102(h) (2a). Inside backing rings may remain at circumferential welded seams of headers provided such construction complies with the requirements of Par. P-112.

Add the following as a *cautionary note:*

For constructions operating in the range where creep and stress rupture strength govern the selection of stresses, it is desirable to remove all weld reinforcement.

***Par. P-102(h) (2).*** Revise to read (2) (a); designate second paragraph as (2) (b) revising new (h) (2) (b) by insertion of phrase "except as restricted by Par. P-180(c)" after reference to Par. P-101(d) (5) in the third line.

***Table P-7.*** Revise to read:

SA-268-47, Grades TP-405, TP-410 and TP-430, add the same stress values as given for Table UHA-23 in the September, 1953 issue of "Mechanical Engineering". Delete the following specifications: SA-158, SA-206, SA-280, SA-315, SA-83 (lap-welded pipe and tubes) and SA-157.

The following changes in grade designations should be made:

| *Specifications* | *Old Grade Designations* | *New Grade Designations* |
|---|---|---|
| SA-213 | T13 | T5b |
| | Y14 | T3b |
| SA-335 | P5a | P5 |
| | P16 | P7 |
| | P17 | P9 |
| SA-182 | F17 | F9 |
| | F2 | F12 |
| | F8 | F304 |
| | F8m | F316 |
| | F8t | F321 |
| | F8c | F347 |

The following are in error in the present Table P-7 and should be corrected:

(1) Note (1) should apply to SA-299 since this steel may graphitize when held at temperatures in excess of 800°F. for prolonged times.

(2) Since there is only one grade in SA-192, "Grade A" is superfluous and should be deleted.

(3) The caption "Electric Resistance Welded Alloy Steels" when applied to SA-249 is erroneous and should be changed to "Welded Alloy Steels."

(4) The nominal composition of SA-217, WC4 should be changed from Ni-Cr-1-Mo to Ni-Cr-½ Mo.

Additional revisions are given in table, revisions to Table P-7 available from the Boiler Code Committee.

### Unfired Pressure Vessels, 1952

***Table UCS-23.*** The revised table is available from the Boiler Code Committee.

***Table UHA-23.*** The revised table is available from the Boiler Code Committee.

***Table UCS-27.*** SA-83 should be deleted. The revised Specification A-83-52T covers Seamless Steel Boiler Tubes only, therefore, the lap-welded grades should be deleted.

Note (3) should be changed to read "Only (silicon) killed steel shall be used above 900°F."

***Par. UA-6(b) (2)***—Revise the introductory phrase to: "(2) Heads of the type shown in Fig. UA-6(b), (No joint efficiency is required)."

Delete "E" in formula (a) making it read:

(a) Head thickness, $t = \frac{5PL}{6S}$

***Par. UA-6(b) (3)***—Revise the introductory phrase to: "(3) Heads of the type shown in Fig. UA-6(c), (No joint efficiency factor is required)."

Delete "E" in formula (a), making it read:

(a) Head thickness, $t = \frac{5PL}{6S}$

***Par. UA-6(b) (4)***—Revise the introductory phrase to: "(4) Heads of the type shown in Fig. UA-6(d), (no joint efficiency factor is required)."

Delete "E" in formula (a), making it read:

(a) Head thickness, $t = \frac{5PL}{6S}$

***Par. UW-11(a)***—Add at the end of the paragraph the parenthetical clause: "(See Par. UW-52 for spot examination)."

***Par. UG-80***—Revise to read: UG-80 Permissible Out-of-Roundness of Cylindrical Shells.

(a) Internal Pressure. The shell of a completed vessel shall be substantially round. The difference between the maximum and minimum inside diameters at any cross section shall not exceed one per cent of the diameter at the cross section under consideration. The diameters may be measured on the inside or outside of the vessel. If measured on the outside the diameters shall be corrected for the plate thickness at the cross section under consideration (see Fig. UG-80.2).

When the cross section passes through an opening the permissible difference in inside diameters given above may be increased by two per cent of the inside diameter of the opening.

(b) External Pressure: The shell of a complete vessel to operate under external pressure shall meet the following requirements at any cross section:

(1) The out-of-roundness limitations prescribed in (a).

(2) The maximum plus-or-minus deviation from the true circular form, measured radially on the outside or inside of the vessel, shall not exceed the maximum permissible deviation "e" obtained from Fig. UG-80.1. Measurements shall be made from a segmental circular template having the design inside or outside radius (depending upon where the measurements are taken) and a chord length equal to twice the arc length obtained from Fig. UG-29.2. The value of $t$ shall be determined as follows:

(a) For vessels with butt joints, *t* is the nominal plate thickness, less corrosion allowance;

(b) For vessels with longitudinal lap joints the permissible deviation *e* may be increased by the nominal plate thickness, less corrosion alloyance;

(c) Where the shell at any cross section is made of plates having different thicknesses, *t* is the nominal thickness of the thinnest plate, less corrosion allowance.

(c) (Delete (c) as these rules now apply to completed vessels).

(d) New (c). No change.

(e) New (d). The dimensions of a completed vessel may be brought within the requirements of this paragraph by any process that will not impair the strength of the material.

(f) New (e). No change.

(g) New (f). No change.

(h) New (g). An example illustrating the application of these rules for a vessel under external pressure is given in Appendix L (Par. UA-271).

***Fig. UG-80.1.***—Revise the title to read: "Maximum Permissible Deviation from a Circular Form "e", for Vessels Under External Pressure."

NOTE: Dr. Bergman has suggested that the ordinate-values in Fig. UG-80.1 be changed from $t/d_o$ to $D_o/t$ to agree with the charts for shells.

If this is approved the ordinate-values in Fig. UG-29.2 should be changed in a similar manner.) Revised Fig. UG-80.1 and UG-29.2 are attached as Appendix III.

***Fig. UG-80.2.***—Revise the title to read: "Examples of Differences between Maximum and Minimum Diameters in Cylindrical Shells."

Change previous reference from ASA B.16e-1939 and ASA B.16e6-1949 to ASA B.16.5 in the following paragraphs: UG-34.1; UCS-8(b); UCS-9(b); UA-6(b) (1) and (b) (2).

NOTE: This reference change also applies to Par. P-27(f) in Section I.

The following are corrections to revisions as contained in December 11th Minutes:

Change reference from Par. UG-36(e) to UG-36(c) (3) in the following places:

Par. UW-14 (new (c) and (d) ).
Par. UG-37(a).
Par. UG-39(a).

and the change specified under Par. UG-36(c) (a) should be to Par. UG-36(c) (c) (3) (a).

Change addition to Par. UG-41(c) as follows:

> "For obround openings, consideration shall also be given to the strength of the attachment joint on one side of the plane transverse to the parallel sides of the opening which passes through the center of the semicircular end of the opening.

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# Elections and Transfers

At the meeting of Council held in Montreal, Que., on Friday, March 26th, 1954, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

*Members:*

K. Aanonsen, *Montreal*
D. F. Aitkens, *Whitehorse*
E. Alzner, *Montreal*
D. B. Annan, *Hamilton*
G. B. Asselstine, *Sarnia*
E. S. Babinszki, *Calgary*
A. Bernups, *Montreal*
J. Burgoin, *Whitehorse*
A. K. Campbell, *Marathon*
W. W. Carey, *New York*
A. E. Chalmers, *Peterborough*
J. R. Cooper, *Welland*
A. Dabrowski, *Montreal*
A. O. Dehm, *Montreal*
H. K. Frymann, *Quebec*
A. Gall, *Kemano*
H. J. Gough-Cooper, *Deep River*
B. W. Hamer, *Ottawa*
C. S. Hedrei, *Montreal*
A. M. Hollum, *Arvida*
V. D. Hunter, *Toronto*
S. G. Jackson, *Saint John*
J. L. Kellermann, *Toronto*
F. H. Lypaczewski, *Montreal*
P. B. Macfarlane, *Montreal*
D. E. McCulloch, *Montreal*
J. McDonald, *Ottawa*
S. Machachey, *Deloro*
J. E. Margison, *Toronto*
A. H. Pengilly, *Hamilton*
E. S. Robinson, *Quebec*
S. P. Sahgal, *Toronto*
J. D. Scott, *Whitehorse*
H. C. Schwinner, *Arvida*
J. M. Sharp, *Ottawa*
W. N. Simmons, *Brockville*
R. W. Stephenson, *Niagara Falls*
H. H. Stewart, *Kingston*
J. D. Trevithick, *Regina*
N. S. Troth, *Penticton*
J. T. Truman, *Lindsay*
B. Ulrich, *Quebec*
H. W. Umphrey, *Montreal*
H. A. van Iterson, *Toronto*
J. E. Vercoe, *Kingston*
W. V. Zinn, *London, Eng.*
G. A. Zulauf, *Quebec*

*Juniors:*

C. T. Aitken, *Montreal*
A. H. Austin, *Trail*
J. F. Best, *Kitchener*
J. W. Black, *Ottawa*
W. G. Brown, *Madsen, Ont.*
B. C. Cameron, *Brockville*
W. S. Cullens, *Montreal*
D. de Pretis, *Montreal*
A. F. Inderwiek, *Armstrong*
E. M. Johnson, *Trail*
K. E. Kummant, *Peterborough*
J. Looyestein, *Vauxhall*
S. A. Luciani, *Shawinigan F.*
W. J. Luciani, *Shawinigan F.*
E. N. MacKay, *Quebec*
M. I. Qureshi, *Lindsay*
J. H. C. Scrimgeour, *Peterborough*
R. H. Shepherd, *Sarnia*
D. H. Snow, *St. Lambert*
B. L. Theriault, *Hawkesbury*
K. D. H. Willcocks, *Windsor*
G. C. Willeumier, *Montreal*

*Transferred from the class of Junior to that of Member:*

G. C. Baker, *Kentville*
G. W. Bernard, *Calgary*
D. W. Blair, *Toronto*
R. S. D. Browning, *Beauharnois*
C. J. Carter, *Fort William*
J. A. Clow, *Calgary*
D. B. Collings, *Springfild*
H. C. Douglas, *London*
L. C. Galloway, *Hamilton*
A. L. Gourley, *Brantford*
J. L. Halter, *Red Rock*
A. M. Hurter, *Montreal*
R. M. Johnson, *Ottawa*
J. E. Keough, *Sarnia*

J. W. MacLaren, *Toronto*
V. E. McCune, *Edmonton*
L. L. Marshall, *Bathurst*
L. F. Miller, *Jasper*
W. J. M. Moore, *Ottawa*
S. B. Moro, *Montreal*
W. V. Nicholson, *Trail*
A. W. Norman, *Whitesboro, N.Y.*
E. J. Sanden, *Edmonton*
R. R. Scott, *Bathurst*
L. Tessier, *Isle Maligne*
G. D. Weston, *Fredericton*

*The following Students were admitted:*

University of Ottawa

G. Arvisais
P. E. Bobin
H. P. Beaudoin
S. Beneteau
K. J. Bergeron
G. E. Berlinguette
A. Boissonnault
A. Bordeleau
J. J. Bouchard
L. P. Boyer
J. J. Brun
R. Cadieux
A. R. Caron
L. Charlebois
J. M. Charron
W. Chiu
J. J. H. Corbeil
D. Corbett
C. Dodd
C. Down
A. Dufresne
M. E. Durham
P. H. Fournier
G. Gaudet
G. Gauthier
N. Houde
A. Kunicki
M. E. J. Lachance
C. R. Laflamme
J. P. Lafreniere
P. Lamarche
R. P. Lane
R. Y. Lapensee
A. Lapointe
C. C. LeBlanc
R. K. Lynch
F. Maisonneuve
C. R. Maillet
H. T. McKinley
R. J. McNally
J. R. J. Mercier
J. Michaud
R. Middlemiss
O. Monforton
M. G. Mulroney
R. G. J. Olivier
G. U. Ouellette
G. Paquette
J. G. Paquin
N. Pezoulas
G. R. Piche
G. Pigeon
J. C. Richard
V. Secours
T. B. Sheehan
F. Trahan
J. J. L. Tremblay
P. A. Tremblay
J. D. R. Vachon
J. G. J. Valiquet
V. J. Vinette
O. Vosniades
L. Weiner
A. Wong

University of Toronto

J. A. Anderson
D. E. Andrew
L. Banyai
R. J. K. Burge
W. B. S. Crowston
W. G. Duncan
D. L. Dunlop
R. A. Findlay
J. R. H. Fowler
J. R. Fusee
J. E. Gruspier
P. G. Harcourt
G. G. Hurlburt
S. F. Lyon
M. J. M. Maughan
R. J. McTavish
R. W. J. Moore
G. Ouellet
P. F. Phelps
G. W. Torrance
A. Tudor
V. Vonas
A. F. Walden
A. T. Webster

Queen's University

P. D. Billings
J. H. Deacon
J. B. Erskine
J. D. Fowler
D. G. Flurey
H. B. Fudge
J. D. Kingston
G. R. McCahill
R. G. Moore
S. D. T. Robertson
D. E. Ross
B. N. Runnalls
J. D. Scott
J. P. M. Simard
G. W. Stewart
D. A. Waller
W. G. Williams

Nova Scotia Technical College

W. C. Bishop
J. E. Campbell
L. F. Camus
M. L. Dubin
D. W. Fong
A. E. Houghton
J. L. O'Toole
F. S. Slocum
W. G. Strachan
P. A. Wright

University of Alberta

F. W. Bardy
M. J. Baron
R. D. Cameron
R. K. Deeprose
G. D. S. Kermack
K. I. Morrison
D. T. Nishimura
K. Puffer

## ELECTIONS AND TRANSFERS

*(Continued)*

H. A. R. de Paiva
G. E. K. Dudman
E. M. Foo
K. M. Foo
A. J. Forbes
H. H. Rix
J. A. Samaska
A. G. Warke
J. M. Wigham
W. W. Wolfe

### Laval University

A. Anctil
R. Desrosiers
J. C. Dupras
G. Faucher
M. Y. Lacroix
J. E. C. Lemyre
J. N. Marcotte
P. H. Morin
A. A. A. Notte
J. Robitaille

### University of New Brunswick

G. A. Caron
C. H. De Grace
F. B. Risteen
F. B. Spinney
F. A. Dunphy
H. C. Gunter
R. J. McAlinden
C. B. Swan
C. L. Van Stone

### McGill University

P. E. Coulter
J. Czolij
J. B. Dick
W. F. Hayes
T. W. Rogers
J. I. Shalinsky

### University of Manitoba

R. Duboff
J. R. M. Marchand
M. P. Schioler
G. E. Sims
P. C. White

### Royal Military College

W. J. Albrecht
D. H. Greenfield
A. M. J. Hyatt
K. Stevenson

### Dalhousie University

E. S. Wiles
M. E. M. Gibson
B.A.I. (Civil) Trinity College 1954
J. DeFeyter
Dech. Enrg., Delft University 1953

**Applications through Associations:**

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

### Alberta

*Members:*
R. N. Cole
R. J. Donaldson
D. R. Mason
W. P. Ogilvie
O. R. Opie
J. D. Watts

*Juniors:*
P. Miller
J. M. B. Scarborough

*Students:*
E. G. A. Henderson
J. Warwaruk

*Junior to Member:*
G. G. Campbell
O. Friesen
L. W. Grover
K. M. Lissel
A. C. Milroy
A. G. Morison

### Saskatchewan

*Members:*
C. J. Frankovitch
R. W. Mathie
J. H. A. Poirier
E. Reed
D. A. G. Smith

*Juniors:*
E. P. Garrison
D. Hoogeveen
G. W. Spratt

*Students:*
J. A. Ash
R. M. Burton
W. A. Burgess
W. A. Cook
J. S. Dudar
Y. A. Eng
J. E. Ewanchyna
B. A. Ferguson
A. D. Peters
D. G. Riecken
P. M. Wright

*Junior to Member:*
E. Davis
A. A. Grindlay
J. E. Haack
H. C. Henderson
N. H. James
R. Koncohrada
W. P. Lampman
D. L. Maguire
M. A. Nelson
G. A. Peterson
C. Roles
R. B. Tennent
F. J. Williams
A. A. Winer

*Student to Junior:*
D. A. Bailey
D. O. Coghlan
E. H. Stinson

### Manitoba

*Members:*
W. H. Cameron
V. A. B. Lovell

### New Brunswick

*Members:*
A. V. McQuarrie

*Junior to Member:*
G. J. Gaudet
C. K. Steeves

### Nova Scotia

*Members:*
W. M. Creelman
J. D. Dexter
E. C. Parsons

*Junior to Member:*
R. P. Blake
K. F. Marginson
R. S. Morrow
F. C. O'Neill
E. R. Richard
G. A. Smith
L. L. Spurr
C. M. Thurgood

### Quebec

*Members:*
M. Eagle
A. G. Lester
A. E. McGruer
P. E. Pesonen

*Juniors:*
J. S. Baldwin
J. H. Onodera

# News of Other Societies

The Montreal Road Laboratories of the **National Research Council** of Canada in Ottawa, are holding an Open House on May 26, 27, 28, 1954.

Invitations may be obtained upon request to R. E. Simmons, N.R.C., Ottawa.

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Professor John Bland of McGill University is chairman of the convention committee for the annual assembly of the **Royal Architectural Institute** of Canada in Montreal, May 11-14, 1954.

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The 37th annual conference and exhibition of the **Chemical Institute of Canada** (18 Rideau Street, Ottawa 2) will take place at the Royal York Hotel, Toronto, June 21-23, 1954.

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The annual meeting of the **Canadian Electrical Association** for 1954 is scheduled for June 24-26, at the Manoir Richelieu, Murray Bay, Que.

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The annual meeting of the **American Society for Testing Materials** (1916 Race Street, Philadelphia 3, Pa.) and exhibits of testing apparatus and technical photography, will take place at Chicago, Ill., June 13-18, in the Sherman and Morrison Hotels.

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The **American Institute of Chemical Engineers** (120 East 41st St., New York 17) announces a special meeting on nuclear energy, at the University of Michigan, Ann Arbor, June 20-25, 1954.

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The conference on Solid State Physics in Engineering Education, to be held at the Carnegie Institute of Technology, June 21-25, 1954, will be open to engineering and physics teachers. It is sponsored also by the American Society for Engineering Education, the National Science Foundation, and the University of Illinois. Information can be obtained from John W. Graham, Carnegie Institute of Technology, Pittsburgh, Penn.

The **American Institute of Electrical Engineers**, North Eastern District, will hold a meeting in Schenectady, N.Y., May 5-7, 1954. The Program has been issued by the A.I.E.E., 33 West 39th St., New York 18, N.Y.

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The University of California has made an advance announcement of the 1954 Heat Transfer and Fluid Mechanics Institute, June 30 to July 2. Information can be obtained from Harold A. Johnson, Division of Mechanical Engineering, University of California, Berkeley 4, Calif.

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The third convention of the **Panamerican Union of Engineering Associations** (UPADI), will be held in Sao Paulo, Brazil, August 3-7, 1954.

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The ACHEMA XI, chemical apparatus and equipment exhibition and convention will be held in Frankfurt am Main, Germany, May 14-22, 1955.

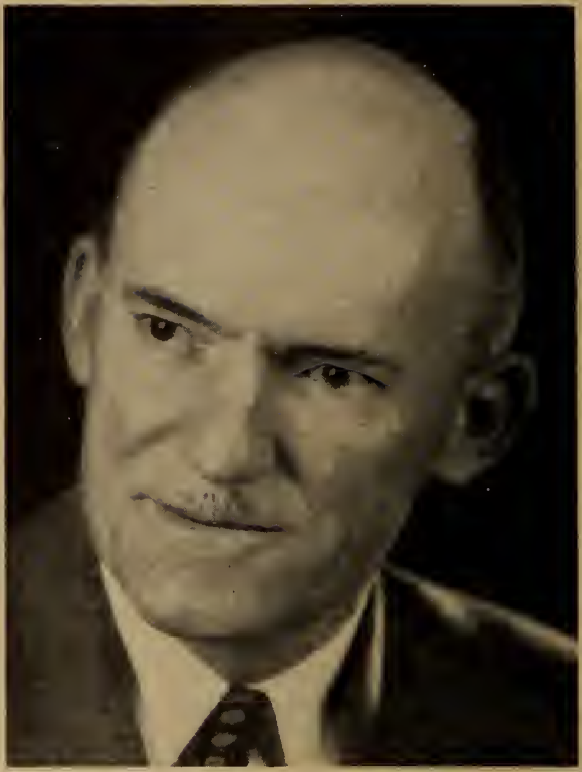
# Donald McGregor Stephens, M.E.I.C.

## President

of

## The Engineering Institute of Canada

## 1954



The president of the Engineering Institute of Canada this year is a real Westerner. He is Donald McGregor Stephens, born in 1903 near Reston, Manitoba, educated in the public and high schools of that province and of Saskatchewan and a civil engineering graduate of the University of Manitoba, where he was president of the engineering undergraduate society in his final year. Before entering the university, Mr. Stephens attended the provincial normal school for a year, taught school in various western towns and was occasionally employed as a construction worker and farm hand, so that he is not unfamiliar with manual labour. Following graduation, he did graduate work for a year in economics and hydraulics at Manitoba.

Like most engineering students he spent his summers in the field; he served on various surveys in northern Manitoba and in 1933 joined the permanent staff of the provincial Department of Mines and Natural Resources, serving as deputy minister of the department from August, 1938, to May, 1951. During these years he was concerned with fur rehabilitation measures, water conservation schemes, mining road projects, forest management and many other programs.

In addition to his regular duties as deputy minister, he served on two committees under reference to the International Joint Commission and having to do with boundary water matters, and on another international engineering board dealing with problems which had arisen with respect to the Souris River. Mr. Stephens also represented his province on the Prairie Provinces Water Board until 1951.

When the Government of Canada set up a Committee on Reconstruction in 1941, Mr. Stephens was selected to represent the western provinces on the subcommittee on construction projects under the chairmanship of K. M. Cameron, M.E.I.C., then chief engineer of the Department of Public Works of Canada. He also represented the prairie provinces on the Federal Government's Forest Insects Control Board until appointed to the Manitoba Hydro-Electric Board.

One of the major problems during the Red River flood of 1950 was to anticipate the probable water levels, and Mr. Stephens organized an emergency flood forecasting unit for this purpose, using personnel drawn from various engineering organizations in Manitoba. The activities of this unit attracted considerable favourable comment. He was then selected to represent Manitoba on the Greater Winnipeg Dyking Board, which put a million cubic yards of fill into its emergency dykes in the summer of 1951, beside building 26 pumping stations to handle Winnipeg drainage in time of flood.

In July, 1948, it was decided by the province to develop 114,000 hp. at Pine Falls, so Mr. Stephens was appointed chairman of an engineering board in charge of all phases of the work. This responsibility was transferred to the Manitoba Hydro-Electric Board when it was set up in May, 1951, with Mr. Stephens as chairman and general manager, the position he now holds. Other work initiated by the Board under his direction is the 80,000-hp. McArthur project and a 60,000-kw. steam station.

Since 1948 Mr. Stephens has also been chairman of the Manitoba section of the Winnipeg River Interprovincial Advisory Board which is responsible for the co-ordination of power development on that watershed by Manitoba and Ontario. In 1952 when the Hydro-Electric Board secured control of the Winnipeg Electric Co., Mr. Stephens became president and general manager of the reorganized company.

When one has read thus far, one will no doubt feel that Mr. Stephens has been and is a busy man. Nevertheless he has found time to take an active interest in Institute and other professional affairs. He was chairman of the Winnipeg Branch of the Institute in 1942, a councillor of the Institute from 1946-49 and vice-president of the Association of Professional Engineers of Manitoba in 1953. He is also a member of the Institute of Public Administration of Canada, of the Canadian Institute of International Affairs and of our sister organization, the Canadian Institute of Mining and Metallurgy.

Mr. Stephens is married to the former Irene I. White; they have four children, three sons and a daughter.

We are sure all members will join the *Journal* in wishing Mr. Stephens all success as president of the Institute; it is evident from his background that he will maintain the high order of administration which has marked the terms of his predecessors.

# Newly Elected Officers of the Institute

**At the Annual Meeting, the president, three vice-presidents and twenty-four councillors will take office. They will serve with others whose terms of office continue. The complete list of the Council will appear in the next issue of the *Journal*.**

**B. G. Ballard,** M.E.I.C., vice-president of the Institute representing the Province of Ontario, is director of the Radio and Electrical Engineering Division of the National Research Council.

Mr. Ballard graduated in electrical engineering from Queen's University in 1924. He attended a graduate engineering course of Westinghouse Electric and Manufacturing Company in East Pittsburgh and in 1925 he entered the engineering department of that company, where he remained for the next five years. In 1930

**B. G. Ballard,** M.E.I.C.

he joined the National Research Council of Canada and assumed charge of the electrical engineering laboratory. In 1948 he was made director of the Radio and Electrical Engineering Division.

During the war Mr. Ballard's activities were devoted mainly to defence work and in particular to the development of mine sweepers for enemy magnetic mines and the protection of ships against these mines. In recognition of his contributions in this field, he was awarded the Order of the British Empire in 1946.

Mr. Ballard is a past councillor and a past chairman of the Ottawa Branch of the Institute; a past chairman of the Ottawa Section of the American Institute of Electrical Engineers; a senior member of the Institute of Radio Engineers; and a member of the Association of Professional Engineers of the Province of Ontario and of the Professional Institute of the Civil Service of Canada. He joined the Engineering Institute in 1931 as an Associate Member, transferring to Member in 1940. He received the Ross Medal of the Institute in 1948 for his paper "Recent Canadian Radar".

**J. O. Martineau,** M.E.I.C., assistant chief engineer of the Department of Roads of the Province of Quebec, has been elected vice-president of the Institute to represent the Province of Quebec.

Mr. Martineau was born at Quebec City, and studied surveying at Laval University and civil engineering at Queen's University, graduating as a bachelor of applied science in 1915. After serving in Canada with the Fifth Company of the Canadian Engineers, he entered the service of the Department of Roads in 1916. In his present position he is also in charge of technical information, research and statistical information.

From 1936 to 1942 Mr. Martineau was a member of the Soil Investigation Committee of the U.S. National Research Council. He is presently a member of the

**J. O. Martineau,** M.E.I.C.

Associate Committee on Soil and Snow Mechanics of the National Research Council of Canada, and a member of the N.R.C. sub-committee on "muskeg".

Mr. Martineau is a member of Queen's Alumni Association and was chairman of the Quebec Branch in 1944. He is member of the Institute of Traffic Engineers; the Portland Cement Association; the Association of Asphalt Paving Technologists; and the Canadian Good Roads Association. He was a councillor of the Corporation of Professional Engineers of Quebec from 1940 to 1944; a provincial representative on the Dominion Council of Professional Engineers in 1942-43.

After serving actively in the Quebec Branch of the Engineering Institute of Canada, he was elected its chairman in 1945, and in 1950 was elected councillor of the Institute representing the Quebec Branch. He joined the Institute as a Member in 1935.

**N. B. Eagles,** M.E.I.C., has been elected vice-president of the Institute to represent the Maritime Provinces.

Mr. Eagles graduated from the University of New Brunswick in 1935, with the degree of B.Sc. in electrical engineering. He served in the R.C.A.F. during the same year as a provisional pilot officer. In 1936 he became associated with the City of Moncton as assistant department head in the electrical department.

He obtained a leave-of-absence in 1941 to accept a position as instructor in the

**N. B. Eagles,** M.E.I.C.

British Commonwealth Air Training Plan. After instructing for two years, he was appointed assistant chief ground instructor at the Elementary Flying Training School at Neepawa, Manitoba.

In 1944 Mr. Eagles returned to his former position with the City of Moncton, and in 1947 was transferred to the city engineer's office as assistant to the city engineer. He was appointed street commissioner and assistant engineer in 1948. In 1949 he became a registered professional civil and electrical engineer in the Province of New Brunswick, and during that year he was promoted to the position of assistant city engineer of the City of Moncton.

Mr. Eagles has been active in engineering affairs. In 1951 he was elected to the council of the Association of Professional Engineers of the Province of New Brunswick for a three-year term of office. During the past five years he has served on the executive of the Moncton Branch of the Institute. He was chairman of the Moncton Branch during 1950-51, and a councillor in 1952-53. He had joined the Institute in 1935 as a student, transferring to Junior in 1940 and to Member in 1942. He has served as vice-president for New Brunswick, of the Maritime Branch of the American Waterworks Association.

**H. A. Marshall,** M.E.I.C., industrial sales representative for Imperial Oil at Sydney, N.S., has been elected to represent the Cape Breton Branch on the Council of the Institute.

Mr. Marshall was born at Dartmouth, N.S. He received a B.Sc. degree from Dalhousie University in 1941, and went to Nova Scotia Technical College where he received a B.Eng. degree in 1943 in mechanical engineering. From 1943 to 1945 he was an engineer officer with the

Royal Canadian Navy. He was attached to the Directorate of Fuel, and served as port fuel officer at St. John's, Nfld., after following a lubrication course at the N.S. Naval Engineering Experimental Station

H. A. Marshall, M.E.I.C.

at Annapolis, Md. In 1945 he joined the Imperial Oil Limited, Maritime division, as an industrial sales and service engineer. He has worked in Halifax, Saint John and Sydney, advising industry on matters of lubrication.

Mr. Marshall was chairman of the Cape Breton Branch in 1952. He has taken an active interest since 1938 when he joined as a Student at Dalhousie. He transferred to Junior in 1943 and to Member in 1946.

Mr. Marshall is on the executive of the Mining Society of Nova Scotia. He is also a member of the Rotary Club of Glace Bay.

**John L. Cavanagh,** M.E.I.C., of New Glasgow, Nova Scotia, will represent the North Nova Scotia Branch on the Council of the Institute.

Mr. Cavanagh is president and general manager of the Malagash Salt Company Limited and a director of the Bank of Canada.

Born at New Glasgow, Mr. Cavanagh was educated in New Glasgow public

J. L. Cavanagh, M.E.I.C.

schools, at Dalhousie University and Nova Scotia Technical College. He graduated in mining engineering in 1911.

For three years he was employed as a mining engineer for the Wabana iron mines of the Nova Scotia Steel and Coal Company Limited. Following this he served as a captain in the Canadian Engineers from August 1914. He joined the Malagash Salt Company as a mine manager on completing his military service in 1918, and since 1947 has been president and general manager of the Company.

Mr. Cavanagh is a member of the New Glasgow Rotary Club; a member and past president of the Association of Professional Engineers of Nova Scotia, and a member of the Canadian Institute of Mining and Metallurgy. His support has also been given to the Engineering Institute, which he joined as a member in 1940.

**W. D. G. Stratton,** M.E.I.C., has been elected a councillor of the Institute to represent the Moncton Branch.

He is a past chairman of the Moncton Branch and a member of the council of the Association of Professional Engineers for the Province of New Brunswick.

Mr. Stratton is district airway engineer for the Maritime District, Department of Transport, Air Services Branch, at Moncton, N.B.

Born in Saint John, N.B., he received his early education there. He graduated in civil engineering from the University of New Brunswick in 1929 and then worked for several years with the Bell Telephone Company at Ottawa and Montreal. From 1934 to 1935, he was inspector of drilling and dredging with the Dominion Department of Public Works at Saint John, and from 1936 he acted as resident engineer for the New Brunswick Highway Division.

In 1940 he joined the civil aviation branch of the Department of Transport at Saint John, N.B., as resident engineer, and in 1949 was appointed district airway engineer at Moncton, N.B.

Mr. Stratton joined the Institute as a Student in 1929, transferring to Junior in 1936, to Member in 1940.

**E. C. Bannerman,** M.E.I.C., will represent the Northern New Brunswick Branch on the Council of the Institute.

Mr. Bannerman is plant engineer for the Bathurst Power and Paper Company, Bathurst, N.B.

W. D. G. Stratton, M.E.I.C.

Born and educated at Sydney, N.S., he went on to Mount Allison University and Nova Scotia Technical College. He received a B.Sc. degree in mechanical engineering in 1930.

He spent three years in engineering sales for Wm. Stairs Son & Morrow, Halifax. He

G. Demers, M.E.I.C.

went to the Dominion Steel and Coal Company then, working from 1933-41 in the maintenance, construction and engineering department.

He was overseas from 1941-1945 with the R.C.E.M.E., serving in England, the Mediterranean and in North West Europe. He returned to the Iron and Steel Division of "Dosco". He joined the Bathurst Power and Paper Company in 1946.

Mr. Bannerman has been on the executive of the Northern New Brunswick Branch since its inauguration in 1953. He joined the Institute as a Member in 1947.

**G. Demers,** M.E.I.C., consulting engineer, will serve on the Council of the Institute representing the Quebec Branch.

Mr. Demers is from Montreal, a graduate in civil engineering from the Ecole Polytechnique, class of 1935. He worked for a time with the Roads Department of the Province of Quebec, first as resident engineer and then as division

E. C. Bannerman, M.E.I.C.

engineer at Carlton, Quebec. In 1939 he took charge of the office of Zachée Langlais, consulting engineer, in Quebec. He opened his own consulting engineering office in Quebec in 1942 and has since been practicing as such.

Mr. Demers is a vice-president of the Corporation of Professional Engineers of Quebec. His support of the Quebec Branch of the Institute has been extensive. He served on the executive in 1950 and 1951, and was elected Branch chairman in 1952. He joined the Institute in 1936 as a Junior, transferring to Member in 1946.

**G. N. Martin,** M.E.I.C., combustion sales engineer of Dominion Bridge Company Limited, Lachine, Que., will serve on the Council of the Institute representing the Montreal Branch. He is a former chairman of the Branch.

Mr. Martin was born at Lachine, Que., receiving his primary education at the Mont St. Louis College and graduating from the Ecole Polytechnique in 1934. The greater part of his engineering career has been spent with the Dominion Bridge Company Limited which he joined in 1935.

From 1938 to 1940, however, he was in England, first with the International Combustion Limited, and then with Central Electricity Board, for the purpose of gaining experience in the boiler field. He was also released from Dominion Bridge for two years during the war for special work with the Aluminum Company of Canada Limited.

Mr. Martin is a member of the Corporation of Professional Engineers of Quebec, the Canadian Boiler Society, the American Boiler Manufacturers' Association, the American Society of Heating and Ventilating Engineers and The American Society of Mechanical Engineers. He joined the Engineering Institute as a Junior in 1937, transferring to Member in 1944. He won the Institute's Phelps Johnson Prize in 1942, and served as vice-chairman of the Montreal Branch in 1952, and as Branch chairman in 1953.

**R. B. Wotherspoon,** M.E.I.C., has been elected to the Council of the Institute representing the Montreal Branch.

Born at Port Hope, Ontario, Mr. Wotherspoon attended Trinity College School, and in 1935 graduated from the Royal Military College at Kingston. He then spent two years in England training in the Royal Engineers, British Army, at the School of Military Engineering and Cambridge University. On his return, he was for three years an assistant superintendent for The Steel Company of Canada's drop forge works at Gananoque, Ontario.

This was followed by six years of war service with the Royal Engineers, during three years of which he was on loan to the Ministry of Supply for work in the armaments inspection and tank design departments.

**R. B. Wotherspoon, M.E.I.C.**

Mr. Wotherspoon became a project engineer with Dominion Textile Company in Montreal in 1946. In January 1953 he joined the Aerocrete Construction Company. On March 1, 1954 he started in a new position as engineer on the new Tyrelene fibre project of the Imperial Chemical Industries of Canada, at Montreal.

Mr. Wotherspoon's service to the Montreal Branch has been great. He was secretary-treasurer from 1949-1952. He joined the Institute as a Junior in 1939, transferring to Member in 1947.

**G. N. Martin, M.E.I.C.**

**D. Ross-Ross,** M.E.I.C., has been re-elected to the Council of the Institute to represent the Cornwall Branch.

Mr. Ross-Ross is from Montreal, where he studied at Wyckem House, Macdonald College Day School, and McGill University, graduating in mechanical engineering in 1917.

He joined the Royal Canadian Navy that year, and after a year at sea was placed in charge of all engine room instructional work at H.M.C. Dockyard, Halifax, in June, 1918. He taught in Central Technical School, Toronto, for a time in 1919 before joining Dominion Rubber Company in 1920. He worked as an industrial engineer and as assistant mechanical superintendent of the Company until 1925, when he went to the Howard Smith Paper Mills Ltd., as a specialist on steam problems. He became chief industrial engineer in 1930 for the Howard Smith Paper Mills Ltd., and associated companies, taking charge of cost accounting of the Company in 1931, and of the purchasing department in 1932. During the war, on loan from his work, he performed numerous duties at Cornwall. He was personnel supervisor for the Cornwall Division in 1941-1946 and for several years was chairman of the Personnel Committee of the Fine Paper Industry. In 1946 he resumed his prewar position of chief industrial engineer, in charge of industrial engineering of all mills and job evaluation.

He has done consulting work in the past for Empire Cotton Mills Ltd., for Allied War Supplies Corporation, Canadian Car Munitions Ltd., and some other companies.

Mr. Ross-Ross has published approximately 15 papers on such subjects as industrial engineering, steam generation and consumption in the pulp and paper industry, maintenance cost control, and personnel work.

Mr. Ross-Ross was elected chairman of the Cornwall Branch at its inauguration in 1946. He joined the Institute as a Student in 1916, transferring to Junior in 1918, to Associate Member in 1921, to Member in 1933. He has been on the Council since 1950, representing the Cornwall Branch. He is also a member of the Association of Professional Engineers of Ontario.

His active support is given, also, to public educational projects. He has been a trustee of the Cornwall Public Library for 10 years. He was chairman of the Township of Cornwall Public School Area Board in 1952, and vice-chairman in 1953. He also served for four years as a trustee of the Cornwall Public Schools Board.

**Dr. J. J. Green,** M.E.I.C., chief of Division "B" of the Defence Research Board, and scientific adviser to the Chief of the Air Staff of the Royal Canadian Air Force, will serve on the Council of the Institute as representative of the Ottawa Branch. He is a past-chairman of the Branch.

Dr. Green was born in Portsmouth, England. He received his early education

**D. Ross-Ross, M.E.I.C.**

at the Portsmouth Municipal College, from which he graduated with a B.Sc. degree as an external student of London University.

In 1926 he proceeded to London University — Imperial College of Science and Technology — Royal College of Science, graduating in 1928 with first class honours in physics, B.Sc. (London) and A.R.C.S. degrees. He received the Imperial College Governors' Prize in physics awarded annually to the first student on the graduating list.

Post-graduate study and research in aeronautical engineering at the Imperial College followed, during which time Dr. Green held a Busk studentship in aeronautics and later a Beit fellowship in scientific research. He received the D.I.C. degree from this College in 1929 and a Ph.D. (engineering-aeronautics) degree from London University in 1930.

From 1930 to 1943 Dr. Green was on the staff of the Division of Mechanical Engineering of the National Research Council, latterly as head of the aerodynamics section.

In 1943 he was commissioned as squadron leader in the R.C.A.F. and appointed chief research engineer at the R.C.A.F. Test and Development Establishment in Rockcliffe. That same year he received the M.B.E. for valuable public service in the field of scientific research, and two years later the King's Commendation for valuable service in the air.

Dr. Green was appointed chief research aeronautical engineer of the newly-formed Air Transport Board in 1945, and was responsible for technical studies and advice to the Board until 1949 when he was appointed to his present position.

He was elected to Fellowship in the Royal Aeronautical Society in 1948, and two years later, he was named a Fellow of the Institute of the Aeronautical Sciences.

Dr. Green learned to fly in 1934 and took advanced flying training with the R.C.A.F. During his war service as chief research engineer at the Test and Development Establishment, he continued to fly on test pilot duties. He has taken an active part in civil flying, serving a term as president of the Ottawa Flying Club, and treasurer of the Royal Canadian Flying Clubs Association.

Dr. J. J. Green, M.E.I.C.

His professional career has been concerned with testing, research and development in aeronautics, and since his appointment to the Defence Scientific Service, his responsibilities and interests have been extended to include the field of armaments, as well as other technical subjects of growing interest and importance to defence.

Dr. Green has contributed a number of papers to the *Engineering Journal.* Others have appeared in the *Philosophical Magazine*, the Reports and Memoranda of the Aeronautical Research Council (England), *The Canadian Journal of Research*, the *Royal Aeronautical Society Journal*, and the *Journal of the Aeronautical Sciences*.

Dr. Green's membership in the Institute dates from 1945. Meanwhile he has been associated closely with the work of the Institute serving on the Ottawa Branch executive, and as its chairman.

**A. R. Hailey,** M.E.I.C., will continue to represent the Peterborough Branch on the Council of the Institute.

As supervisor, motor control engineering, of Canadian General Electric, at Peterborough, Mr. Hailey supervises design and drafting of large induction motors, high speed synchronous motors and generators, exciters, welding generators and welding electrodes. He received this appointment following company reorganization in January 1954. He had previously been manager of engineering for the Induction Motor Department, an appointment received in March 1953.

Born at Vancouver, B.C., Mr. Hailey attended the University of British Columbia, where he received a B.A.Sc. degree in electrical engineering in 1941. Upon graduation he accepted employment with Canadian General Electric in Peterborough in the test course. In 1942 he was appointed a design engineer in what is now the motor and generator engineering division, Peterborough Works, and has since then been closely associated with the design of d-c. rotating machinery and synchronous motors and generators.

Mr. Hailey joined the Institute as a Junior in 1942, becoming a Member in 1949. His service to the Institute has been extensive, as will be indicated by a list of the offices he has held: chairman of the Junior Section of the Peterborough Branch, 1943, secretary-treasurer of the Branch, 1946, chairman of the meetings and papers committee, 1948, chairman of the Branch, 1949, councillor, 1952-1953. He has also served as secretary-treasurer of the Canadian General Electric Test Alumni Association, and is a Member of the Association of Professional Engineers of Ontario.

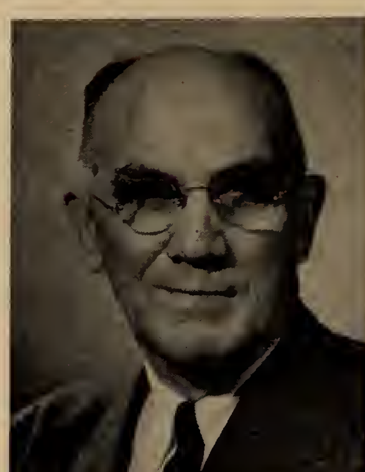
A. R. Hailey, M.E.I.C.

**John G. Hall,** M.E.I.C., district manager and director of the Combustion Engineering Corp. Ltd., in Toronto, has been elected a councillor of the Institute.

Mr. Hall is from Cornwall, Ont., where he received his elementary and high-school education. He studied mechanical engineering at McGill University, Montreal, receiving the degree of B.Sc. in 1921.

After following a student apprenticeship course at the Grand Trunk Railway, Mr. Hall worked for the Back River Power Company, Montreal. Joining Combustion Engineering Corp. Ltd., in 1924, he worked in the Winnipeg Office from 1924-1927; in the Montreal Office from 1927-1940.

He has been in Toronto since 1940. There Mr. Hall has taken an active interest in the work of the Institute. He served on the Toronto Branch executive in 1949-50; as vice-chairman in 1952 and as chairman in 1953. He joined the Institute in 1919 as a Student, transferring to Associate Member in 1924, to Member in 1931.



John G. Hall, M.E.I.C.

**Paul E. Buss,** M.E.I.C., who has been representing the Niagara Peninsula Branch on the Council since 1946, has been re-elected for a fifth term.

Mr. Buss, president of Spun Rock Wools Ltd., Thorold, Ont., is originally from Three Rivers, Michigan. He received his engineering education at the University of Michigan.

During World War I, he served with the United States Army Engineers in France. Mr. Buss was employed on the engineering staff of Provincial Paper Limited on construction of the first sulphate plant at the head of the lakes at Port Arthur, Ont. He later worked on the engineering staff of Dominion Engineering Works, and for a number of years was plant engineer at the Thorold division of Provincial Paper Limited. During 1932-33 he and his brothers carried on experiments in developing the new process for producing rock wool by the spinning method. He is now president of Spun Rock Wools Limited at Thorold.

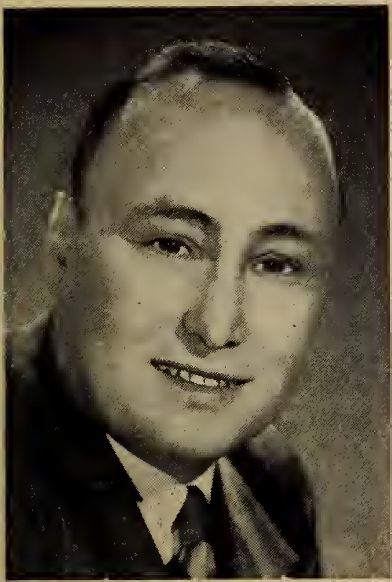
Mr. Buss joined the Institute as an Associate Member in 1927 becoming a Member in 1940. His helpful association with the work of the Institute dates back to 1931 when he was elected secretary-treasurer of the Niagara Peninsula Branch. He was chairman of the Branch in 1935.

P. E. Buss, M.E.I.C.

**M. A. Montgomery,** M.E.I.C., has been re-elected as councillor representing the Kitchener Branch of the Institute. Mr. Montgomery is sales manager of Canadian Blower and Forge Company, Kitchener.

Born in Prince Albert, Sask., he studied mechanical engineering at the University of Saskatchewan, graduating with a B.Sc. degree in 1934. He was a sales engineer for Sarco Canada Ltd., Toronto, from 1935 to 1937.

He joined the Canadian Blower and Forge Company Limited sales staff in 1937 in the Montreal District. From 1942 to 1945 he served as an engineer officer in the Royal Canadian Navy, Construction Directorate. Returning to Canadian Blower and Forge Company Limited, he moved to Kitchener where he held the position of assistant sales manager for engineering



M. A. Montgomery, M.E.I.C.

products. He was appointed sales manager in August, 1951, and in January, 1952, he was appointed to the board of directors of the Company.

Actively associated with the Engineering Institute, he was elected the first chairman of the Kitchener Branch, on its inauguration in 1950. He represented the Branch on the Council in 1952-53. He joined the Institute in 1938 as a Junior, transferring to Member in 1949. He is also a member of the Kitchener Chamber of Commerce, the Association of Professional Engineers of Ontario, and the Gyro Club.

**Norman A. Eager,** M.E.I.C., vice-president and general manager of the Burlington Steel Company Limited at Hamilton, Ontario, will represent the Hamilton Branch on the Council of the Institute. He is a past chairman of the Branch.

Mr. Eager is a director of his Company. In 1952 he was appointed to the Hamilton Advisory Board of the Huron and Erie Mortgage Corporation and the Canada Trust Company. He is also a director of the Pilot Insurance Company.

Born at Montreal, Que., he received his engineering education at McGill University where he obtained the degree of B.Sc. in 1922, and at Cornell University where he received his M.C.E. degree the following year. On graduating, he worked for the Church Ross Construction Company in Montreal, after which he was a design and sales engineer for the Canadian Vickers Company. In 1926 he joined the Shawinigan Water & Power Company with whom he worked for fifteen years, being appointed to the position of power sales research engineer. In 1940 he went with the Burlington Steel Company, Hamilton, Ont., as assistant sales manager. He was appointed sales manager in 1944.

Mr. Eager joined the Institute as a Junior in 1925, transferring to Associate Member in 1934 and becoming a Member in 1940. In addition to his considerable service to the Institute, he has been active in the Canadian Construction Association, and the Canadian Institute of Steel Construction.

**Frederic Alport,** M.E.I.C., will be a member of the Institute's Council, representing the Huronia Branch.

It was largely with Mr. Alport's help that this Branch was formed during 1953 and inaugurated in September 1953, and he was the first chairman. He has been a Member of the Institute since 1940.

Born in Orillia, he received his early

Frederic Alport, M.E.I.C.

education there. He studied civil engineering at the School of Applied Science of the University of Toronto.

He worked for the National Transcontinental Railway on location for six years before returning to the University, where he obtained a B.A.Sc. with honours in 1913, specializing in sanitary and municipal engineering.

He did land survey work in British Columbia, and qualified in 1914 as a Dominion Land Surveyor, and a Manitoba Land Surveyor.

During the first World War Mr. Alport served in France with the Canadian Engineers, as staff captain of the 4th Canadian Engineers Brigade. He was

N. A. Eager, M.E.I.C.

awarded the Military Cross, and was twice mentioned in despatches.

On returning from military service Mr. Alport worked on construction for Stone and Webster, and with Holbrook, Cabot and Rollins, New York; with George A. Fuller, of New York, and with Patrick McGovern, Inc., of New York. Joining the firm of Curran and Briggs, Toronto contractors, in 1934, he was construction superintendent in charge of road work and bridges. He went to the Department of Public Works in 1934, working in Toronto as an assistant engineer, and going to Halifax as a senior assistant engineer in 1938. In 1936 he received the degree of Civil Engineer from the University of Toronto.

The Department of National Defence employed Mr. Alport as a consulting engineer to the director of Naval Service. He was on loan from the Public Works Department, which later stationed him in Ottawa. There he acted as representative of the Department on the Lake of the Woods Control Board, and has handled administrative work of the Northwest Territories, including the Yellowknife projects. He was a member of the special committee of three appointed by the Minister of Transport to study and report on the St. Lawrence deep water channel from Montreal to the sea. In 1946 Mr. Alport was awarded the Order of the British Empire for distinguished service.

Mr. Alport went into private practice in Orillia, in 1947, specializing in harbour works, tunnels, foundations, water supply and sewage disposal.

**Edwin W. Dill,** M.E.I.C., of Polymer Corporation Limited, has been re-elected as councillor of the Institute, representing the Sarnia Branch.

Mr. Dill graduated in mechanical engineering with the degree of B.A.Sc. from the University of Toronto, class of 1928. In the early years of the war, he was engaged on general plant engineering with the Welland Chemical Works, an important explosives manufacturing plant in the Niagara Falls area. He left there in 1924 to work on the design of the steam and power plant for Canada's new synthetic rubber industry, in the office of the designers, H. G. Acres and Co. On completion of construction he assumed the position of steam and power plant superintendent. Two years ago, Mr. Dill left the more strictly engineering phases of industry to go into industrial relations work and is now assistant manager of the

E. W. Dill, M.E.I.C.

Industrial Relations Division, of Polymer Corporation Limited.

Mr. Dill's efforts on behalf of the Engineering Institute have been effective. He was one of a committee of three appointed to inquire into the feasibility of forming a branch in Sarnia; and he is a charter member of the Sarnia Branch, serving on the executive for several years and as vice-chairman. He has served on the Council since 1952. He joined the Institute as a Student in 1929, transferring to Associate Member in 1938, and to Member in 1940. Active in local civic affairs, Mr. Dill has served on the Sarnia Hospital Board of Commission as a member and as chairman. Mr. Dill contributed greatly to the efforts in getting construction started on a modern new hospital which is to receive its official opening in March of this year.

**C. W. Boast**, M.E.I.C., of Kapuskasing, Ont. has been elected to the Council of the Institute to represent the North Eastern Ontario Branch.

Mr. Boast was born at Richmond, Que., and graduated from McGill University in civil engineering in 1917.

Following graduation, he accumulated experience on varied civil and mechanical engineering projects in both Canada and the United States, principally in design and construction of industrial buildings, concrete storage and power dams and materials handling equipment. He became associated with the pulp and paper industry in 1921 when he joined the Kimberley-Clark Corporation of Neenah, Wisconsin. He is now chief engineer of Spruce Falls Power and Paper Company Limited, an associate company of Kimberley-Clark, at Kapuskasing.

Mr. Boast has been associated with the Institute since graduation, transferring to Associate Member in 1922, and to Member in 1940. He is also a member of The Association of Professional Engineers of Ontario.

C. W. Boast, M.E.I.C.

**D. C. Holgate**, M.E.I.C., manager of the Sault Structural Steel Company Limited, has been re-elected a councillor of the Institute representing the Sault Ste. Marie Branch.

Born in Montreal, he attended Acadia University, receiving a B.A. degree in mathematics in 1935. He attended McGill University in Montreal, graduating in 1938 with the degree of B.Eng. in civil engineering.

He joined the staff of Dominion Bridge Company Limited in Toronto in 1939, and was transferred to the Sault Structural Steel Company Limited, a subsidiary, in 1941. The company recently announced his appointment as manager.

Mr. Holgate was secretary-treasurer of the Sault Ste. Marie Branch in 1947, and chairman in 1949. He joined the Institute in 1942 as a Junior, transferring to Member in 1947. He is also a member of the Association of Professional Engineers of Ontario.

**C. P. Haltalin**, M.E.I.C., of the Winnipeg Electric Company has been elected a

D. C. Holgate, M.E.I.C.

Councillor of the Institute representing the Winnipeg Branch.

Mr. Haltalin was born in Winnipeg, and ireceved his general education at Daniel McIntyre Collegiate. He attended the University of Manitoba, graduating in 1929 with the degree of B.Sc. in electrical engineering.

His association with the electric utilities

C. P. Haltalin, M.E.I.C.

commenced soon after graduation, when he worked on substation design under E. V. Caton, M.E.I.C., then chief engineer of electric utility, at the Winnipeg Electric Company. His advancement can be traced in a list of the positions he has held: junior engineer, assistant electrical engineer, supervisory engineer, and chief electrical engineer. In 1953 he was appointed manager of the operating division of Winnipeg Electric Company.

Associated with the work of the Engineering Institute for many years, Mr. Haltalin was chairman of the Winnipeg Branch in 1945. He joined as a Student in 1927, transferring to Associate Member in 1934 and to Member in 1940. He is a member of the Winnipeg Kiwanis Club.

**Junius Jonsson**, M.E.I.C., has been elected a councillor of the Institute to represent the Saskatchewan Branch.

Mr. Jonsson was born and educated in Iceland. He came to Canada in 1900, and from 1901 until 1908 he was assistant to the late H. B. Proudfoot, D.L.S. During this time he worked in Manitoba, Saskatchewan and Alberta on timber birth sur-

Junius Jonsson, M.E.I.C.

veys, townsite surveying, bridge and subway location surveys and waterpower surveys.

He joined the engineering staff of the city of Saskatoon in 1908, under Chipman and Power, consulting engineers, who at that time were installing the public utilities for the city. He later became assistant city engineer and held that position until 1921. From 1921 to 1953 he was city engineer and superintendent of utilities for the City of Prince Albert. He retired in 1953.

Mr. Jonsson joined the Engineering Institute of Canada, as an Associate Member, in 1920 and became a Member in 1938. He has served on the executive of the Association of Professional Engineers of Saskatchewan and is a member of the Western Canada Water and Sewage Conference.

**H. R. Hayes**, M.E.I.C., has been elected to represent the Calgary Branch on the Council of the Institute.

Mr. Hayes is the general supervisor of standards at the Head Office of Burns & Co. Limited in Calgary. He was first employed by this meat packing firm in 1937 as supervisor at the Edmonton Plant. In 1940 he was promoted to his present position which deals with the administration of the cost control plan in the company's seven plants. This includes plant layout, operating methods, procedures, and schedules primarily from the economic standpoint. He sits on the company's committee for union negotiations, as well as acting in an advisory capacity for subsidiary companies. He was closely associated with the team who developed the company's pension insurance and welfare plans.

Originally from Gleichen, Alta., Mr. Hayes graduated in 1934 from the University of Alberta with an honours degree of B.Sc. in civil engineering and was awarded the prize of the Association of Professional Engineers of Alberta. Following graduation, he returned to the maintenance of way department of the Canadian Pacific Railway where he had been employed previously as an undergraduate. His early engineering work with the Railway was with the water service branch. He was subsequently employed as transitman at Calgary, Lethbridge, Edmonton and Medicine Hat.

He served as chairman of the Calgary Branch of the Institute in 1951-52, and on the executive in two previous years, as well as being chairman of the program committee.

**J. M. Campbell**, M.E.I.C., has been elected to represent the Lethbridge


H. R. Hayes, M.E.I.C.


J. M. Campbell, M.E.I.C.

Branch on the Council of the Institute.

Mr. Campbell was born and educated in Dumfermline, Scotland. He trained as an engineer in Scotland with the Fife County Council, as a pupil to the road surveyor and master of works, and he came to Canada in 1907.

He worked for the Canadian Pacific Railway at Souris, Man., from 1907, and became a division engineer at Kenora, Ont. in 1912. During World War I, from 1916-1919, he served as lieutenant with the 12th Battalion Canadian Railway Troops in France.

Returning to the C.P.R. after the war he continued his remarkable career in railway engineering in Western Canada. He served the company as division engineer in Winnipeg, Moose Jaw and at Lethbridge. Mr. Campbell retired from the position of division engineer at Lethbridge in 1952.

Mr. Campbell's association with the Institute dates from 1920, when he became an Associate Member. He transferred to Member in 1940.

**N. J. Allison,** M.E.I.C., of the International Pipe Line Company in Edmonton and chairman of the Edmonton Branch of the Institute has been elected to the Council of the Institute representing the Edmonton Branch.

Mr. Allison was born in Paisley, Scotland. He received his formal education at Paisley Grammar School, Strathallan School, the Paisley Technical College in Scotland and the Liverpool Technical College in England. He is the holder of the British Board of Trade Extra First Class Certificate, and the British Board of Trade First Class Motor Certificate.

He served his apprenticeship as engineer in the shops and drawing office of Thos. Reid & Sons in Paisley, and the Fairfield Shipbuilding & Engineering Co. Ltd. in Glasgow, Scotland.

In 1927 he was employed by Blue Star Line (1920) Ltd. of London as seagoing engineer in charge of watch on steam reciprocating, turbine and diesel-engined ships, as well as on refrigeration machinery. Six years later he returned to Thos. Reid & Sons in Paisley as draughtsman on design of marine auxiliaries. In 1934 he joined the Anglo-Iranian Oil Co. Ltd. as assistant engineer on the oil processing plant construction and general oil field maintenance in Iran. The following year he entered Kuwait Oil Co. Ltd. as mechanical engineer in Kuwait on general construction, maintenance and development of a new field.

In 1940 he joined the Royal Indian Naval Reserve in New Delhi as equipment officer at Naval Headquarters. He was responsible for speeding shipbuilding for the Royal Indian Navy, modifying internal arrangements of ships and planning shore bases. During 1942-1944 he was in charge of planning construction and of operating the landing craft base at Bombay and of training personnel required for that base.

In 1944 he returned to Anglo-Iranian Oil Co. Ltd. and served as field engineer at Gach Saran, and superintendent engineer at Kuwait, Masjid-i-Sulaiman, Lali, Haft Kel, White Oil Springs and Ahwaz fields. By 1947 he became fields mechanical engineer responsible for mechanical engineering, construction and maintenance, including welding and mobile plants in all oil fields in Iran.

He entered the producing department of Imperial Oil Limited in 1948 as construction and maintenance engineer. He has been in his present position since February, 1949.

In addition Mr. Allison has recently joined the Royal Canadian Naval Reserve with the rank of commander (E) and has been appointed engineer officer of H.M.C.S. *Nonsuch*.

Mr. Allison is a member of the Institute of Marine Engineers, and of the Institution of Engineers and Shipbuilders in Scotland, and of the Association of Professional Engineers of Alberta.

As a member of the executive of the Edmonton Branch, and as chairman in 1953, Mr. Allison's interest in the work of the Institute has been effective. He joined as a Member in 1948.

**S. H. de Jong,** M.E.I.C., has been elected as councillor of the Institute representing the Vancouver Branch.

Mr. de Jong is associate professor in the Department of Civil Engineering at the University of British Columbia. He is in charge of surveying instruction.

He was born at East Kildonan, Man. and graduated from the University of Manitoba in 1931 with a B.Sc. degree in civil engineering. He received his M.Sc. degree from this university in 1940.

Mr. de Jong was associated from 1927-1931 with the Engineering Department of the Manitoba Good Roads Board and from 1931 to 1935 he was employed as a demonstrator in the civil engineering department of the University of Manitoba. He then worked on topographical survey with the Department of Mines and Resources.

In 1941 he joined the staff of the University of Toronto, Department of Civil Engineering, as a demonstrator and lecturer. He went to the University of British Columbia in 1945.

Mr. de Jong's summer work has included a variety of experience, as a designing draughtsman for H. G. Acres and Co., on reinforced concrete design of the Shipshaw power plant, on the staff of the City Planning Board of Toronto, and as a designer of power plant sub-structures for the Ontario Hydro. He has done topographic surveys for the Department of Lands and Forests of B.C., and for the Department of Mines and Resources. He has carried out miscellaneous land survey and private practice in professional engineering work since 1950. He contributed a technical article to the Engineering Journal in June 1943.

Mr. de Jong is a special examiner for the Board of Examiners, Dominion Land Surveyors; a member of the Canadian Institute of Surveying and Photogrammetry and of the American Society of Photogrammetry.

He has been an active member of the Institute, serving as secretary-treasurer of the Toronto Branch from 1941 to 1945, and chairman of the Vancouver Branch in 1951. He joined the Institute in 1936 as a Junior, transferring to Associate Member in 1937, and to Member in 1940. He is also chairman of the Vancouver Branch of the Community Planning Association of Canada.


N. J. Allison, M.E.I.C.


S. H. de Jong, M.E.I.C.

# *Personals*

## News of the Personal Activities of Members of the Institute

**C. W. West,** M.E.I.C., director of canal services of the Department of Transport, has been appointed deputy minister succeeding J. C. Lessard, who has retired.

In his new position he will have jurisdiction over marine services, canal services, steamship inspection, steamer operation, St. Lawrence ship channel, all administrative branches and the special projects branch of the department.

Mr. West is an honour graduate of the University of Toronto in hydraulic engineering, class of 1915.

During the first World War he served with the Canadian Infantry and the Canadian Engineers. After demobilization he was appointed senior assistant and then division engineer in charge of construction of sections 3, 4 and 4b of the Welland Ship Canal in the Department of Railways and Canals.

In 1933 he organized the operation staff of the Welland Ship Canal and became the first superintending engineer, which position he held until 1947 when he was transferred to Ottawa as director of canal services.

**David B. Steinman,** M.E.I.C., New York City consulting engineer, has retired from his office and membership on the State Board of Examiners for Professional Engineers on which he served for more than 24 years. His retirement also marks the completion of 25 years of leadership in the State Society during which period he founded the National Society of Professional Engineers and helped to secure the enactment and strengthening of engineers' registration laws.

**D. A. Livingston,** M.E.I.C., of Vancouver. B.C., has been appointed engineer of construction on the extension of the Pacific Great Eastern Railway southward through West Vancouver.

Mr. Livingston, who has worked on railway projects from one end of Canada to the other, spent six years planning and building the Quebec North Shore Labrador line.

He is a Life Member of the Engineering Institute.

**W. A. James,** M.E.I.C., was recently appointed chief engineer of Imperial Tobacco Company of Canada, Limited.

A graduate of McGill University in civil engineering, class of 1927, and a past student of the Massachusetts Institute of Technology, Mr. James has been in the employ of this company for 25 years. He has risen through various branches of the engineering department, and prior to his present appointment, was chief construction engineer since 1945.

Mr. James is a member of the Association of Professional Engineers of Ontario and of the Corporation of Professional Engineers of Quebec.

**Dr. D. R. Stanley,** M.E.I.C., partner in Associated Engineering Services Ltd., consulting engineers, Edmonton, presented a paper at a convention of the American Society of Civil Engineers, in Atlanta, Georgia, in February, 1954. He spoke on research work which he conducted on water filtration using radioactive tracers.

Dr. Stanley is a graduate of the University of Alberta in civil engineering, and received master of science and doctor of science degrees from Harvard University.

**Dr. G. G. Meyerhof,** M.E.I.C., has been appointed to the position of supervising engineer in the Montreal office of the Foundation of Canada Engineering Corporation Limited.

He has also recently been awarded the Research Medal of the Institution of Structural Engineers, England, for his foundation research and its application to structural design. Dr. Meyerhof presented a paper on these studies to the Montreal Branch of the Engineering Institute in January, 1954, and this was published in the *Engineering Journal* in February, 1954.

**E. A. Kelly,** AFFIL. E.I.C., manager of Sault Structural Steel Co. Limited, since 1940, will work with the Company in a consulting capacity. Having been with the Dominion Bridge organization for 50 years, his industrial experience and intimate knowledge of the growing Northern Ontario area will continue to be of service. Mr. Kelly's successor as manager is D. C. Holgate, M.E.I.C.

**Stirling Ross,** M.E.I.C., B.C. Telephone Company staff engineer, has retired after completing 50 years of service in the telephone industry.

Mr. Ross was born in Renfrew, Ont. He went to work for the Northern Electric Company "in the days when it was considered ridiculous to telephone across the street when you could walk, and when telephone men earned about 17 cents an hour".

Mr. Ross joined the B.C. Telephone Company in Vancouver in 1909 and during the next 43 years played a major role in the design and installation of all central office exchange equipment in the company's system.

Starting as switchboard installation foreman, Mr. Ross was made superintendent of switchboard construction in 1922, and in 1924 was appointed equipment engineer. In 1944 he assumed the dual position of equipment and building engineer, and a year ago was appointed a staff engineer in charge of special projects. As equipment and building engineer, he was largely responsible for the design and erection of all company buildings between 1944 and 1951.

Mr. Ross was a member of the Point

E. A. Kelly, Affil.E.I.C.

Stirling Ross, M.E.I.C.

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Grey School Board of which he was the last chairman before amalgamation in 1929, and of the Point Grey Town Planning Commission. He played an important part in the construction of various schools in that area. Among these was the Point Grey Junior High School.

Mr. Ross organized B.C. Chapter 53 of the Telephone Pioneers of America and served as its first president.

He is a member of the Professional Engineers of British Columbia.

**J. A. Tod,** M.E.I.C., supervising engineer for the Kitchener-Galt-Guelph section of the Bell Telephone Company of Canada, has been elected chairman of the Kitchener Branch of the Engineering Institute for the coming term.

Mr. Tod was born at Neepawa, Man. He received his general education at the high school in Newmarket, Ont., and afterwards entered the University of Toronto where he received his B.A.Sc. degree in civil engineering in 1943. While attending university he was employed during the summer months as instrumentman on road construction and on plant layout work. He also worked with the Canadian National Railways in Montreal.

Upon graduation he joined the Royal Canadian Engineers and served as works officer at Sydney, Windsor and Halifax, N.S. He was subsequently posted to Ottawa as staff officer with the Directorate of Works and Construction. In 1946 he was discharged with the rank of captain.

He then joined the Bell Telephone Company of Canada in London, Ont., where he was employed on outside plant engineering. He was appointed to his present position in 1953.

Mr. Tod is a charter member of the Kitchener Branch and has served on the executive since its inauguration, his more recent office being that of vice-chairman in 1952-53.

**Herbert E. Pawson,** M.E.I.C., has retired as commercial manager of Power Corporation. He had completed 30 years of service with Southern Canada Power Company and Power Corporation.

Mr. Pawson was active in the Canadian Electrical Association, and served as its president in 1947-48.

**R. E. Hayes,** M.E.I.C., manager of the engineering department of The General Supply Company of Canada Ltd., has been elected chairman of the Ottawa Branch of the Engineering Institute.

Mr. Hayes is a native of Ottawa. After attending Lisgar Collegiate, he entered McGill University, graduating with a B.Sc. degree in engineering in 1924.

R. E. Hayes, M.E.I.C.

For a year and a half after graduation was employed on the sales staff of Messrs. Peacock Brothers Limited in Montreal. Then in May, 1925, he joined the staff of the engineering department of the head office of The General Supply Company of Canada Ltd. in Ottawa.

Mr. Hayes is a member of the Corporation of Professional Engineers of Quebec, and of the Association of Professional Engineers of Ontario.

**E. G. Carty,** M.E.I.C., general executive assistant in the Department of Transport, retired recently after almost 40 years of service with the government.

Born in Dublin, Ireland, Mr. Carty received his preliminary education in private schools. He attended the City Guilds of London Technical College from which he obtained diplomas in mechanical and electrical engineering. Mr. Carty was awarded a Yarrow scholarship by the Institution of Engineers, following which he attended evening classes at Liverpool University. He received his associate membership in the Institute of Civil Engineers in 1907, and the following year his B.Sc. degree in engineering with first class honours from the University of London.

He came to Canada in 1907 and was first associated with the general contracting firm of MacArthur Perks Co. Ltd. of Ottawa in connection with the Georgian Bay Ship Canal project. In 1913-14 he was assistant engineer with the 31-Mile Lake water scheme of the City of Ottawa.

After serving first with the Naval Intelligence and later as captain in the Canadian Expeditionary Forces in World War I, Mr. Carty was associated for different periods with the Department of the Interior, as assistant engineer in the Grand Trunk Railway, and with the Civil Service Commission on arbitration valuations. In 1921 he joined the Department of Railways and Canals which later formed part of the Department of Transport on its formation in 1936.

Mr. Carty is a Life Member of the Engineering Institute.

**Robert Cheyne Eddy,** M.E.I.C., sales manager and director of George Eddy Company Limited, has been appointed chairman of the Northern New Brunswick Branch of the Engineering Institute.

R. C. Eddy, M.E.I.C.

Mr. Eddy was born in Bathurst, N.B. After graduating from the local high school in 1936, he entered the University of New Brunswick for one year before proceeding to Queen's University where he received the B.Sc. degree and medal in 1941.

After graduation he undertook post graduate work at the University of Michigan and at Queen's University, but interrupted these studies to join the Royal Canadian Engineers in 1942. Serving with the 18th Field Company in 1944, he was severely wounded during operations in Holland. For his part in the action near Caen he was awarded the Military Cross. After convalescence in England, he returned to Canada as an instructor in June, 1945.

Mr. Eddy spent the following winter as lecturer in the chemical engineering department of Queen's University. He then entered the family business in Bathurst, N.B., and is at present sales manager and director of George Eddy Company Limited.

Mr. Eddy is also a director of Eddy Hardware Limited, Raworth and Mollins Limited, Bathurst Broadcasting Co. Ltd., the Maritime Lumber Bureau and the Canadian Forestry Association. He is a past-president of the New Brunswick Retail Lumber Dealers' Association, and a member of the Bathurst School Board.

In 1953 Mr. Eddy helped to establish the Northern New Brunswick Branch of the Engineering Institute. He holds the honour of having been elected its first chairman.

**H. C. Fitz-James,** M.E.I.C., vice-president of Pacific Coast Pipe Company Limited of Vancouver, B.C., has retired.

Mr. Fitz-James joined Pacific Coast Pipe Company Limited in 1908 and shortly afterwards was named manager. In 1915 he was appointed vice-president of the firm.

After schooling in Canada and England, Mr. Fitz-James' early career began with his apprenticeship on a large sailing ship and a trip around the world. This was followed by a seven-year period in South Africa, part of which he spent as assistant underground mine surveyor with De Beers Consolidated Mines Limited in Kimberley, and part in Rhodesia.

Mr. Fitz-James returned to Canada in 1907, and after a short term on maintenance engineering with the Canadian Pacific Railway Company in Revelstoke, B.C., he joined Pacific Coast Pipe Co. Ltd. His activities have taken him on many trips to Eastern Canada and parts of the West Indies.

He is a Life Member of the Engineering Institute and has always shown an active interest in its meetings.

**Murray H. Prescott,** M.E.I.C., has been named to the post of senior public health engineer with the sanitation division of the Saskatchewan Department of Public Health.

Mr. Prescott was born in Saskatoon and was educated in that city, graduating from the University of Saskatchewan with a B.Sc. degree in civil engineering.

After graduation he enlisted in the Canadian Army and served as a training officer with the Royal Canadian Engineers.

At the close of the war he joined the engineering staff of the City of Swift Current, becoming city engineer in 1949.

He went to Regina in 1951 and was associated there with an engineering firm on municipal consulting work on sewer and water installation. Prior to his present appointment, Mr. Prescott was a resident engineer on pipeline construction with the Buffalo Pound project.

**Herbert P. Sisson,** M.E.I.C., assistant division engineer with the Ontario Department of Highways in Port Arthur, retired recently after completing 46 years in government service.

Mr. Sisson was born at Bethany, Ont., and was educated in eastern Canada. After a brief teaching career, he joined the Department of Public Works in 1908 as a bridge foreman, and was later transferred to duties in the roads department. When the departments of Public Works and Northern Development were amalgamated in 1923, Mr. Sisson was appointed road and bridge superintendent.

The Department of Highways took over the Department of Northern Development several years later and Mr. Sisson was made assistant divisional engineer, a post which he held until his recent retirement.

During the past few years most of his time was devoted to bridge work and public parks. He supervised the building of Bailey bridges across the Steel River and Little Pic River between Terrace Bay and Marathon.

Mr. Sisson is a charter member of the Thunder Bay Municipal League, and the Association of Professional Engineers of Ontario.

**Robert L. Dunsmore,** M.E.I.C., president of Champlain Oil Products Limited in Montreal, has been elected chairman of the Montreal Branch of the Engineering Institute.

Mr. Dunsmore was born at Seaforth, Ont. He received his early education at the Collegiate Institute at St. Thomas, Ont., after which he obtained his B.Sc. degree in civil engineering from Queen's University in 1915. Previous to graduation, Mr. Dunsmore was employed in the Ontario Forestry Service, the Geodetic Survey of Canada and the Department of Public Works.

During the first war Mr. Dunsmore served as a major with the Royal Canadian Engineers, spending four and a half years overseas. He was awarded the Military Cross for gallantry.

**R. L. Dunsmore, M.E.I.C.**

In 1919 he joined the Imperial Oil Company at Sarnia, Ont., as assistant engineer, becoming assistant master mechanic in 1920. He was made engineer in charge of construction of the Calgary refinery two years later, and assistant superintendent there in 1923.

Mr. Dunsmore became assistant superintendent of IOCO refinery in 1925 and the following year was appointed superintendent of the Talara (Peru) refinery of the International Petroleum Co. Ltd., becoming general superintendent within the next three years.

In 1930 Mr. Dunsmore returned to Canada to become superintendent of the Imperial Oil Company in Halifax. He remained in this position until 1944 when he was appointed manager of the company's Montreal refinery.

During the second war Mr. Dunsmore served as director of fuel for the Royal Canadian Navy with the rank of commander. He was also appointed assistant director of plans.

In 1946 he was named co-ordinator of manufacturing for International Petroleum Co. Ltd., and three years later he was appointed president of Champlain Oil Products Limited.

Mr. Dunsmore is a past vice-president of the Engineering Institute, and a past chairman of the Halifax Branch.

**Leslie B. Allan,** M.E.I.C., has been appointed commissioner of works for the municipality of Metropolitan Toronto which now functions as an autonomous municipality under legislation passed by the Ontario legislature last year.

Mr. Allan received his degree in civil engineering from the University of Toronto in 1911. As a student he was employed as a draughtsman, timekeeper and inspector with the Department of Works, and on joining the department in 1913 on a permanent basis, he was made assistant to the divisional engineer. A year later he became assistant

L. B. Allan, M.E.I.C.

superintendent of construction on day-labour work. After three years' service as a major with the 1st battalion of the Canadian Railway Troops, he returned to his position as superintendent, and in 1919 was made superintendent of construction.

In 1928 he was promoted to the position of first assistant engineer in the roadway section, and the following year was made engineer in charge of the section.

Early in 1946 he became principal assistant engineer of the department, and in 1947 was promoted to the position of deputy city engineer. Three years ago he succeeded the late Murray A. Stewart as commissioner of works and city engineer.

Mr. Allan is a member of the Association of Professional Engineers of Ontario.

**Don N. Cooke,** M.E.I.C., manager of the Soft Water Supply Limited, has been elected chairman of the London Branch of the Engineering Institute for 1954-55.

Mr. Cook was born at Tilbury, Ont. He received his general education at the Tilbury Public and Continuation Schools and the Chatham Collegiate Institute. After receiving his B.A.Sc. degree in electrical engineering from the University of Toronto in 1935, he was for three years illuminating engineer with The Holophane Company Limited in Toronto. In 1939 he joined Johnston-Turner Electric Repair and Engineering Co. Ltd. in London, Ont., as sales engineer.

He joined the Royal Canadian Ordnance Corps in 1940 and served as C.R.E.M.E. successively with the 2nd Canadian Corps Troops, the 2nd Canadian Infantry Division and the 5th Canadian Armoured Division. He subsequently became D.D.M.E. with the 1st Canadian Corps and then with the 2nd Canadian Corps, becoming officer commanding of the 1st Canadian Base Workshop. After service in the United Kingdom, Italy and North West Europe, he was discharged in November 1945 with the rank of colonel.

Since his return to Canada he has been manager of Soft Water Supply Ltd. in London.

D. N. Cooke, M.E.I.C.

**Professor William Bruce,** M.E.I.C., has been promoted from associate professor to professor of mechanical engineering by McGill University.

Professor Bruce is a native of Falkirk, Scotland. He obtained his under-graduate and graduate training at the University of Toronto.

In 1946 he joined the staff of McGill University as assistant professor, and was named associate professor in 1949.

**Gordon W. Ross,** M.E.I.C., manager of the apparatus division of Canadian General Electric Company Ltd., has been elected chairman of the Cape Breton Branch of the Engineering Institute for 1954-55.

G. W. Ross, M.E.I.C.

Mr. Ross was born at Cabino, Que., and received his general schooling at Edmundston, N.B. In 1942 he obtained his B.Sc. degree in electrical engineering from the University of New Brunswick.

Upon graduation he entered the Canadian General Electric Company's test course, and in the fall of 1943 he joined the Royal Canadian Air Force. Upon his discharge as a navigator, he returned to the Canadian General Electric Company. In 1946 he was transferred from the lighting department at head office to the Ottawa office as lighting specialist.

Mr. Ross was then sent to Sydney in 1947 on industrial sales. In his present position as manager of the apparatus division, he is responsible for the sales in Cape Breton and Newfoundland of industrial items such as transformers, switchgear, motors and hoist drives.

**John P. Watts,** M.E.I.C., has been elected chairman of the Peterborough Branch of the Engineering Institute for the term 1954-55.

Mr. Watts was born in London, England, and came to Canada as a child with his parents in 1912.

He received his general education at Haileybury, Kitchener - Waterloo and Kingston schools, and graduated with a B.Sc. degree in electrical engineering from Queen's University in 1936.

Upon graduation he undertook the Canadian General Electric test course at Peterborough. In 1938 he joined the wire and cable department as an engineer and became division engineer of that department in 1948. Two years later he was appointed manager of product planning, and only recently he was named engineering manager in the wire and cable department.

Mr. Watts is a member of the American Institute of Electrical Engineers and of the Association of Professional Engineers of Ontario.

In 1952 he served as secretary-treasurer of the Peterborough Branch of the Institute, and the following year as chairman of its meetings and papers committee.

John P. Watts, M.E.I.C.

**W. T. Butler,** M.E.I.C., administrative assistant to the director of research of Abitibi Power and Paper Co. Ltd., has been elected chairman of the Sault Ste. Marie Branch of the Engineering Institute.

Mr. Butler was born at Calgary, Alta. He received his general schooling in Winnipeg and Montreal, and in 1940 obtained his B.Eng. degree in chemical engineering from McGill University.

Immediately upon graduation Mr. Butler entered Howard Smith Paper Mills Limited as assistant mill chemist in the Beauharnois division.

W. T. Butler, M.E.I.C.

During the war Mr. Butler served for four years with the Canadian Armoured Corps in the 17th Duke of York's Royal Canadian Hussars and the 4th Princess Louise Dragoon Guards in England and central Mediterranean areas.

At the close of the war he returned to Howard Smith Paper Mills Limited as chief mill chemist in the Beauharnois division.

In 1947 Mr. Butler joined Abitibi Power and Paper Co. Ltd. as technical control superintendent at the Sault Ste. Marie division. Since 1952 he has occupied the positions of senior chemical engineer, and latterly, administrative assistant to the director of research.

Last year Mr. Butler served as vice-chairman of the Sault Ste. Marie Branch of the Institute.

He is a member of the technical section of the Pulp and Paper Association and of the Technical Association of the Pulp and Paper Industry.

**John E. Clarke,** M.E.I.C., has been transferred as divisional engineer with the Nova Scotia Department of Highways and Public Works from Bridgewater, N.S. to Middleton, N.S.

Mr. Clarke is a graduate of Acadia University, class of 1929.

He has been elected president of the Association of Professional Engineers of Nova Scotia for 1954-55.

**K. Madsen,** M.E.I.C., has been appointed town engineer for Grande Prairie, Alta.

A native of Denmark, Mr. Madsen came to Canada in the late 'twenties. He was associated for some time in engineering work for the Province of Alberta, and during the past year has been conducting a private practice in Calgary.

Mr. Madsen is a graduate in civil engineering of the University of Alberta, class of 1950.

**H. G. Russell,** M.E.I.C., is now supervisor of planning and training with the California Texas Oil Company in New York.

He is a 1940 chemical engineering graduate of McGill University.

**T. J. Carbone,** M.E.I.C., has been appointed township engineer of the Township of McKim in Sudbury, Ont.

He was previously associated with the Mascioli Construction Company in Timmins, Ont.

Mr. Carbone is a graduate in civil engineering of the University of Toronto, class of 1934.

**L. T. Baird,** M.E.I.C., has been transferred by Storms Contracting Co. Ltd from Petawawa, Ont. to Toronto.

He was formerly associated with Foundation Company of Canada Ltd at Owen Sound, Ont.

Mr. Baird received his B.A.Sc. degree from the University of Toronto in 1934.

**G. P. Webb,** M.E.I.C., is now attached to the power and transformer sales section of the apparatus division's marketing department of the Canadian General Electric Company in Toronto. He will subsequently be transferred to Guelph, Ont., where the company's new transformer works is located.

Mr. Webb graduated from London University in 1952.

**Wattan S. Panesar,** M.E.I.C., has been transferred by R.C.A. Victor Company Limited from Montreal to Prescott, Ont.

Mr. Panesar graduated in chemical engineering from the University of British Columbia in 1935.

**J. R. O'Grady,** M.E.I.C., is now project engineer with Dow Chemical of Canada Limited in Sarnia, Ont.

He was previously associated with Canadian International Paper Co. Ltd in Temiskaming, Que.

Mr. O'Grady is a 1946 graduate of Queen's University in civil engineering.

**Denis Temple,** M.E.I.C., is now associated with the St. Lawrence Cement Company in Quebec City.

He was previously with the architectural services department of Atomic Energy Limited at Deep River.

**Denis Temple, M.E.I.C.**

Mr. Temple is a 1934 graduate of the Imperial College of Science and Technology in London, and is a member of the Institute of Civil Engineers.

**D. James Wardle,** M.E.I.C., has been appointed assistant manager of the Ottawa branch of Terminal Construction Co. Ltd.

He was formerly resident engineer with Defence Construction Ltd. in Camp Borden, Ont.

**F. J. McDiarmid,** M.E.I.C., is general manager of Powertronic Equipment Limited in Toronto.

He was formerly project engineer with the Department of Defence Production in Ottawa.

Mr. McDiarmid is a graduate in mechanical engineering of Queen's University, class of 1933.

**A. A. Goldes,** M.E.I.C., is now structural engineering associate with Messrs. Shore & Moffat, Toronto architects.

He was formerly design engineer with Dominion Bridge Co. Ltd. in Winnipeg, Man.

Mr. Goldes is a 1941 engineering graduate of Witwatersrand University.

**Marcel R. Gingras,** JR.E.I.C., has joined Daly & Morin Limited in Verdun, Que.

He was previously associated with Merck and Company Ltd. in Montreal.

Mr. Gingras is a graduate in chemical engineering of McGill University, class of 1944.

**Robert G. Curry,** JR.E.I.C., has joined The Foundation Company of Canada Ltd. at Levack, Ont. He was previously connected with McNamara Construction Co. Ltd.

Mr. Curry graduated in civil engineering from Trinity College, Dublin.

**Capt. J. J. Kane,** R.C.E.M.E., Jr.E.I.C., has been promoted from the rank of lieutenant. Capt. Kane, previously adjutant in the 23rd Infantry Brigade Workshop of R.C.E.M.E., has been posted to Korea.

Capt. Kane is a 1947 mechanical engineering graduate of Queen's University.

**J. Philip Shnier,** Jr.E.I.C., formerly with American Texolite Corporation in Paterson, N.J., is now connected with the Fabrikoid division of Canadian Industries Limited.

He is a graduate of the University of Oklahoma in chemical engineering, class of 1947.

**D. Zavitzianos,** Jr.E.I.C., has joined the structural design department of General Engineering Company Limited at Willowdale, Ont.

He was formerly field engineer with Pigott Construction Co. Ltd. in Toronto.

Mr. Zavitzianos graduated in civil engineering from Athens National Technical University in 1948.

**G. R. Carruthers,** Jr.E.I.C., is now engineer at the Quebec Works of Canadian General Electric Company Limited in Quebec City.

He was previously foreman of the company's relay department in Peterborough, Ont.

Mr. Carruthers graduated in electrical engineering from McGill University in 1948.

**G. R. Dargis,** Jr.E.I.C., is fleet superintendent for Steinberg's Wholesale Groceterias Limited.

He was formerly associated with Sorel Industries, Sorel, Que.

Mr. Dargis graduated in mechanical engineering from the Nova Scotia Technical College in 1948.

**Glebe Kravetz,** Jr.E.I.C., has recently joined The Prepakt Concrete Company in Cleveland, Ohio. His first assignment with this company will be in connection with the Kitimat-Kemano project in British Columbia.

Since his arrival in Canada in 1951, Mr. Kravetz has been associated with the soil engineering department of The Foundation Company of Canada Limited.

Mr. Kravetz is a 1949 civil engineering graduate of Ecole Speciale des Travaux Publics, Paris.

**G. A. Boire,** Jr.E.I.C., has been appointed division sales supervisor of Imperial Oil Limited in St. John's, Newfoundland.

During the past three years Mr. Boire has served as sales representative in Montreal, as industrial sales representative in Quebec City, and as resident manager in the North Shore area.

Mr. Boire graduated in mechanical engineering from McGill University in 1949.

**W. T. Clarke,** Jr.E.I.C., has been appointed Ontario field manager of Construction Borings Limited in Toronto.

Until recently he was employed as district manger by Gunite & Waterproofing Ltd. in Montreal.

He received his B.Eng. degree in civil engineering from McGill University in 1949.

While in Montreal, Mr. Clarke was an active member of both the Engineering Institute and the Corporation of Professional Engineers of Quebec, having served on the executive of the Junior Section of the Institute, and as chairman of the Committee for the

Young Engineer of the Corporation of Professional Engineers.

**C. L. Wild,** Jr.E.I.C., is associated with Brook Motors Limited at Leicester, England.

He was formerly associated with A. R. Williams Co. Ltd. in Toronto.

Mr. Wild graduated in electrical engineering in 1949.

**M. M. Williams,** Jr.E.I.C., has joined Calgary Power Limited in Calgary, Alta.

Mr. Williams was formerly connected with Montreal Engineering Company Ltd.

Mr. Williams received his civil engineering degree with honours from the Nova Scotia Technical College in 1947, and his mechanical engineering degree with honours from the same college in 1949.

**Capt. G. L. O'Brien,** R.C.E.M.E., Jr.E.I.C., has been posted from the engineering camp at Vedder Crossing, B.C., to the Aberdeen Proving Grounds, Maryland, U.S.A.

Capt. O'Brien graduated in mechanical engineering from the University of Saskatchewan in 1949.

**Richard M. Cook,** Jr.E.I.C., has been transferred by Ferranti Electric Limited from Ottawa to the research department in Toronto.

Mr. Cook graduated from the University of British Columbia in engineering physics in 1949.

**W. Donald Paton,** Jr.E.I.C., is structural design engineer with C. C. Parker & Associates Ltd. in Hamilton, Ont.

He was formerly design engineer with Pre-Compressed Concrete Engineering Co. Ltd. in Montreal.

Mr. Paton graduated in civil engineering from the University of Toronto in 1950.

**F. F. Newton,** Jr.E.I.C., has joined Canadian Bechtel Limited in Sarnia, Ont.

He was previously associated with Burns & Dutton Ltd. in Calgary, Alta.

Mr. Newton graduated in civil engineering from McGill University in 1950.

**A. Koropatnick,** Jr.E.I.C., is now associated with the Manitoba Hydro-Electric Board at Lac du Bonnet, Man.

He was previously with the engineering department of the water resources branch of the Department of Resources and Development.

Mr. Koropatnick is a 1950 civil engineering graduate of the University of Manitoba.

**R. K. Vail,** Jr.E.I.C., has been transferred by E. G. M. Cape and Company from the R.C.A.F. Station, Greenwood, N.S. to Toronto, Ont.

Mr. Vail is a 1950 graduate of the Nova Scotia Technical College.

**M. G. Brown,** Jr.E.I.C., is now patent examiner at the Dominion Government Patent Office in Ottawa.

He was formerly design engineer with the Mathews Conveyor Company of Port Hope, Ont.

Mr. Brown graduated in mechanical engineering from the University of British Columbia in 1950.

**J. E. L. Murphy,** Jr.E.I.C., is now employed as sales representative in the textile fibres division of Canadian Industries Limited in Toronto.

Mr. Murphy was previously technical assistant in the company's nylon division in Kingston, Ont.

He is a graduate of the University of Toronto in chemical engineering, class of 1950.

**Lieut. J. W. Lelacheur,** R.C.E.M.E., Jr.E.I.C., is now Area EME Newfoundland Area and Officer Commanding of the 19th Company, R.C.E.M.E.

Lieut. Lelacheur is a 1950 graduate in mechanical engineering of the Nova Scotia Technical College.

**S. G. Frost,** Jr.E.I.C., has accepted the position of assistant research officer in the building research division's building code section of the National Research Council in Ottawa.

He was formerly connected with Canadian Celanese Ltd. in Drummondville, Que.

Mr. Frost graduated in civil engineering from McGill University in 1950.

**W. J. Swanson,** Jr.E.I.C., is now townsite engineer for Pacific Mills Limited at Ocean Falls, B.C.

He was previously associated with Foundation Co. of Canada, Ltd.

Mr. Swanson received his B.Sc. degree in civil engineering from the University of British Columbia in 1951.

**Michael J. Nugent,** Jr.E.I.C., is now with the air conditioning department of Canadian General Electric Co. Ltd. in Montreal.

He was formerly with the same department in Toronto.

Mr. Nugent graduated in mechanical engineering from the Nova Scotia Technical College in 1951.

**W. A. S. Marshall,** Jr.E.I.C., is superintendent of construction with R. Timms Construction and Engineering Limited of Welland, Ont. He was previously employed as an estimator and as field engineer by the same firm.

Mr. Marshall graduated in civil engineering from the University of Toronto in 1951.

**Robt. H. Regimbal,** Jr.E.I.C., is with the Victor division of the Radio Corporation of America in Camden, N.J. He is at present in the antenna design section of television transmission and is employed on the design of television VHF and UHF networks.

He was formerly connected with Canadian Electronics Aviation in Montreal.

Mr. Regimbal graduated in civil engineering from Ecole Polytechnique in 1951.

**H. C. Rynard,** Jr.E.I.C., has been transferred by H. G. Acres & Co. Ltd. from Niagara Falls, Ont. to Labrieville, Que.

He is a graduate in civil engineering of the University of Toronto, class of 1951.

**Thos. E. Smith,** Jr.E.I.C., has joined M M. Dillon and Co. Ltd., consulting engineers in London, Ont.

He was previously associated with Atlas Steels in Welland, Ont.

Mr. Smith graduated in electrical engineering from the University of British Columbia in 1951.

**E. W. Owen,** Jr.E.I.C., has been appointed assistant distribution and planning engineer for the Ottawa Hydro-Electric Commission.

Before assuming this position, Mr. Owen was associated with the power transformer engineering department of Canadian General Electric Company Limited.

Mr. Owen graduated as an electrical engineer from the University of Manitoba in 1951.

**Jean-Claude Gregoire,** Jr.E.I.C., has joined Southern Canada Power Co. Ltd. in Montreal.

Mr. Gregoire is an honours graduate in electrical engineering of Laval University, class of 1951.

**G. J. Maier,** Jr.E.I.C., has been transferred as petroleum engineer by Hudson's Bay Oil and Gas Company Limited from Calgary to Drumheller, Alta.

Mr. Maier is a 1951 graduate in petroleum engineering of the University of Alberta.

**F. A. Dobson,** Jr.E.I.C., has joined McColl Frontenac Oil Co. Ltd. as a design engineer.

He was previously plant engineer with Welland Electric Steel Foundry Ltd. in Welland, Ont.

Mr. Dobson is a 1951 mechanical engineering graduate of the Nova Scotia Technical College.

**Gordon A. Dysart,** Jr.E.I.C., is now electrical engineer with Donnacona Paper Company Limited at Donnacona, Quebec.

He was formerly associated with McColl Frontenac Oil Co. Ltd. in Montreal.

Mr. Dysart obtained his B.Eng. degree from McGill University in 1951.

**Wm. M. Fraser,** Jr.E.I.C., is an assistant field engineer with The Bechtel Corporation of San Francisco, Calif.

He was formerly associated with Canadian Bechtel Ltd. in Hope, B.C.

Mr. Fraser is a graduate in civil engineering of McGill University, class of 1952.

**George B. Nelson,** Jr.E.I.C., is a plant engineer with Lever Brothers Limited, Toronto.

He was formerly design engineer at Spruce Falls Power and Paper Co. Ltd. in Kapuskasing, Ont.

Mr. Nelson graduated in mechanical engineering from the University of Toronto in 1952.

**L. E. Dickinson,** Jr.E.I.C., is supervisor of quality control in the power products division of Canadian Westinghouse Company Ltd. in Hamilton, Ont.

Mr. Dickinson graduated in mechanical engineering from the University of British Columbia in 1952.

**J. A. Cowlin,** Jr.E.I.C., is an engineer with the Municipality of Saanich, B.C., and is located in Victoria, B.C.

Mr. Cowlin was previously with Consolidated Mining and Smelting Company Limited at Trail, B.C.

He graduated from the University of British Columbia in civil engineering in 1952.

**Ronald G. Foxall,** Jr.E.I.C., has joined Canadian Forest Products Limited at Port Mellon, B.C., as plant engineer.

He was recently associated with the research and development department of the Canadian National Railway.

Mr. Foxall graduated in civil engineering in 1952 from the University of British Columbia.

**E. J. Macfarlane,** Jr.E.I.C., has been transferred by the Shawinigan Water and Power Company from Three Rivers, Que., to Thetford Mines, Que.

Mr. Macfarlane has been associated with this company since his graduation in 1952 in electrical engineering from Queen's University.

**John Westaway,** Jr.E.I.C., has been transferred by Canadian Westinghouse Co. Ltd. from Hamilton, Ont., to the Forcacava power installation in Brazil where he will assist in the installation of four generators in the new underground development.

Mr. Westaway is a 1952 graduate of Queen's University in mechanical engineering.

**Gerald A. Sweeney,** Jr.E.I.C., has joined the Aluminum Company of Canada Ltd. in Montreal.

Mr. Sweeney graduated in electrical engineering from the University of Manitoba, class of 1952.

**R. R. Carwardine,** Jr.E.I.C., is employed as an estimator and general job superintendent in the commercial and industrial construction firm of George A. Crain & Sons Ltd. in the Ottawa area.

Mr. Carwardine has been associated with this company since his graduation in civil engineering from McGill University in 1952.

**H. Debicki,** Jr.E.I.C., has joined the Welland Ship Canals division of the Department of Transport at St. Catharines, Ont.

He was formerly employed as assistant civil engineer with Teagle & Sons of Toronto.

Mr. Debicki is a graduate of the University of London, class of 1952.

**J. E. Dooley,** Jr.E.I.C., is at present at Metropolitan Vickers Electrical Co. Ltd., Manchester, England, specializing in the study of steam and gas turbines as part of his Athlone Fellowship.

Mr. Dooley is an honours graduate in mechanical engineering of the University of Toronto, class of 1952.

**Ross Thompson,** Jr.E.I.C., has been transferred by the Aluminum Company of Canada Ltd. from the general electrical engineering department in Montreal to the electrical conductors division of the Aluminum Laboratories at Kingston, Ont.

He is a 1952 graduate in electrical engineering of the University of British Columbia.

**Martin S. P. Reszetnik,** Jr.E.I.C., is a design engineer with the City of Waterloo, Ontario.

Mr. Reszetnik graduated from McGill University as a civil engineer in 1953.

**R. J. Chapman,** S.E.I.C., is now employed as industrial engineer with Kawneer Canada Limited in Toronto.

He was previously associated with John Inglis Co. Ltd. in Toronto.

Mr. Chapman is a 1953 graduate in mechanical engineering of the University of Manitoba.

**D. N. Dastur,** S.E.I.C., has joined the consulting engineering firm of James F. MacLaren in Toronto, Ont.

Mr. Dastur is a 1953 graduate in civil engineering of the University of Toronto.

**E. R. Armstrong,** S.E.I.C., has joined Light Weight Aggregates of Canada Ltd. in Calgary, Alta.

Mr. Armstrong is a ceramics engineering graduate of the University of Saskatchewan, class of 1953.

**Michael R. Thompson,** S.E.I.C., has returned from England and is now in the employ of Price Brothers & Co. Ltd. at Kenogami, Que.

Mr. Thompson is a graduate in mechanical engineering of the University of Toronto, class of 1953.

**Cyril R. Elliott,** S.E.I.C., has been appointed junior resident engineer with the highways division of the Department of Public Works in St. John's, Nfld.

He was previously with the Willatt Engineering and Surveying Company at Port aux Basques, Nfld.

Mr. Elliott graduated in civil engineering from the Nova Scotia Technical College in 1953.

**John Robt. Jenkins,** S.E.I.C., is assistant field engineer with the Petroleum and Natural Gas Conservation Board at Lloydminster, Alta.

Mr. Jenkins graduated in chemical engineering from the University of Alberta in 1953.

# Obituaries

*The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.*

**Gordon McLeod Pitts,** M.E.I.C., member of the Montreal architectural firm of Maxwell and Pitts and vice-chairman of the Montreal city executive committee, died suddenly at his home on March 1, 1954.

Mr. Pitts was born in Fredericton, N.B., on March 10, 1886. He attended elementary and high school in Fredericton and Ottawa, and then entered McGill University, where he obtained his B.Sc. degree with honours in structural engineering in 1908, his M.Sc. degree in 1909, and his B.Arch. degree in 1916.

He began his engineering and architectural career as a draughtsman for The Peoples Gas Supply Company in Ottawa in 1906, as an engineer with Canadian Pacific Railways in 1907, and as an engineer with the Trans-Continental Railway in Ottawa in 1908.

G. McL. Pitts, M.E.I.C.

In 1909 he served on the staff of McGill University and during that same year was employed as an engineer with P. Lyall and Sons Construction Company, where he remained until he joined George Fuller and Company in 1912.

Mr. Pitts was superintendent on construction for the Montreal High School in 1913-14, served again on the McGill University staff in 1915-16, and during the next three years was assistant to John A. Pearson, architect for the reconstruction of the parliament buildings.

He then joined the firm of Edward and W. S. Maxwell and four years later formed the partnership of Maxwell and Pitts. In the following years he participated in architectural and engineering services on such projects as the Chateau Frontenac in Quebec City, the Dominion Express Building in Montreal, the National Bridge Works and the Connaught Park development.

In 1942 he was appointed a member of the McGill board of governors and was later named as one of its representatives on the Montreal city council. He served as chairman of the university's site planning committee and in 1946 was made an honorary life member of the Graduates' Society after being "continuously active in the affairs of the society for 30 years."

His roles in the city administration included serving as vice-chairman of the Town Planning Committee and of the Montreal Transportation Research Committee, and chairman of the Special Bridge Committee.

He was the author of "Transportation in Canada", "Planning the Canada of Tomorrow", and other articles on post-war planning and housing.

Mr. Pitts was a Fellow of the Royal Institute of British Architects and Canadian representative on its council. He was a Fellow of the Royal Architectural Institute of Canada of which he was past-president. He served as president and councillor of the Province of Quebec Association of Architects and was awarded the Association "Medal of Merit". He was a member of the Architects' Registration Council of the United Kingdom, and of the Corporation of Professional Engineers of Quebec.

He joined the Engineering Institute of Canada as a Student in 1908, transferring to Associate Member in 1914, and to Member in 1938. Always active in Institute affairs, he served as chairman of the Committee on Consolidation, and as chairman of the Radio Broadcasting Committee. He was elected councillor of the Institute representing the Montreal Branch in 1941-42 and 1942-43.

## Letter to the Editor:

The obituary columns of the *Journal* will be carrying news of the untimely death of Gordon McLeod Pitts, engineer and architect. May I have the privilege of adding a footnote to your notice, about a contribution of Mr. Pitts to the Institute which may be unknown to most of the younger members.

Recent discussions, especially in Ontario, of the possible uniting of the various engineering organizations in Canada will have reminded older members of the similar movement of exactly twenty years ago. It was in 1934 that the Committee on Consolidation was appointed by the Institute. Its name proved to be unfortunate but the interest which it generated within the profession in all parts of Canada was remarkable.

The Committee prepared a plan of union for the Institute and the professional associations. Although agreed to by all the groups consulted throughout Canada, it failed to win the necessary two-thirds majority vote on ballot to the Institute membership, by a critically few votes. Progress has been made along the lines then suggested, as the several cooperative agreements and recent discussions demonstrate, but the advance has been slow indeed compared to the high hopes of 1936.

Gordon Pitts was the chairman of that Committee on Consolidation. For two years it was his principal professional interest. He devoted to its work his abundant energies and an immense amount of time and effort. As secretary of the Committee, I was perhaps able to see more intimately than other members the full extent of the contribution of Mr. Pitts and to appreciate the devotion to the Engineering Institute which alone activated his work.

The legacy of that work can be seen today. Although in more recent years, University and civic duties claimed most of his interest, even his natural disappointment at the result of the "Consolidation" effort in no way dimmed his interest in and concern for the Engineering Institute.

We had often talked of writing up together the story of the developments of 1934 to 1936 now that the passage of the years gives proper perspective to all that then transpired. That joint task can not now be carried out but when the story is recounted in full it will be clear to all that Gordon Pitts made a great contribution to the advancement of the engineering profession in Canada.

Robert F. Legget, M.E.I.C., C.I.S.C.,
Ottawa

# Employment Service

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

## SITUATIONS VACANT

### CHEMICAL

CHEMICAL ENGINEER with rubber experience to sell rubber chemicals and compounds for Canadian manufacturer in Eastern Ontario and Quebec. Salary and profit sharing. Opportunity for an aggressive sales minded man. File No. 4764-V.

CHEMICAL GRADUATE with experience, preferably sales, in metal cleaning, electroplating and/or painting. This is a salaried position plus expenses, commission and annual bonus. Firm also provides a liberal retirement insurance and hospitalization program. Location working out of Toronto. File No. 4783-V.

SAFETY ENGINEER required by large research organization at Ottawa. A graduate in engineering (Chemical Engineering preferred) or chemistry from a University of recognized standard is required. Must be physically fit and have several years' industrial experience in technical work. Some safety engineering experience desirable. Willingness to learn, good judgment, ability to co-operate and tact in dealing with people are very important. Duties include investigation of accidents, fires, and potential health hazards in the laboratories. and the recommendation of safety measures; co-operation with the scientific, medical, plant engineering and personnel office staffs; the preparation of reports and maintenance of statistics; as well as other related work. Initial salary up to $5,150.00 per annum depending on qualifications. Apply by letter giving full details of education and experience File No. 4798-V.

### CIVIL

THE TOWNSHIP OF TORONTO requires a graduate civil engineer to act as an assistant engineer in their engineering department on design and construction work in connection with water and sewer systems. Applicants should have from 2 to 4 years experience on water and sewer work. Apply stating age, qualifications and salary expected. File No. 4792-V.

RECENT GRADUATES IN civil engineering for employment in Southern Ontario as sales representatives of national manufacturer and erector of steel construction products. Preparatory training course provided. File No. 4793-V.

REQUIRED GRADUATE civil engineers for specialized work in soil mechanics and foundation engineering. Graduate soils work desirable. Locations: Montreal and Toronto with some travelling. File No. 4794-V.

GRADUATE CIVIL ENGINEER wanted for municipal work in Alberta and Saskatchewan. Please submit details of experience and when available. Experience in water and sewer utility construction preferred. File No. 4811-V.

CIVIL ENGINEER required for Ontario Government to take charge under direction, of the administration of The Provincial Aid to Drainage Act throughout the Province. Should have experience with land assessments and understand the municipal drainage act. Position requires mostly office administration work, but some contact work with municipal officials throughout the Province is required. Full employee privileges available, including three weeks vacation, a day and one-half per month illness credit, and superannuation. Interested parties should apply in own handwriting giving full particulars of age, education and especially experience in the type of work to be performed. Salary can be set to suit qualifications of successful applicant. File No. 4812-V.

CIVIL ENGINEER registered professional engineer with experience in municipal engineering required by firm of consulting engineers. Applicants must be capable of making detailed designs and supervising field crews. Work will be in Alberta from Edmonton office. Address all applications giving full details of qualifications, experience, references and salary required to File No. 4814-V.

ASSISTANT CITY ENGINEER required as first assistant of the City Engineer to assist in administration of the department involving planning, co-ordinating and supervising of various municipal projects including construction and maintenance of roadways, works, bridges, sewers, sewage disposal, garbage collection and disposal, traffic control and related work. University graduate in civil engineering and preferably considerable varied administrative and supervisory municipal engineering experience in the above noted work. Location Edmonton, Alberta. Apply not later than April 30-54. File No. 4816-V.

CIVIL ENGINEER, University graduate in civil engineering of at least three years experience after graduation, capable of performing under general supervision the following work: Preparation of reports, hydraulic investigations, structural analyses, design of dams, pipelines, tunnels, surge tanks, power houses and similar structures, supervise draughting and undertake same where required. Previous experience in hydro-electric field desirable. Location British Columbia, salary range $325-$475 per month. File No. 4828-V.

APPLICATIONS FOR THE POSITION OF TOWN ENGINEER, for the Town of Dauphin in Manitoba, population 6,500. Engineer to have charge of construction and maintenance of streets and sidewalks, gravity water system and sewage disposal plant. Applicants will require to state qualifications and experience, furnish references and state the earliest possible date on which duties will be assumed. File No. 4829-V.

### ELECTRICAL

FIELD ENGINEERS preferably with electrical background by oil well service company operating in Western Canada. Five months training period. Comprehensive employee benefits. Work is substantially in the field for initial years with irregular hours. Age limit of 28 preferred. Engineers will be based in active oil exploration area of Western Canada. Well established company active throughout world. Inquiries welcomed. File No. 4754-V.

ELECTRICAL ENGINEER required to fill position as Senior product engineer with long established and expanding company manufacturing rectifiers and distribution equipment for public utilities. Must have proven technical and administrative ability to assume responsibility for all design, development and product engineering and supervision of engineers, technicians and draughting staff. File No. 4756-V.

ASSISTANT PROFESSOR required in the department of electrical engineering of University located in Maritime Provinces. Preferably Canadian, under 35, and with at least two years experience. The course involves D.C. machinery A.C. circuits and introductory electronics. File No. 4760-V.

ELECTRICAL ENGINEER bilingual, required for system planning studies of rapidly expanding utility located in P.Q. Duties will involve problems of distribution, transmission and hydraulic generation. Educational requirements: graduation in electrical engineering, from a recognized university and from 3 to 7 years experience preferably in a utility or allied field. Employee benefits include: pension, group insurance, and hospitalization plan. In reply please give age, marital status, summary of experience and salary required. File No. 4781-V.

GRADUATE ELECTRICAL ENGINEER required for new plant in Ontario. Applicants should have experience in the telephonic communications field. Company is engaged in the manufacture of telephone dial switching equipment and associated apparatus such as telephone relays etc. The work involves the following detailed engineerings. The preparation of specifications detailing each item of equipment to be supplied for a particular installation. The preparation of exchange drawings to be used by installers in the installation of equipment. File No. 4784-V.

POWER PLANT ENGINEER required for large industrial concern near Montreal to take care of high pressure steam plant turbo-generators and refrigeration. Only those having both practical experience and technical knowledge need apply. State age, experience, and salary expected. File No. 4795-V.

ELECTRICAL ENGINEER required by paper company located in Eastern Canada. Young graduate with some experience not necessarily in paper mill. File No. 4799-V.

ELECTRICAL ENGINEER required by hydro commission in Ottawa. Should have at least 4 years experience in urban electrical distribution, and to act as an assistant to the distribution engineer. File No. 4801-V.

SALES ENGINEER required by well established and highly respected company in the field of scientific illumination. Duties, after a specific training period of approximately two years duration, will involve the sale of prismatic lighting units and the discussion of lighting applications with architects, consulting engineers and electrical contractors, officials of industrial and commercial firms, municipal and hydro offices. Qualities of personality, diligence, and dependability along with a sincere desire for a permanent career in the lighting industry are of prime importance. File No. 4807-V.

ELECTRICAL ENGINEER, university graduate in electrical engineering for investigation and design under supervision of electrical transmission and distribution systems. Work consists of: field survey and report on distribution projects, engineering planning, preparation of cost estimates and bills of material, and general routine having to do with transmission and distribution projects. This is a junior position offering good opportunity for experience in transmission and distribution engineering. Location British Columbia. Salary range $250-$325 per month. File No. 4828-V.

ELECTRICAL ENGINEER, university graduate in electrical engineering with at least two years experience after graduation, capable of performing under general supervision the following work: Planning, and design of high voltage switching and transformer stations and electrical portion of generating stations, both hydro and diesel, specification of electrical apparatus and preparation of bills of material; supervise draughting and undertake same where required. Previous experience in electrical power apparatus, relays, etc., and their application with utility or at manufacturer's factory desirable. Location British Columbia. Salary range $300-$475 per month. File No. 4828-V.

ELECTRICAL ENGINEER required, preferably with aviation experience. The work will consist of designing modifications to aircraft power supply and control systems, dictated by airline service and maintenance requirements. It will further include the supervision of drawing preparation and the writing of modification instructions for the maintenance department. The job will include periodic report writing, equipment surveys, the writing of test schedules and general, service and liaison for the various departments within the company. Job is of a permanent nature with the salary range depending entirely upon the qualifications of the applicant. File No. 4833-V.

### MECHANICAL

INDUSTRIAL ENGINEER required by large organization. Applicants should be preferably graduate engineers in mechanical. The age range could be from 25 to 40 and the duties involved will be engineering studies of manufacturing operations for the purpose of improving operating methods, equipment material handling, etc. Experience in time study for the establishment of production standards for large incentives, would be a decided advantage. Due to rapid expansion opportunities for advancement are excellent. Starting salaries range from $4,000 to $6,500 depending on qualifications and experience. File No. 4762-V.

MECHANICAL ENGINEER required by air conditioning and ventilating contractor in Montreal. Duties to include field supervision and estimating. Man must be familiar with sheet metal work and installation of air-conditioning equipment. Must be bilingual. File No. 4767-V.

GRADUATE MECHANICAL ENGINEER, 23 to 28, interested in sales, to work as assistant in general engineering and sales department of growing engineering company. Company specializes in aircraft parts and industrial work. Location Montreal. Please write giving full details. File No. 4772-V.

TWO RECENT ENGINEERING graduates, preferably mechanical required by large beverage company for plant work in Toronto and Montreal. File No. 4766-V.

MECHANICAL ENGINEER graduate of a Canadian college and registered professional engineer with 15 years experience in design of pressure vessels, pressure piping, for work in Windsor, Ontario. Salary ranges between $8,000. and $10,000. depending on qualifications. Please write giving full details including experience, age, references, etc. An interview will be arranged. File No. 4769-V.

PROFESSOR OF MECHANICAL and head of mechanical engineering department required by the University of Roorkee founded in 1949 as the first technical university in India. Roorkee is about 100 miles north of Delhi. Applicant should be a mechanical engineer with a sound background of modern mechanical science. He should have a high academic qualification preferably Ph.D. or D.Sc. The direction of specialization is not important. Age preferably not under 38-40 years. Duration of appointment minimum two years preferably three. Living accommodation provided and free medical attention. File No. 4780-V.

INSTRUCTOR OF MECHANICAL engineering to teach mechanical drawing and assist in mechanical engineering laboratory courses. Preference will be given to an applicant with experience in the field of machine shop practice and industrial engineering, who would have an opportunity to develop courses in this field. Location University of B.C., Vancouver. File No. 4791-V.

MECHANICAL ENGINEER required by plant engineering branch of large research organization at Ottawa. Applicants should be B.Sc. graduates in mechanical engineering with at least three years' experience in the design of heating and ventilating of offices and industrial buildings. Duties include the preparation of drawings and specifications for heating and ventilating, and the assistance in the design, layout, and adjustment of refrigeration and air conditioning equipment. Initial salary up to $5,750 depending on qualifications. Apply by letter giving full details of education and experience. File No. 4798-V.

MECHANICAL ENGINEER as assistant superintendent required in a modern yarn spinning mill in the City of Granby, Que. The position calls for the services of a mechanical engineer between 24 to 32 years of age who is primarily interested in production and plant engineering. Previous textile experience is not necessary but manufacturing experience including staff supervision would be of advantage. Complete details of the position will be provided during a personal interview. Applicants are requested to outline their qualifications in detail, incorporating in their reply their home address and a telephone number through which they can be contacted during the day. File No. 4802-V.

MECHANICAL ENGINEER required by manufacturer in Montreal of air handling, automatic control equipment, etc., to act as sales engineer. Applicant should have some experience, not necessarily sales work. Excellent offer. File No. 4806-V.

PROFESSIONAL ENGINEER preferably mechanical but not necessarily required by real estate organization. Age 40 to 50 years with experience where work would result in the greatest general knowledge of different types of industry, or allied work. Ability to meet and sell senior industrial executives. Group commission plan. Applicant will be trained to become assistant manager of the department. Location Toronto, a knowledge of the Toronto area would be helpful. File No. 4821-V.

MECHANICAL ENGINEER REQUIRED BY LARGE world-wide industrial organization. Experienced design engineer on heavy forging operations. Applicant should be between 30 and 45 years of age and have a sound knowledge of manufacturing methods. Position with Head Office of company situated in Toronto. Salary in accordance with the responsibility of the position. File No. 4824-V.

MECHANICAL ENGINEER required by architectural firm in Winnipeg. Must be able to handle design for heating, ventilating and plumbing equipment for a wide range of building types. Excellent opportunity with a young progressive firm for the right man. Write giving full details of training and experience. File No. 4826-V.

MECHANICAL ENGINEER $6,420 to $7,200 department of public works, Ottawa. Details and application forms at your Civil Service Comm. Office, National Employment Office, Post Office and University Placement Office. Quote competition No. 54-1202. File No. 4805-V.

### MISCELLANEOUS

GEOLOGISTS OR GEOLOGICAL engineers with a minimum of 5 years experience in geological exploration in Western Canada and/or Northwestern U.S. required by consulting firm. Must be qualified to assume complete responsibility of large exploration projects involving photogeological techniques. Occasional field work only. Top salary to qualified applicants. File No. 4758-V.

UNIVERSITY GRADUATE in electronics or applied physics required to act as assistant (technical) to the sales manager of a medium sized company engaged in the development and manufacture of advanced defence apparatus and systems. To draft specifications, prepare technical requests, edit instruction manuals, catalogues, price lists, etc. Work is concentrated in Montreal. However, there is a possibility of frequent travel mainly in Quebec and Ontario. File No. 4763-V.

YOUNG CIVIL OR mechanical engineer required by a pulp and paper company in Quebec. Applicant should have a minimum of three years experience in engineering and maintenance preferably in the pulp and paper industry. Applicant should be fluent in either French or English and should be able to get along in both. Replies should outline qualifications, experience, age and salary expected. File No. 4768-V.

SALES ENGINEER required by firm located in Montreal. Applicant should be acquainted with combustion lines, have sales experience, entries to architects, consulting engineers. This position could be either full or part time on a commission or drawing account basis or other arrangements could be made after discussion. File No. 4771-V.

MACHINERY MANUFACTURERS' agents require sales engineer preferably bilingual to cover Quebec and S. Ontario. In applying indicate knowledge of previous sales experience and territory covered. File No. 4776-V.

THREE ENGINEERS REQUIRED by manufacturer of multiwall kraft bags and related paper products, 1954 graduates to 6 years of experience. Training period in Montreal. Subsequent work in variety of locations. File No. 4777-V.

CHEMICAL OR MECHANICAL engineer required for coal preparation research. Experience in coal cleaning, especially with driesson cyclones and dense media desirable but not essential. Starting salary will depend on training and experience and will be in a bracket of $4,000 to $5,000 per annum plus cost of living bonus based on the consumer's index. The present bonus approximates $300 annually. Apply with all particulars, recent photo and addresses for reference. File No. 4778-V.

ENGINEER REQUIRED BY manufacturer located in Maritime Province planning to enlarge research facilities. Applicant should have been connected with the chip board companies in Europe and have sufficient technical knowledge and related experience to proceed along certain lines of development. File No. 4782-V.

CHIEF ENGINEER and director required by structural engineers Toronto. Applicants must be structural engineers specialized in design and full control of drawing office for many years in position of entire responsibility for the design of work of great magnitude in both reinforced concrete and structural steel. Suitable age between 35 and 45. File No. 4785-V.

CIVIL ENGINEER required by private consultant located in Ontario. Requirements are at least five years experience engineering. Preference will be given to applicant having commission as land surveyor. Salary $4,500.00. Please state age, education and experience to fullest extent and ability. File No. 4786-V.

SENIOR ENGINEER, quality control university graduate in engineering physics, electrical engineering or mathematics and physics, majoring in electronics. 5 years experience in radio manufacturing preferably in a technical function. Knowledge of shop methods and inspection practice. Familiarity with all types of radio technical equipment. Knowledge of radar and especially in testing. File No. 4787-V.

ENGINEER REQUIRED with experience in structural steel for design and sales work, by steel fabricator in Montreal. Salary open depending upon qualifications. File No. 4790-V.

DESIGN ENGINEERS, experienced in the engineering design of aircraft instruments and accessories or equivalent industrial products, required to join a small progressive company located in Montreal. Excellent working conditions and benefit plans. Apply outlining qualifications and salary expected. File No. 4796-V.

SALES ENGINEER required to join a small progressive company located in Montreal. Experienced in the field of aircraft, radio, instruments, electrical accessories or oxygen equipment. Permanent positions. Apply outlining qualifications and salary expected. File No. 4796-V.

GRADUATE ENGINEER to fill the position of Plant engineer, and should have some product design and cost estimating experience. Plant maintains press, foundry, plating, wire forming, etc., facilities. Location Province of Quebec. File No. 4797-V.

THE COMMUNITY PLANNING ASSOCIATION of Canada invites applications for the principal staff position in its national office. Applicants should have a general knowledge of community planning and municipal affairs, and must have an ability to prepare information and publications on planning subjects in non-technical language. Applicants need not possess professional qualifications as planners. The salary will be commensurate with the qualifications and experience of the person appointed. File No. 4800-V.

SALES ENGINEER for field work to represent manufacturers agency selling original and maintenance equipment used in mines, paper mills and heavy industry. Company operating in Northern and Northwestern Ontario, also Northwestern Quebec. Progressive training for suitable applicant. Technical, mechanical maintenance or mill experience desirable. Submit record of education, experience, references and photograph, to File No. 4803-V.

CHEMICAL OR MECHANICAL ENGINEER with from two to five years experience on industrial maintenance work. The position is in the maintenance department working as a project engineer on projects on the maintenance of the buildings and equipment of the plant, including some design work in the nature of alterations and improvements. Location P.Q. File No. 4808-V.

CIVIL OR MECHANICAL sales engineer required by manufacturer's agent for a complete new line of diesel explosion pile drivers and explosion transfers in all provinces. This is an opportunity with great prospects for a man familiar with construction work. Applicants should be capable of giving technical advice on machines and attachments for construction work. Applicants should also be able to plan a sales programme on a province wide basis. Reply giving full particulars including references in first letter. File No. 4809-V.

SENIOR DESIGNER required for work on steam boilers and associated equipment. Applicants should have 3 to 5 years recent experience in this field. The work will include the detailed handling of contracts, and the design work necessary for the preparation of proposals and specifications. The applicant should be conversant with heat transfer as it relates to steam power equipment. A knowledge of work on pressure vessels and heat exchangers will be desirable. Location Toronto. File No. 4810-V.

QUALITY CONTROL SUPERVISOR required in Montreal. A Canadian manufacturer of fibres, adhesives and plastics is seeking a graduate engineer with industrial experience in quality control and knowledge of statistical methods. This key position with a future requires a man with ability to plan, organize and supervise all of our quality control activities and to carry out liaison work with our American parent companies. Bilingual required. Salary will be negotiated. All inquiries and applications will be treated in confidence. Please send a complete resume of your educational background, work experience, personal data and references etc. to File No. 4813-V.

FEDERAL CIVIL SERVICE requires a number of engineers for employment as patent examiners at Ottawa to undergo training in patent law and patent regulations in force in Canada, and then to assume the responsibility for the examination of applications for patents in the field of engineering with a view to making recommendations for the award or denial of patents. The desirable qualifications include a bachelor's degree in applied science with specifications in mechanical, chemical or electrical engineering from a university of recognized standing. File No. 4815-V.

ENGINEERS ARE REQUIRED by the International Economic and Technical Co-Operation Division, Ottawa, Canada, for the Government of India. Mechanical and Civil graduate engineers with particular experience in connection with hydro-electric design, preferably for high dams, having had responsible charge of the work of design groups involving supervision of planning and scheduling work of subordinates and of the execution and adequacy of designs. The Bhakra-Nangal project is a multi-purpose river valley development scheme for harnessing Sutlej River waters to extend irrigation. File No. 4817-V.

SALES ENGINEER required by a growing organization in the compressor and compressed air equipment field. Area would be South Central Ontario. Straight salary basis. File No. 4818-V.



U.N.E.S.C.O. HAS BEEN requested for assistance in recruiting suitable candidates for vacant university professorships abroad. Burma: agronomic chemistry and soil chemistry. India: economics, civil, mechanical and electrical engineer. Indonesia: technological subjects. Israel: hydraulics and/or sanitary engineering, electrical (Electronics and telecommunication), mechanical, mathematics, general mechanics, and oscillations, metallurgy, aircraft structures, aircraft propulsions (applied aerodynamics). Turkey: electro-technics hydraulics (power), roads and communications. construction and building materials. Uruguay: construction of buildings. Venezuela roads and communications, hydraulics (construction), building material and soils. File No. 4819-V.

MANUFACTURER OF complete line of industrial, electrical motor control equipment has just completed a new plant in Galt, Ontario. Competent sales engineers are required for Ontario and Quebec territories. Applicants should have electrical, mechanical or engineering business training. File No. 4820-V.

SALES ENGINEER is required by a prominent Canadian electronics manufacturer. This man must be a recent graduate in physics, engineering physics or chemistry and have sales experience or aptitude. The product is a wide range of high quality electronic research and control equipment and the sales territory includes all Quebec industrial centres with headquarters in Montreal. Reply should include details of age, experience and education. A recent photograph should be included if possible. File No. 4822-V.

ENGINEER REQUIRED WITH experience in methods and standards. Applicant should have a good technical and work shop training with a knowledge of time study. Location Ontario. Manufacturer of machine tools. File No. 4823-V.

STRUCTURAL ENGINEER with a few years experience for consulting office in Montreal. Inside and outside work, design, calculation. drawing and supervision. File No. 4825-V.

THE PAKISTAN INDUSTRIAL DEVELOPMENT Corporation invites applications for position of works manager for their paper mills at Chandraghona. File No. 4827-V.

SENIOR DRAUGHTSMAN: for structural and civil. Draughtsman capable of working up final design drawings from engineering sketches and preparing bills of material for structural and civil projects. Where required he shall be capable of checking or supervising the work of other draughtsmen. Work includes arrangement and details of dams, penstocks, power plants, buildings, etc., including detailing of structural steel, reinforced concrete and piping. Also plotting of maps from field notes. Requires good draughting ability and sound knowledge of work. Location British Columbia. Salary range $250-$325 per month. File No. 4828-V.

INTERMEDIATE DRAUGHTSMAN: for structural and civil. Draughtsman capable under moderate supervision of carrying out the work or parts thereof described for senior draughtsman. Requires draughting ability with fair knowledge of work. Salary range: $200-$275 per month. Location British Columbia. File No. 4828-V.

INTERMEDIATE DRAUGHTSMAN: STATION ELECTRICAL. Draughtsman capable under moderate supervision of working up final electrical station arrangements from engineering sketches, preparing bills of material, switchboard and similar wiring diagrams, and selection of cable and conduit to code requirements. Work includes general arrangement and electrical drawings for hydro and diesel generating stations, substations. Requires draughting ability and basic familiarity in arrangement and wiring of electrical apparatus. Location British Columbia. Salary range $200-$275 per month. File No. 4828-V.

JUNIOR DRAUGHTSMAN: Station Electrical. Draughtsman capable under supervision of carry out work or parts thereof described above for intermediate draughtsman. Requires some experience in electrical wiring diagrams. Location British Columbia. Salary range: $150-$200 per month. File No. 4828-V.

MEMORIAL UNIVERSITY OF NEWFOUNDLAND, St. John's, invites immediate applications for the following position to take effect in September, 1954. Assistant or Assistant Professor in the Department of Engineering. The duties would include lecturing and laboratory supervision. The subjects of instruction are drawing, surveying and mechanics. The university has a liberal pension scheme and a generous sabbatical leave programme. Appointments are provisional for the first two years. Travel expenses to a maximum of $750.00 will be paid. Immediate applications or requests for information should be sent by airmail with curriculum vitae and names of three references. File No. 4830-V.

## SITUATIONS WANTED

BILINGUAL MECHANICAL INDUSTRIAL graduate engineer, age 42 with personality and experience, presently employed. Seeks opportunity where diplomatic ability, technical knowledge could be used in supervisory capacity. All offers considered. File No. 140-W.

SANITARY ENGINEER, Civil engineer, B.Sc., Queen's 1948, M.A.Sc., U. of Toronto 1949, P.Eng., Jr.E.I.C., age 29, single. Four and a half years practical experience in municipal and sanitary engineering. Was chief municipal engineer for one and a half years responsible for design and development of waterworks and sewage projects. Also experienced in supervision of construction of various municipal projects, as well as in administration of a municipal engineering department. Presently employed as design engineer dealing with sewage treatment plants, water works projects, sewer designs, roads and pavements. Am seeking a responsible position, preferably with a firm of consulting engineers where individual initiative, hard work and proven ability will be recognized. Am a member of the Canadian Institute on Sewage and sanitation and the American Waterworks Association. File No. 250-W.

CIVIL ENGINEER AND land surveyor, M.E.I.C., 26 years of varied experience abroad and Canada, in: railroad, airport, road, dam, watersupply, irrigation, building, factory construction and related survey of layouts and location. In charge of survey parties and supervising and directing construction. Service with the Royal Engineers in the Middle East and East Africa. Married, bilingual. Seeks responsible position in Ontario or Quebec, where experience will be of value. File No. 489-W.

MECHANICAL ENGINEER, M.E.I.C., with apprenticeship and university background available for responsible position, on reasonable notice. Interested in representing manufacturers wishing to develop and service markets in Canada or abroad. Experience includes design, construction and maintenance in the pulp and paper industry; several years handling sales of power plant equipment. Working knowledge of French and German. Free to travel. File No. 2642-W.

MECHANICAL ENGINEER, graduate 1944, single, age 34, with experience in mechanical and industrial engineering. Administrative and supervisory experience with responsibility at management level. Assistant plant manager, maintenance supervisor, plant engineer and industrial engineer in welding industry, heavy equipment, printing industry. Cost study, wage incentives, production control, plant layout, and time study. Seeking opportunity to join progressive firm in engineering, production or plant. File No. 2920-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (EE), Manitoba 1950, age 30, married, one child. 1½ years experience on induction motor design. Over 2 years experience in the supervision of transformers. Also gained experience in the specifying and supervision of installation of new testing equipment. Interested in securing a responsible position in Western Canada with either a manufacturing firm, a utility, or a governmental branch, preferably in Regina or Winnipeg. Available on one month's notice to present employer. Complete qualifications upon request. File No. 3309-W.

GRADUATE MECHANICAL ENGINEER, Sask. 1948, Jr.E.I.C., married, R.C.A.F. veteran. Three years experience in production control, method analysis, time study, cost control and industrial relations. Also some experience in steel mill maintenance. Three years experience on construction jobs supervising mechanical installations including heating, ventilating and plumbing trades, boiler installation, water treatment and mine installations. Desires position with firm requiring above mechancal experience and/or opportunities for design with consultant firm, preferably in central Canada. File No. 3516-W.

MECHANICAL ENGINEER, Queen's 1944, M.E.I.C., P.Eng., married, age 34, eight years experience as plant engineer, including planning, design, erection and maintenance on process steam, refrigeration, air conditioning systems, seeks employment in plant engineering, preferably, but not necessarily, in smaller city or town in Ontario or Western Canada, with growing company. Available on three months notice. References include present employer. File No. 3935-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., 1950 honours graduate, age 27, married. One year's experience in the operation and administration of a small railway system including some supervision of personnel. Three years experience on layout and design of machinery utilizing air, hydraulic and electrical power supplies, and the setting up of controls for same. I have been responsible for the planning, layout, design and field installation of equipment in several large plants. Interested in a position involving design and development work, production engineering or plant engineering with the opportunity to take on responsibility. File No. 3975-W.

ENERGETIC YOUNG civil engineer, M.E.I.C., P.Eng., single. Varied heavy construction experience: pulpmill, steam and diesel plants, docks, houses, barracks, hangars, runways, highways, sewer and water systems, surveying. Finishing assignment as resident engineer on $16,000,000 project. Available for responsible position, field or office. File No. 4015-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng., 1949 graduate. Experience undergraduate, 3 years electronics. Postgraduate, 1 year electronics, 2 years steam power plant operation, 2 years construction, operation and maintenance of hydro-electric plants, transmission and distribution systems, substations. Age 32, married, 1 child. Desire change of location. File No. 4124-W.

ELECTRICAL ENGINEER Jr.E.I.C., B.A., Sc., U.B.C. 1950. Age 29, married, 2 children. Two year graduate training course with large electrical manufacturer. 14 months pulp and paper experience including maintenance and new installations. Desires position with more responsibility. File No. 4153-W.

CHEMICAL ENGINEER, Queens' 1949, Jr.E.I.C., veteran, 33, married. Three years supervisory experience in the development, control and production phase of a large chemical plant. Desire the same type of experience in another manufacturing field. Canadian or Foreign. File No. 4166-W.

CIVIL ENGINEER M.Sc., M.E.I.C., P.Eng. (Ont.), graduated 1947 is available. First class designer of all types of modern structures, inventive, enterprising and with flair for structures involving complex statistical problems. File No. 4173-W.

MECHANICAL - CHEMICAL ENGINEER, (M.Eng. Dresden-Karlruhe) M.E.I.C., P.Eng. Former lecturer at McGill. 15 years experience as plant engineer and assistant manager in heavy industrial and chemical plants. Process and design for chemical plants. Bilingual. Single. Location anywhere. File No. 4183-W.

CIVIL ENGINEER B.A.Sc., P.Eng., Jr.E.I.C., seeks position with contractor or manufacturer. Five years concentrated experience civil and mechanical design, estimating, supervision. Am interested in position with opportunities in Ontario. Presently employed. Available upon reasonable notice. File No. 4191-W.

MECHANICAL ENGINEER, B.Sc., University of Saskatchewan, 1950. Jr.E.I.C., age 28, married. Have been doing plant engineering work since graduation. Desire position with opportunity, location not important. File No. 4328-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Eng., power option, McGill, 1950. Age 32, bilingual, single. Post graduate experience includes two year industrial training course and engineering sales work with large electrical manufacturing company. Also possesses B.Sc. in physics and background of diversified experience. Presently following evening courses in business administration. Desires position with responsibility. Apply to File No. 4343-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng. (Que. and Ont.), married, age 30, presently employed, with 8 years experience ranging from construction of residential, industrial and commercial buildings; design of timber structures including glue laminated members; considerable purchasing cost accounting, job liaison, estimating, and responsibility for complete execution of contracts, desires position where diversified abilities may be best utilized leading to future advancement in responsible position. File No. 4254-W.

CHEMICAL ENGINEER, 1945 graduate M.E.I.C., P.Eng. (Ont.) with several years work in anodizing, lacquering, plating, plastic and metal-spraying, phosphatizing, electropolishing. Particular consideration of corrosion problems in the chemical beverage, textile industry. Has practical experience in managing as well as laboratory work in the field of analyzing and material testing. Did extensive research on chemical durability of lacquers and on adhesion of metals and paints on aluminum and steel. Desires a position in a plant or in a developing and research laboratory. File No. 4359-W

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng., McGill, 1951, power option, seeks employment in construction or manufacturing line. Maintenance and construction experience. Presently employed as resident electrical engineer on large project for a firm of consulting engineers. Location no object. File No. 4202-W.

GRADUATE ENGINEER, B.Sc. Mining Engineer, University of Leeds, England, 1954, Jr.E.I.C. Age 25, married, one child. 18 months experience in municipal and general civil engineering, 8 months mechanical drafting. Desires change to position with a future. File No. 4207-W.

ELECTRICAL ENGINEER, B.A.Sc. (UBC, 1951), age 29, experience: design and development of induction motors, power stations, high voltage switchgear, surveys of manufacturing and test facilities, training course with large manufacturer; desirous of improving present position; supervisory, administrative, junior executive jobs preferred. File No. 4239-W.

ELECTRICAL ENGINEER, B.E. (University College Dublin) Associate Member Institute of Civil Engineers of Ireland. Age 34, married, with children. Nine years experience with electricity supply organization. Experience mainly in electrical distribution design and construction overhead and underground networks. Arriving Canada March or April. Seeking interviews for position as distribution engineer. Location unimportant. File No. 4400-W.

CIVIL ENGINEER, B.E. (National University of Ireland), Jr.E.I.C. Two years experience in structural steel design; 6 months with Canadian structural firm; also worked for short time on traffic survey. Presently employed (Montreal) in job requiring very little engineering training. Desires position offering experience in various branches of municipal engineering. Taking course leading to A.M.I. Mun.E. Location of little importance. Available on reasonable notice. Age 23, married. File No. 4401-W.

ELECTRICAL ENGINEER, B.Eng. (Hons)., M.A.Sc., M.E.I.C., P.Eng., age 35 married and presently completing eighth year as Professor of Electrical Engineering. Has taught many different courses on senior and graduate level with emphasis in power. Broad general experience in construction, public utility work and as a naval officer. Has done considerable consulting work of general nature. Seeks appointment which should offer a broad challenge in keeping with background proferred. File No. 4402-W.

DIPLOMA ENGINEER, Mechanical, P.Eng., M.E.I.C., with comprehensive technical knowledge, creative ability and 18 years experience in design and manufacture of diversified machinery and devices such as power shovels, hydraulic presses, aircraft engines, pumps, machine tools, electric automatic controls, welded products, as well as experience in organizing and managing plants with up to 5,000 workers, economical minded with mature judgment, at present engaged in machine tool development seeks a position with a progressive company where his past experience could be utilized best. File No. 4403-V.

CIVIL ENGINEER, B. of Sc. in Eng. M.E.I.C., P.Eng., Danish citizen, age 46, married seeks responsible position with future possibilities. Over twenty years experience in all sorts of heavy construction: roads, concrete pavings, excavation, dikes, sewers, reinforced concrete: bridges, piles, buildings, hangars. Design. Fully familiar with administration and thoroughly experienced in preparation, organization and supervision of construction. Preferably in larger city. Available on approximately one month's notice. Future possibilities will be considered more than starting salary. File No. 4409-W.

PROFESSIONAL ENGINEER (Ont.) B.Sc. (E.E.) U. of Manitoba, veteran, age 28, married 2 children, Canadian Westinghouse Training course. Nearing completion of post-graduate work in Business Administration, consisting of evening classes leading to M. Com. Presently employed as project engineer responsible for co-ordination of all phases of manufacture of projects. Desire responsible position in administration or production. File No. 4404-W.

CIVIL ENGINEER, B.Sc., Jr.E.I.C., now employed with 3 years' foreign experience, construction and structural design (reinforced concrete) and one year Canadian experience in building construction and draughting (not in structural design) is seeking a junior position with prospects in structural design, preferably in Toronto. File No. 4407-W.

ELECTRICAL ENGINEER, Jr.E.I.C., U. of Alberta, 1949, veteran, age 33, married. 1½ years in industrial and commercial construction, 3 years design and development of power plants for large communication company. Experienced in electrical controls. Prefer Alberta or B.C. but willing to locate anywhere if work is interesting and has advancement possibilities. File No. 4411-W.

CHEMICAL ENGINEER, S.E.I.C., Jr.C.I.C., B.Sc. (Queen's 1952) single, age 22, desires position with responsibility in industry or technical sales. Three years summer employment in the paper industry. Have two years municipal engineering administrative experience working with senior executives and meeting the public. Location headquarters preferred in E. Ontario. File No. 4414-W.

SANITARY ENGINEER, M.A.Sc. University of Toronto as of April 1954, S.E.I.C., B.Sc. (C.E.) University of Manitoba 1952. One year's experience in building construction. Desires position offering experience in sanitary or Public Health Engineering. Location immaterial. Available beginning of May. File No. 4415-W.

OVERSEAS POSITION preferred by graduate chemical engineer, Jr.E.I.C., McGill 1949, war veteran. Considerable experience in mechanical work such as all phase of design fabrication and erection of heavy structural, plate and mechanical products. Also process plant experience and considerable customer contact experience. Presently employed in a supervisory capacity. File No. 4416-W.

MECHANICAL ENGINEER, B.Sc. 1st class hons. Ph.D. (Durham) G.I. Mech.E., married, age 24, recently arrived from England seeks position in development or production. Experience includes 18 months in general engineering and 3 years supervision and direction of a research project in the field of applied thermodynamics. Training includes stress analysis, gas and fluid dynamics and industrial management. Has also had experience in writing and editing reports and publications. Available immediately, location anywhere. File No. 4417-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950 graduate, Toronto, veteran, 32, single, some research experience, over three years in chemical industry on project and design work, involving process and services equipment and piping, instrumentation and building construction, including some estimating, purchasing, expediting and inspection. Desires position of greater responsibility in similar work or in maintenance work of a general nature. File No. 4418-W.

CIVIL ENGINEER, B.Sc. C.E. U.N.B. 1950, Jr.E.I.C., age 30, married. 4 years experience as construction engineer on highways, including reinforced concrete bridges. 2 years in charge of building construction, including sewage disposal systems, water supply, etc. One year as design engineer of municipal street layout, landscaping, etc. Available on short notice anywhere in Canada. File No. 4419-W.

CIVIL ENGINEER, D.L.C. Hons. (Civil Engineering), M.E.I.C., P.Eng. (Ont.), Grad. Inst. Struct. Eng., awaiting election to A.M.I.C.E., age 23, single. 6 years experience on construction of dry dock and deep-water quay, power station, airfields, bridges, roads and railways, survey, design of steel-piled cofferdams, track layout and construction schemes. Responsible for supervision of layout, construction, concrete inspection, pile-driving, underwater drilling, pressure grouting, test boreholes, diving operation, measurement of quantities and cost reports. Presently employed as area engineer on construction of chemical plant. Desires position of responsibility suitable to past experience. Location — anywhere in Canada. File No. 4420-W.

ADMINISTRATIVE ASSISTANT, B.Eng., Jr.E.I.C., McGill, age 26. Experience includes time and methods study, job classification and plant engineering. Presently graduate student in business administration at University of Toronto. Desires position as staff assistant to an executive in a company in Toronto. Available in May. File No. 4421-W.

MECHANICAL ENGINEER (McGill-1951), Jr.E.I.C., single, age 27. At present attending Graduate School of Business Administration (Western). Two years experience in engineering department of a newsprint mill, layouts, maintenance, reports, budgets, field work and 4 summers varied experience in construction, manufacturing, etc. Seeking employment with medium or small sized manufacturing concern. Location preferably Ontario. Available mid-May. File No. 4423-W.

MECHANICAL ENGINEER, bilingual, M.E.I.C., P.Eng., age 41, M.Sc. 1938 veteran, presently employed. 16 years diversified technical experience in Air Force and industry, including 6 years Canadian experience in design and maintenance of steel mill equipment, structural steel, piping, handling equipment, transmissions, plant layouts, reinforced concrete, building, etc., desires position requiring initiative, organizing and supervisory ability. File No. 4425-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Eng, Nova Scotia Technical College 1952. Age 28, married, one child. Presently engaged as electrical inspector with corps of engineers, U.S. Army on defence projects in Labrador. Duties include diesel and steam power plants, power transmission and distribution facilities and the installation of electrical equipment in connection with extensive P.O.L. distribution. Have open mind regarding position offered. Foreign location preferred. Available upon reasonable notice to present employer. File No. 4428-W.

CIVIL ENGINEERING GRADUATE (B.Sc. St. Andrews University, Scotland) 1953, with some field experience, desires position anywhere in Canada. File No. 4429-W.

ENGINEERING PHYSICIST, M.Sc. (Physics) Delft U. (Netherlands) 1950, B.Sc. (Electrical Engineering) 1936, 7 years service and sales engineering of medical X-ray equipment, 2 years development of X-ray tubes, 3 years electrical and electronic instrumentation in university lab, 4 years representation of large European manufacturer of radio and electronic equipment, electron tubes and electronic components in national and international electro technical standardization committee. Experienced secretary of international technical conferences, good specification writer, fluent English and German, working knowledge of French. Married, three daughters. Detailed resume on request. Interview preferably in first week of April. Location Western Canada or Southern Ontario. File No. 4430-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.A.Sc., University of British Columbia 1951, single, age 35. Seeks position in communications in British Columbia. Two years experience in meteorology and marine and aviation radio communications prior to graduation. Post graduate experience; 1¾ years of development, production, and maintenance engineering in quartz crystals manufacture; 1 year development work on microwave equipment. File No. 4431-W.

MECHANICAL ENGINEER, P.Eng., G.I. MechE., single, age 27. Experience: 2 years general workshop practice including overhaul of steam and diesel engines and factory machinery repair. 18 months machine and structural design and draughting. Desires work on production or plant maintenance in Montreal or B.C. File No. 4436-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., age 32, married, bilingual. Seven years varied experience in electric generation and distribution. Some familiarity with relays. Good mathematical background. Desires opportunity to train as relay engineer with large utility. Would consider attending G.E. or Westinghouse relay course and willing to sacrifice for this opportunity. Location no object. File No. 4437-W.

ELECTRICAL ENGINEER, M.E.I.C., A.M. I.E.E., British, 37 years of age, with considerable experience in the design and development of naval and associated installations, also in testing of all types of shipboard equipment and preparation of test programmes, data, etc.; and also having considerable experience of servo mechanisms and other remote control devices, including railway power signalling systems; having been responsible at various times for preparation of specifications, quotations, purchase orders, estimates, etc.; and having supervised the activities of junior engineers, draughtsmen, technicians and electricians in various capacities; seeks a lucrative and responsible post in August, 1954. Will serve anywhere, and would be fully prepared to travel extensively, if necessary. Seeking a post which will lead to a senior position and permanency. File No. 4441-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., married. 20 years experience industrial equipment layout, mills crushing plants, smelters, handling equipment, design and supervision of design and construction. Two years plant engineer. Location preference Toronto area. Desires position in engineering office as supervisor or assistant in plant layout and design. File No. 4442-W.

CIVIL ENGINEER, M.Sc., 1931, Technical University of Warsaw, A.M.I. San.E., war veteran, age 48, 15 years experience in hydraulic works, water supply and sewerage, formerly residing in Great Britain and nearly one year in Canada. Seeks position with a municipality or a firm which offers a good opportunity for advancement. Location secondary, available in two weeks notice. File No. 4443-W.

MINING ENGINEER, P.Eng., in Alberta, M.E.I.C., Jr.C.I.M.M., graduate 1951, age 30, married, veteran. Practical experience in steel work in shipyards, carpentry, contracting and sales. 2 years experience in geophysics for major oil company. Experience in water and sewerage systems and mining exploration. Highest references. Very versatile. Desires permanent position with responsibility and advancement. Preferably in Alberta. File No. 4445-W.

CIVIL ENGINEER, M.E.I.C., B.Sc. Eng. U.K. P.Eng., Ontario, veteran Royal Navy, married, age 30, five years experience (approximately one year in Canada), layout and design of roads, storm and sanitary sewers, some design of reinforced concrete and steel bridges and structures, desires responsible position where above experience an asset. Available on one month's notice. Location immaterial. File No. 4447-W.

ELECTRICAL ENGINEER, Jr.E.I.C., 31, McGill 1950, P.Eng. (Ontario), 3½ years experience in electrical layout and design of plant distribution and services and design of automatic sequencing control for process equipment in automotive industry, desires work with consulting firm or industry with diversified and interesting work. File No. 4448-W.

ENGLISH CIVIL ENGINEER, B.Sc. (Hons.) A.M.I.C.E., aged 27. Hoping to emigrate to Canada with wife in May, desires responsible job in connection with the design of water supply and sewage schemes in which he has experience. Would also consider site control work in this field and would prefer to work in Vancouver district although other facts considered. File No. 4449-W.

CIVIL ENGINEER (M.Sc., P.Eng.), University of Warsaw, Poland, age 41, presently employed. Twelve years successful experience in structural designing, which includes 8 years of site supervision. Seeks opening with progressive firm. Specialist in prestressed concrete. Bilingual. Three years Canadian experience as senior designer. Available on short notice. File No. 4450-W.

CONSTRUCTION ENGINEER, M.E.I.C., age 45; no dependents. 30 years general construction and mechanical experience, 21 since graduating, 10 years sales. Now completing an operation. Free to travel or relocate anywhere, Canada or foreign. Prefer north country, frontier or foreign —general construction—townsite—supervisory. File No. 4451-W.

CIVIL ENGINEER, S.E.I.C., B.Eng. McGill 1953, with construction and field work experience, seeks position in the field preferably on construction. Single, willing to work anywhere in Canada. File No. 4452-W.

CIVIL ENGINEER, Jr.E.I.C., N.S.T.C. 1952, veteran, age 28, married. Approximately one year experience in surveying and drafting for road construction job, and one year working with municipal type of construction and maintenance. Seeks employment with either consultant engineer, municipal engineer, or town planner, doing calculations, designing, and drafting. The possibility of technical experience derived is of paramount importance. File No. 4454-W.

CIVIL ENGINEER, N.S.T.C., 1949, M.E.I.C., P.Eng., provincial land surveyor of Nova Scotia and New Brunswick, age 27, veteran, married, 2 children. Experience survey of naval base construction; instrumentman on construction of train boat gypsum disposal plant, topographical survey; resident engineer on construction of services for 100 houses project; 3 years resident engineer on highway construction, both subgrade and pavement; 1 year office engineer on materials takeoff, ordering, and control; 1 year design of industrial buildings, municipal services, specification writing, project supervision. Present work expected to terminate in May. Prefer construction or associated work with a good future. File No. 4455-W.

EXPERIENCED CONTROL ENGINEER, B.Sc. electrical engineering, Laval University 1947. One year post graduate studies in servomechanisms electronics and network theory, Ohio State University. Age 30, married. Six years experience in U.S.A. on design and development of control systems such as autopilots, remote flight control systems, speed and voltage regulators for inverters and air turbine driven alternators. Also design experience on magnetic amplifier, circuits. Canadian citizen desires to return to Canada and will consider any reasonable opening with Canadian firm. Would prefer position involving both administrative and technical duties and a certain amount of travel. Preferred location Montreal area. File No. 4461-W.

MECHANICAL ENGINEER (Technikum Winterthur, Switzerland, grad. 1949), 29, married. Experience in welding, design and estimating of pressure vessels, platework, piping. Completely familiar with ASME and API codes, high pressure water tube boilers. Capable of supervision desires responsible position in office or shop, vicinity of Edmonton, Calgary or Vancouver. File No. 4465-W.

CIVIL ENGINEER, Jr.E.I.C., now interested in broadening his background. Five years experience in surveying for many purposes, including construction and pulp and paper manufacture. Very much interested in design. Available April 30th. File No. 4466-W.

CIVIL AND STRUCTURAL ENGINEER, M.A., Cambridge University, graduated 1947, professional Engineer (Ontario). Jr.E.I.C., 6½ years experience civil and structural engineering in industry, consulting engineering and research. First class administrator with considerable organizational experience. Expert in structural analysis and design in both steel and concrete. Specialist in prestressed concrete. Presently employed in Toronto, and would prefer to remain there, or would represent Canadian organization in England. Position of responsibility required, where good use can be made of organizational ability and where there is opportunity for advancement. File No. 4467-W.

MECHANICAL ENGINEER, married, age 43, M.I.M.E., Ch.Eng., attached to Dutch Merchant Navy during second world war. Twenty-five years experience in construction, operation and maintenance of high pressure steam plants, turbo generators, diesel engines and refrigeration plants. Available on one month's notice. File No. 4468-W.

CIVIL AND SOIL MECHANICS ENGINEER, Jr.E.I.C., B.Sc. with post graduate studies. Age 34, married, 3 children, R.C.A.F. veteran. 6½ years experience. Experienced in organizing soil mechanics laboratories, lab testing, interpretation of laboratory results. Slope and slide investigations. Supervision of drilling and foundation investigations for dams, buildings, highways. Earth and concrete materials investigations. Retaining walls, earth and concrete dams. Tunnelling in clay. Deep shafts in clay and gravel. Studies in open channel flow. Reinforced concrete. Reports, design and supervision of construction. Mathematically inclined. Some knowledge of German. Available after May 15th. File No. 4469-W.

BRITISH GRADUATE (Electrical) 45 years of age, married, 1 child, 5 years in Canada; P.Eng. M.A.I.E.E., M.E.I.C., etc., formerly specialist in electric traction but very adaptable and with wide experience in other engineering realms; has initiative, pleasing personality, good contact man; possesses diploma in salesmanship; good liaison engineer, correspondent, writer of specifications, reports and articles; highest references, desires scope for advancement; now resident near Montreal. File No. 4470-W.

GRADUATE MECHANICAL ENGINEER, 34 years of age desires position where high quality design work is appreciated. Experience as follows: Internal combustion engines, 3 years; chemical plant machinery, 3 years; agricultural machinery, 2 years, at present mining equipment. File No. 4471-W.

MECHANICAL ENGINEER SASK. 1947, Jr.E.I.C., P.Eng. (Que.), age 31, with 7 years experience sales and application heating, ventilation and air-conditioning with large Canadian firm. Industrial consulting and public building mechanical specifications. Desires position with consulting engineers or architects. Location Ontario or Western Canada. Available on reasonable notice to present employer. File No. 4472-W.

ELECTRICAL OR MECHANICAL SALES. P.Eng. S.E.I.C., B.A.Sc., U.B.C., mechanical 1951 Graduates test course with C.G.E. One year preparing for outside sales, over one year successfully selling full range of electrical power apparatus in Toronto and Western Ontario for large nationally known electrical manufacturer. Experience with steam turbines, pumps and various other types of mechanical equipment. Excellent executive valuation report, together with business and education resume sent on request. Desire position leading to outside sales work or managerial position with progressive company in British Coulmbia or Alberta. File No. 4473-W.

RESPONSIBLE POSITION WANTED by graduate chemical engineer, McGill 1949. Presently employed by pulp mill engineers, supervising field and layout work. Veteran, age 32, with industrial and direct selling experience. Has proven initiative and willing to accept responsibility. Desires position providing executive training and a challenge. File No. 4474-W.

ELECTRICAL ENGINEER, graduate 1949, power and machinery, Edinburgh, Scotland. M.E.I.C., Grad. I.E.E., Whitworth Prizeman, married, two children. 5 years electrical engineering apprenticeship. 3 years electrical draughting. 3 years electrical engineer. Experience on rural and urban distribution; construction, maintenance and operation; H.V. and M.V. lines, cables, substations and associated gear; estimating, profile surveying, pressure testing, fault location etc. Also inspection, testing and maintenance of all types industrial electrical machinery and cabling in paper mills, quarries and other industry; ie. generators, motors, switchgear, transformers, elevators etc. Desires employment on either distribution work, plant maintenance or with consulting engineer, commencing beginning of September. File No. 4475-W.

CHEMICAL ENGINEER B.A. 1937, B.A.Sc. 1939, U.B.C., P.Eng. (Ont.), member of the Chemical Market Research Association, married with 2 children desires responsible position in chemical or allied industry. Diversified experience in explosives, pulp and paper and plastics. Most interested in development type of work or production. Well experienced in preparation of reports on markets and economics. Resume of experience on request. File No. 4476-W.

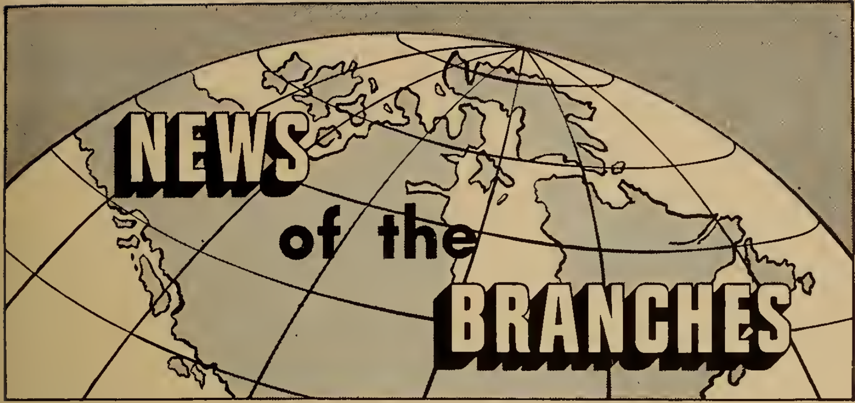
CIVIL ENGINEER, P.Eng., Jr.E.I.C., with two years experience in reinforced concrete, detailing and design. Seeks part time employment in Montreal area. File No. 4477-W.

MECHANICAL ENGINEER, graduate Nova Scotia T.C. 1946, M.E.I.C. and eight years experience in design, application and installation of heating, ventilating, air conditioning and combustion equipment. Desires change of employment where past experience could be best utilized. Location preferred Ontario or Quebec. File No. 4478-W.

EXECUTIVE MANAGEMENT career development desired by Chemical Engineer, M.E.I.C., age 37, married, no children. Strongest capabilities are organization, administration, adaptability, and effective contacts. Successful and well-rounded experience in operations, technical control, research and development, and management techniques in major manufacturing industry. Seeks challenging opportunity as manager, assistant, or equivalent, with progressive enterprise willing to delegate responsibility upon proof of ability. File No. 4482-W.

MECHANICAL ENGINEER, M.E.I.C., graduate of Delft Institute of Technology, Holland. 20 years experience, particularly in boiler houses, steam and condensate handling, instrumentation, watertreatment, air handling, plant layouts. Also office management, business administration, sales promotion. Seeks senior position with manufacturing concern, consultants or sales organization. Sound Canadian practice. Bilingual. Location anywhere in Canada. File No. 4483-W.

MECHANICAL ENGINEER, 1947, P.Eng., M.E.I.C., with 6 years experience as sales engineer handling mining, contracting, industrial and pulp and paper machinery, desires position of expanded responsibility in sales field or with mechanical maintenance department of industry. 34 years old, married. File No. 4484-W.




**Activities of the Forty-seven Branches of the Institute and abstracts of papers presented at their meetings**

## Brockville

J. G. Kerfoot, m.e.i.c.,
*Secretary-Treasurer*

J. F. Preston, jr.e.i.c.,
*Branch News Editor*

***The First Meeting***

On Tuesday, March 2, the Brockville Branch held its first meeting in the Manitonna Hotel. Brigadier Quilliam, retired British Army officer, gave an interesting lecture on the Middle East. This was a very timely topic in view of the situation that presently exists in that part of the world. After the speech there was a lively question period and the brigadier gave excellent answers to all questions. At the conclusion a buffet supper was served.

The total turnout amounted to thirty-one members, including one who came from Cardinal. It is hoped that there will be a better turnout for the meeting to be held on March 24.

## Lethbridge

R. D. Hall, jr.e.i.c.,
*Secretary-Treasurer*

Paul Harding, jr.e.i.c.,
*Branch News Editor*

***Joint Meeting***

The annual joint dinner meeting of the Association of Professional Engineers of Alberta, and the Lethbridge Branch E.I.C. was held at the Marquis Hotel, Lethbridge on January 29, 1954.

The chairman of the meeting was J. J. Hanna, president of the A.P.E.A. Other out of town officials of the Association present included J. F. McDougall, registrar and A. E. McDonald, executive secretary.

L. A. Thorssen, vice-president of the association introduced the guest speaker, Donald Cameron, director of extension, University of Alberta.

In his address, Mr. Cameron stated that there is an increasing realization on the part of business and industry that if they are to meet the challenge of today they must equip themselves as well as they can.

The tremendous technological advances of recent years have presented a social challenge to business men, Mr. Cameron said. In order to keep up with the changes, many are finding it necessary to go back to school, he said, noting the great increase in short courses now being offered by the University of Alberta.

Mr. Cameron noted the rapid technological advances made by Russia in the past 37 years and told the engineers to "remember that what Russia has done China will do in the same period of time." India would follow them and then other countries which had formerly been regarded as backward.

This "ferment" in the undeveloped countries, he said, was beginning to have a great impact on the thinking of business and of individuals.

There's a need for special preparations for business men to deal with changes in technology and in the impact of government in the world today.

Many were worried about "big government," he said, "but we must recognize that in the kind of world in which we live the impact of government is liable to be greater than less. We must learn how to get along with it and to control it."

The realization of business that special training is needed to meet the new challenges has led to the formation of the six-weeks Banff School of Advanced Management and to the numerous short courses offered by the university.

The Banff School, he said, was set up as a practical course for business-men with practical experience. Most of the work is done by the case and seminar method giving the men experience in working out actual business problems.

Lecturers, he said, are leaders in their fields and attempts are made to get teachers with practical as well as academic experience.

The school has pioneered in providing courses on the general economic climate in which business is conducted. Top economic advisors in the Department of Trade and Commerce and the Bank of Canada are engaged to teach these courses.

Other courses teach the functions of an executive, marketing, human relations in industry, labor relations, and other business functions, Mr. Cameron said.

Mayor A. W. Shackleford welcomed out of town guests on behalf of the city. He praised the work of engineers but urged them to become more public relations conscious to let the public know the work they were doing.

Dave Cramer, chairman of the Branch, thanked Mr. Cameron on behalf of the Association and Branch members for his very interesting and educational talk.

Dinner music was supplied by the Brown's Orchestra, and W. Kergan favoured the meeting with two solo numbers. Community singing was ably led by R. S. Lawrence.

## Newfoundland

M. A. Foley, m.e.i.c.,
*Secretary-Treasurer*

***Electric Motors in Industry***

The regular monthly meeting of the Newfoundland Branch of the Engineering Institute of Canada was held at Memorial University on Monday, January 11, 1954.

The Branch chairman, C. Knight, introduced the evening's special speaker, Wm. Watson, manager of Canadian General Electric in Newfoundland, who spoke on "The Application of Electric Motors and Their Controls in Industry." He began by outlining the factors governing the selection of the proper motor for any particular application. These are: the source of power available; the size of the load; the starting torque requirements; the speed required; the conditions under which the motor will operate; how it is to be connected to the load; the type of mounting; the ambient temperature; the type of thrust; the accelerating time and the frequency of starting and stopping to which the motor will be subjected. The speaker emphasized that for economy and availability a standard motor should be used whenever possible.

Mr. Watson continued by describing the characteristics of the principal types of a.c. motors, the sub-divisions

## Note

**It was necessary to withhold much of the Branch News received for this issue because of the great amount of space devoted to technical papers. The news items withheld will appear in the May *Journal*.—Editor.**

of each type and the various applications of each. He then described the controls that should be used with induction motors, wound rotor motors and synchronous motors and for different applications of each.

Mr. Watson concluded his talk by telling of the difficulties encountered in motor starting where the power supply is limited as is the case in some of the smaller communities in Newfoundland. He emphasized that in all cases the largest motor should not draw more power than one-quarter of the generator rating and that generators should always be equipped with automatic voltage regulators.

The vote of thanks extended the speaker by C. Henry was heartily endorsed by the meeting.

Following adjournment, supper was served by members of the Engineers' Wives Club.

## North Eastern Ontario

C. D. McCulloch, Jr.E.I.C.,
*Secretary-Treasurer*

***Hon. T. P. Kelly Is Guest Speaker***

The North Eastern Ontario Branch held a meeting on December 12, 1953, at which the Hon. T. P. Kelly, minister of Mines for Ontario was the guest speaker. The meeting was held in the Hotel Iroquois in Iroquois Falls. A total of forty-five members and their wives attended the meeting.

G. M. Lyon, branch chairman conducted the business portion of the meeting and called on A. A. Kidd, M.E.I.C., of Cochrane, to introduce the guest speaker.

Mr. Kelly spoke of the progress made in natural resource industries in Northern Ontario. He referred to the rapid growth of the pulp and paper and mining industries in the north. He commented on the part that the railways and highways have played in this development. Mr. Kelly stated that behind all this progress has been the engineer and that the history of achievement in Northern Ontario has been a story of engineering endeavour.

The speaker was thanked by W. B Hall, M.E.I.C., of Iroquois Falls.

## Saint John Branch

L. L. Marshall, Jr.E.I.C.,
*Secretary-Treasurer*

H. S. Cleave,
*Branch News Editor*

***Joint Meeting***

Members of the Saint John Branch were hosts to the Association of Professional Engineers of New Brunswick, Jan. 28, when a dinner meeting was held at the Admiral Beatty Hotel.

Guest speaker of the evening was Brigadier T. Eric Snow, O.B.E., C.D., who spoke on Camp Gagetown. Augmenting his talk with maps Brig. Snow spoke of the many factors that had made the Gagetown area the logical site of this tremendous camp.

Brig. Snow was introduced by Col. D. F. Seely and thanked by J. M. Redding.

During the evening toasts were proposed to the Association of Professional Engineers of New Brunswick and to the E.I.C.

The Association Scholarship was awarded to E. C. Garland, an engineering student at U.N.B., by J. M. M. Lamb, president of the Association.

R. M. Richardson, chairman of the local branch presided.

Head table guests included: W. M. Brennan, S. W. Emmerson, T. D. Horsler, R. D. C. Clarke, D. O. Turnbull, Brig. T. Eric Snow, R. M. Richardson, J. M. M. Lamb, H. Clair Mott, H. W. MacFarlane, V. M. Blackett, and K. V. Cox.

***Col. Grant Is Guest Speaker***

Col. L. F. Grant, field secretary of the E.I.C. was guest speaker at the Feb. 26 meeting of the Saint John Branch. His subject "The Saint Lawrence Seaway," presented from the historical, rather than the technical point of view was illustrated by slides.

An interesting question and answer period followed the talk.

The meeting was held at the Admiral Beatty Hotel with R. M. Richardson presiding.

On behalf of the members L. S. Mundee thanked Col. Grant.

# LIBRARY NOTES

## Additions to the Institute Library

**Reviews — Book Notes — Abstracts**

## BOOK REVIEW

**Proceedings of the general discussion on heat transfer, 11th-13th September 1951.** London, Institution of Mechanical Engineers, New York, American Society of Mechanical Engineers, 1952. 496 pp., illus., $7.50 (U.S.).

Arranged on a co-operative basis by the Institution of Mechanical Engineers and The American Society of Mechanical Engineers in New York, the object of these general discussions was to review developments in the knowledge of the principles of heat transfer, and in the design of apparatus making use of such knowledge.

A total of ninety-three papers were presented in all. These have been divided into five convenient sections:

1. Heat transfer with change of state.
2. Heat transfer between fluids and surfaces.
3. Conduction in solids and fluids.
4. Radiation, instrumentation, measurement techniques, and analogies.
5. Special problems such as heat transfer in turbine blade cooling, in liquid metals, in gas turbines, and in piston engines, the mercury boiler, and so on.

A total of fifty co-operating institutions took part in the discussions, including the Conference of Engineering institutions of the British Commonwealth, and the Conference of Representatives from the Engineering Societies of western Europe and the United States of America, established in nineteen forty-six and nineteen forty-eight respectively.

The international understanding obviously arising from this meeting was in itself very gratifying to all delegates. But besides this, the ever-increasing importance of heat transfer in the realms of chemistry, petroleum and coal for the higher performance of equipment in industry and the need of more accurate design of equipment made from both costly and scarce materials was a very great incentive.

Discussions and communications are included in the volume, and there is an excellent introduction, and account of the opening dinner. The closing technical session is reported in the last eight pages, made up of discussions of certain points noted during the session which seemed to call for further consideration.

Papers are listed in the table of contents, and authors and participants and subject index follow the text at the back.

This will be an invaluable volume for all our members interested in heat transfer in any of its aspects. E.K.

## BOOK NOTES

**Prepared by the Library**

**The Engineering Institute of Canada**

*Book notes marked by an asterisk have been provided through the courtesy of the Engineering Societies Library in New York.

***The atomization of liquid fuels.** E. Giffen and A. Muraszew. Toronto British Book Service, 1953. 246 pp., illus., $7.25.

This book, based on a survey of published information, is an attempt to picture the whole process by which an initially continuous liquid jet is broken up into a great number of small droplets—a process widely used with liquid fuels for internal combustion engines and furnaces. It deals with the process of disintegration; characteristics of fuel sprays and the effect on these of the atomizer, the liquid, the gaseous medium and injection pressure; the theory of the swirl atomizer; and experimental study methods.

**Ceiling unlimited: the story of American aviation from Kitty Hawk to supersonics.** Lloyd Morris and Kendall Smith. Toronto, Macmillan, 1953. 417 pp., illus., $7.25.

Opening in December nineteen hundred and three, the collapse of the Samuel Pierport Langley's aerodrome into the Potomac river, followed by an account of Wilbur and Orville Wright's epic eight hundred and fifty-two foot flight in fifty-nine seconds, is the reader's introduction to the past half century of flying in the United States.

The Curtiss exhibition flight of nineteen nine, Harriet Quimby, the first American licenced woman pilot of nineteen twelve, Byrd's flight over the North Pole, in nineteen twenty-six, the Lindbergh flight of nineteen twenty-seven, Amelia Earhart's North Atlantic solo flight in nineteen thirty-nine, up to the faster than sound flight by Captain Yeager in nineteen forty-seven, and the combat landing by helicopter in Korea in nineteen fifty-one, all are covered in this quite readable account of American flying progress.

The illustrations are most interesting, photographic both old and new, and, for reference purposes the book is excellently indexed.

***The control of quality in melting and casting.** Institute of Metals. Symposium, March 1953. London, The Institute, 1953. 88 pp., illus., $2.50. (Monograph and report series, No. 15).

These six Institute of Metals papers numbers 1448-1453, with discussion, as presented at a symposium in March nineteen fifty-three cover in the first paper the principles of technical control in metallurgical manufacture, and in the five succeeding papers, the control of quality in the melting and casting of brass ingots and billets, of copper and its high conductivity alloys, of zinc and zinc alloy slabs and billets, of aluminum alloys, and of magnesium alloys.

They are reprinted from the Journal of the Institute of Metals—Ed. note.

**Design for decision.** I. D. J. Bross. Toronto, Macmillan, 1953. 276 pp., $4.75.

Have you ever come across a series of planned decisions for given situations? Do you want to cease cerebrating altogether, and let George, the Super Decision Maker, think for you, with his electronic brain?

Yes, decisions are now being worked out statistically, and rules are being evolved for solutions to situations.

This is a serious presentation, in its way, and chapter heads range from the history and nature of decision; prediction, probability and rules for action, to models and sampling, and statistical inference and techniques.

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### Ordering

Any book or pamphlet may be ordered through the library. All publications of affiliated societies, whether books, pamphlets, or periodicals, should be ordered through the library, as reduced rates are applicable on these to all members. Except in the case of library deposits **please make no payments in advance.** Non-members may consult the library, but may not borrow material. Please address all requests to **The Library.**

A classified bibliography of thirty-eight entries, and an index, increase the usefulness of this strange volume.

**Economic controls and defense.** D. H. Wallace. New York, Twentieth Century Fund, 1953. 260 pp., $2.00 (U.S.).

"The leading questions, still unanswered, are: when is a crisis extreme enough to require controls, and what controls are called for?"

The principal idea in this book is to deal with the problems presented through the use of direct controls in a long defense period. The possibilities and dangers of varying degrees of government controls, over materials, wages, manpower, rationing, and price control are all considered and thoughtfully discussed, and a chapter on basic problems and policies is included, by J. M. Clark, Professor emeritus of political economy at Columbia university.

The principles considered in these pages make food for thought for any country.

**Engineering thermodynamics.** B. E. Short et al. New York, Harper, 1953. 467 pp., diagrs., $6.00 (U.S.).

Essentially a textbook, the material in this volume was collected to be of use to second year students at the University of Texas, in the heat power and thermodynamics course. It presupposes knowledge of calculus, engineering, mechanics, and elementary chemistry and physics.

For practical study purposes, changes from the usual order of presentation will be noted, chiefly that the properties of solids, liquids and vapors are discussed before those of ideal gases, and entropy is introduced early as a basic property and working tool.

Problems are included with each chapter and the book is well indexed.

**The Financial Post survey of mines, 1954.** Toronto, Financial Post, 1953. 382 pp., $3.00.

The 1954 edition of the Financial Post survey of mines reviews the developments in Canadian mining in 1953, and forecasts a continuation of the record-making expansion of that year for 1954.

The new and expanding projects contributing to this record output are mentioned: Labrador-Quebec iron ore, Lynn nickel, Eldorado's Ace uranium mine, Steep Rock, Beaverlodge, and many others.

There is an interesting list of the price range of Canadian mining stocks and of metals during the year. The major part of the book consists of a list of the mining companies in Canada, arranged by province. Information is given relating to capital, earnings, dividends, output, ore reserves, developments, etc., primarily intended for investors who may wish to assess the value of their holdings, either present, or intended.

A very useful section is devoted to maps of Canadian mineral areas, showing the holdings of the different companies.

***Housing and building in hot-humid and hot-dry climates.** Washington, D.C., Building research advisory board, 1953. 177 pp., illus., pa. $6.00 (U.S.). (Research conference report No. 5).

The four sessions of this conference dealt respectively with the following subjects: the problem of living in hot environments, architectural design for hot climates including bioclimatic requirements, structural features and the performance and properties of materials, mechanical problems such as cooling and dehumidification. Many of the papers present considerable detailed technical information.

**International brewers' directory: in collaboration with authorities and brewery associations.** Zürich, Verlag für wirtschaftsliteratur G.m.b.H., 1950. 504 pp., $12.00.

Here is something different but quite important in the realm of books of interest in engineering circles.

With text in English, French and German, and arranged alphabetically by continents, the volume also contains a front index, which lists the countries concerned alphabetically.

Following the list of brewers and addresses, is a list of suppliers, a technical French/German lexicon, and English/German lexicon, comparative tables of liquid measures and weights, and a list of Brewers' and Maltsters' Associations, arranged alphabetically by country.

This is rather a unique volume, and is handled on this continent by the Swiss American Advertising Company in New York, who also have a Montreal agent.

**International rubber directory: in collaboration with associations and authorities.** Zürich, Verlag fur wirtschaftsliteratur G.m.b.H., 1953. 416 pp., $12.00.

Published by the same firm as the Brewers' Directory, this volume is also trilingual, having all information in German, French and English.

The compilers differentiate between natural and synthetic rubber, and list them completely separately.

As in the brewers' directory, also, continents are listed, and countries alphabetically indexed, under manufacturers of rubber goods, and manufacturers of synthetic rubber.

Schools and research laboratories, professional organizations, and professional journals are also listed, and again, vocabularies in German/English/French; English /German/French and French/German/ English.

This publication should be of great interest to a large number of our members.

**Introductory circuit theory.** E. A. Guillemin. N.Y., Wiley, 1953. 550 pp., diagrs., $8.50.

Intended primarily as a text book for second year students, the author presents in this volume, an introductory treatment of electric circuit theory (i.e., linear, passive, lumped, finite and bilateral).

Steady state and transient circuit analysis are clearly considered, as is also the introduction to synthesis procedures.

Graphical interpretations and computational aids are included. There are also problems at the ends of chapters, and the volume is indexed.

Our student members should be most interested.

**Manual on rock blasting.** K. H. Frankel, ed. Stockholm, Aktiebolaget Atlas Diesel; Montreal, Canadian Copco, Dorval. varied paging, $15.00.

Numerous small and relatively limited publications are available on blasting in certain areas illustrating individual technical methods.

It is hoped that this manual, however, published by Atlas Diesel, in four languages in parallel column, English, French, German and Swedish, will be accepted as a standard international textbook for all types of blasting problems.

All papers included are based on actual experiences of the contributing authors, which should make it of universal practical value. Also, the loose-leaf format is purposely flexible, so that papers on new processes may be added from time to time.

At the present time, the book is divided into eight sections, namely: Geology; Terminology; Rock Blasting Methods; Planning and practical results; Compressed air supply; Drill steels; Explosives, charging, firing; Ventilation. It is indicated that further headings will be added as more papers are included.

Photographic and diagrammatic illustrations are numerous throughout the text, one of special interest being folded diagrams of Alpine tunnels with statistical details as to construction.

It is estimated that this volume will fill a great need in the blasting field.

Further papers, as published, will be distributed in Canada by Canadian Copco in Dorval, a suburb of Montreal.

**Materials for product development, 1953: proceedings of the Basic Materials conference held in conjunction with the first Basic Materials exposition in New York, June, 1953.** New York, Clapp & Poliak, 1953. 265 pp., illus., $7.50.

T. C. DuMond, the editor of Materials and Methods, and chairman of this conference, opens with an introductory paper on the role of engineering materials to-day.

Following this, the papers are arranged by general subject under the following headings: Economics of engineering materials; High strength with low weight; High- and low-temperature service; Atomic energy; Electrical and electronic service; Materials selection and specification; Coordination in selection of materials.

Questions and answers are included with most of the papers. As each one is presented by a specialist in the field, personal practical experience greatly enhances the informational value of the whole volume. The speakers throw out suggestions, ask questions regarding possible further uses of particular materials, and answer queries from the audience.

Being so very up-to-date, and so very practical, this book should prove of great value to all our members interested in both proven and potential uses of new materials.

**Metal machining.** L. E. Doyle. New York, Prentice-Hall, 1953. 511 pp., illus., $10.00.

It has been said that the purpose of engineering is to create useful goods and services, to make them better, cheaper and more abundant. Metal machining makes most engineering projects possible, in that it is the basis for all manufacturing, both for the creating of metal products, and the creating of machines to produce products metal or otherwise.

Tools which have been devised and designed for more accurate methods of cutting and forming metals are called

machine tools. Metal machining indicates the work done by them. The purpose of all machining is to finish surfaces as required.

This volume is logically divided into types of machines and their operations. Each chapter has questions at the end, some have questions and problems, and some also carry, in addition, a bibliography.

The book is excellently indexed, and should be a mine of information, particularly for our student members.

***Modern electroplating.** Edited by A. G. Gray. New York, Wiley, 1953. 503 pp., $8.50.

A complete revision of the Electrochemical Society's publication issued with the same title in nineteen forty-two. Almost all important plating processes are discussed from both the practical and theoretical points of view with information given on principles, constituents of baths, operating conditions, maintenance and control, preparation of basis metals, and finishing of deposits. A chapter is included on the plating of uncommon metals.

**Newnes electrical pocket book,** 12th ed. London, Newnes, Toronto, British Book Service, 1953. 391 pp., figs., $2.00.

This twelfth edition of the Newnes electrical pocket book includes several new sections, and some of the existing ones have been revised. The new sections are on the subjects of atomic energy, ultra-violet lamps, radiant heat drying and cold pressure butt welding, especially for aluminum and copper.

The Pocket book includes a certain amount of theoretical groundwork, and space is given to descriptions of the circuits and principles of various types of electrical apparatus. The inclusion of these technical descriptions, together with the information provided in the tables and illustrations should make this a very handy reference book for those who are concerned with various types of electrical equipment and apparatus.

**Normblatt-Verzeichnis 1953: ein Katalog aller deutschen Normen und Normblatt-Entwurfe.** Berlin, Deutsche Normenauschuss, 1953. 344 pp., $2.00.

In response to requests from our members, we are pleased to announce the acquisition of this German list of standards.

The main portion of the volume is arranged by subject, and by the Universal Decimal Classification, which also includes number of pages and date of publication.

Standards published by other organizations and accepted by DIN are listed, with identifying letters.

This is followed by a numerical index, and a complete alphabetical index by key word.

This should prove a most useful volume to a large number of our readers.

**Our neighbour worlds.** V. A. Firsoff. New York, Philosophical library, 1953. 336 pp., illus., $6.00.

Opening with a very readable scientific explanation of the adjacent universe, the author of this volume then presents the facts of the case as now accepted with regard to potential interplanetary travel.

"With such 'orbital bases' and fuel dumps as stepping stones a space-ship could hop from one gravitational orbit to another, be refuelled under way and have enough puff left to reach Mars, Venus, and perhaps venture farther afield. Space stations and fuel dumps could, of course, be established also at the other end of the run, and Mars at least has two excellent ones provided by nature in the form of its tiny moons. Phobos and Deimos. Some planetoids and minor satellites of Jupiter may likewise be used for this purpose."

Possible space suits are described with details as to design and specifications based on present scientific knowledge.

The whole book makes fascinating reading, is not too far fetched, and contains bibliographical references to further reading on each phase of the subject.

**Outline of executive development.** Lee Stockford, comp. Pasadena, California Institute of technology, 1953. 46 pp., pa., $2.00 (U.S.) (Bulletin no. 23).

Every company is faced with the problem of the choice of executives, and these days many companies, especially the larger ones which may have plants or offices in various parts of the country, are turning more and more to a regular program for the training and selection of suitable men and women.

This outline, which was used as a basis for discussion at the 1953 Summer conference on executive development, was evolved from the highlights of discussions at similar Conferences held in 1951 and 1952.

The notes are broken down into various sections. First are considered the reasons for establishing an executive development

program, then points are given on organization planning and policies, and the initiation of a program, and the items to be included. These cover such things as job description, personal qualifications to be considered, rating, selection, executive traits, and executive environment."

Ideas are given for a training program and of the final goals to be achieved.

A useful list of selected references is also included.

**Pensions and profit sharing.** Composite authors and the editorial staff of the Bureau of National Affairs. Washington, The Bureau, 1953. 272 pp., $5.50 (U.S.).

Recognizing the need of the executive for basic background information for the proper appraisal of pension and saving plans and consideration of employees, this volume has been prepared by individuals each a specialist in his own field.

Features of present day pension plans, tax and legal aspects and their financing are all discussed. This is followed by costs and cost experiences, bargaining on pensions, and administration and human relations with all their implications and suggestions.

Footnotes and references are included, as well as actual cases being cited, and tables presented, and the book is indexed.

This book is different and worthy of consideration by management executives.

***Pipe and tube bending.** P. B. Schubert. New York, Industrial Press, 1953. 183 pp., illus., $5.00 (U.S.).

A practical manual describing the common methods and the operating characteristics of the equipment used in the bending of ferrous and non-ferrous pipe and tubing. The formulas employed for various degrees of bend, and tables for the minimum radii of bends are given. An appendix on tubing classification is included.

**Proceedings of symposium on prestressed concrete statically indeterminate structures.** London, Cement and Concrete Association, 1953. 180 pp., diagrs., 25/-.

This Symposium on prestressed concrete was organized by the Prestressed concrete development group and the Cement and concrete association with the object of enabling engineers to express their views on continuous, statically indeterminate structures, of which few have been built in England. This book consists of the seven papers presented at the Symposium, together with the closing remarks of F. G. Thomas who summed up the Proceedings, and a list of those taking part in the symposium.

The papers deal with various aspects of the problem of continuity in prestressed concrete construction, ranging from theoretical analysis to actual experimental work on interconnected prestressed beams. The practical examples given of actual continuous statically indeterminate structures include both bridges and buildings.

Many of our members will be interested in this book, especially in view of the Conference on prestressed concrete recently held in Toronto, and of the fact that two of the papers are by Yves Guyon and Professor Gustave Magnel.

**Static electrification—a symposium held in the Institute of Physics, March 1953.** London, The Institute, 1953. 104 pp., illus., 25/-. (British journal of applied physics, Supplement No. 2).

Early in 1951 it was proposed to the Board of the Institution of physics that a monograph should be published on the generation and effects of static electricity. It was decided, however, that it would be advisable to hold a conference first at which all aspects of the subject could be discussed. The papers presented at the Conference, held in March 1953, are published in this supplement to the British journal of applied physics.

The papers are grouped in three sections: the general principles of the generation and dissipation of static electricity, useful applications of static electrification, and harmful effects.

The conference was opened by Professor F. L. Vick who gave a general lecture on contact electrification, and one session was devoted to electrostatic machines, consisting principally of two papers dealing with machines for the production of high energies, and machines capable of supplying useful power.

The section on harmful static electrification includes papers on its dispersal from places where it might cause explosions, for example, hospital operating rooms, from places where the quality of a product might be affected, or from where it might cause damage.

These papers probably present the most comprehensive account of the work in this field, and also serve to show the gaps which still exist in the knowledge of the subject. The book should be of interest to many of our members.

**Steelwork in building.** W. B. Scott. London, Spon; Toronto, British Book Service, 1952. 203 pp., diagrs., $5.00.

This volume scarcely needs an introduction after the explanation that it is a commentary on the British Standard Specification on the use of structural steel in building.

The revision of standards for the design of structural steelwork in building came into effect with the revision of British Standard 449 in nineteen forty-eight, and the almost simultaneous publication of a Code of Practice (C.P. 113), entitled "The structural use of steel in buildings".

Amendment number one to British Standard 449, issued in July nineteen forty-nine (P.D. 929) is also considered. The standard is reproduced in its entirety, and comments, criticisms and discussions are included.

The detailed index will be a great assistance in using the volume which will be practically a necessity on the desk of any engineer engaged in this type of work.

**Stress concentration design factors.** R. E. Peterson. New York, Wiley, 1953. 155 pp., charts, spiral binding, $8.50.

A statement of the United States Navy Bureau of Aeronautics quoted in the Preface to this book states: "While minor improvements in fatigue life may be accomplished merely by changing material, few serious fatigue difficulties have been completely corrected in this way. Such difficulties are almost always traceable to improper design, fabrication, and maintenance . . . By studying stress concentration factors much can be learned about how to produce designs that are superior from the standpoint of resistance to repeated loads and how to evaluate approximately the influence of various geometric features."

It is the purpose of this book to give the designer information which will help him to improve his design calculations to reduce the danger of failure. That there is this concern with improving detail design and engineering drawing is also shown in the publication by the British standards institution of a revised standard on the subject, No. B.S. 308, reviewed elsewhere in these Library Notes.

The first chapter deals with definitions and design relations, and succeeding chapters discuss the various design elements, grooves and notches, shoulder fillets, holes in plates or shafts, etc. The Appendices give stress relations for members with single groove or notch, application of Mohr theory for fatigue of brittle materials, derivation of relation for limited number of cycles and derivation of combined stress relations.

There are many charts showing stress concentration in the various elements, as well as diagrams in the text.

The book is essentially a working tool, and not a textbook. A complete list of contents introduces the text, and a list of symbols is included. The graphical figures at the back are thumb indexed for speedy reference, and the spiral binding allows the book to be flat while open and in use. It also has a bibliography of one hundred and seventy-four items.

**Technology of engineering materials.** B. R. Hilton. London, Lange Maxwell; Toronto, Butterworth, 1953. 389 pp., diagrs., 36/-.

As the proper function, reliability, safety and life of any structure or a part of it is dependent upon the materials used in its construction, the technology of engineering materials is a very important subject.

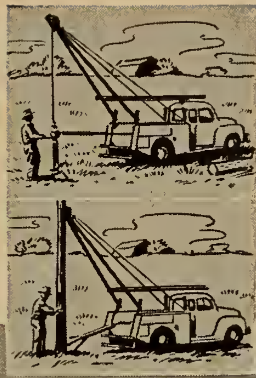
In this volume the number of chapters has been kept to a minimum, and a logical arrangement of material under pattern making and foundry work is followed by the preparation, production, and treatment of ferrous and non-ferrous metals. The chapters are divided into numerous sections, with running headings, and specific references can be checked in the detailed index.

Questions are included with each chapter, and forty-six pages of glossary add further to the value of this excellent book.

**UHF television antennas and converters.** Allan Lytel. New York, Rider, 1953. 118 pp., illus., $1.80.

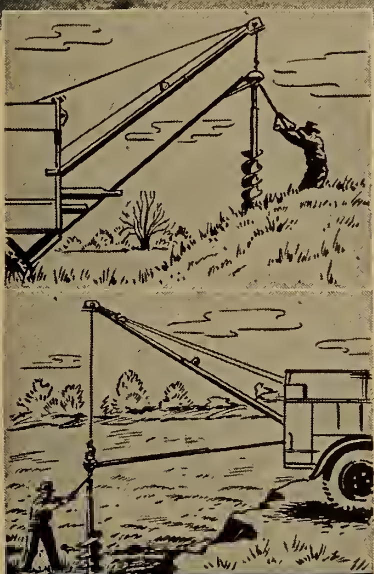
The purpose of this book is to explain in simple terms the function and operation of the UHF conversion systems which are appearing on the market in increasing numbers. It explains the complete UHF installation from the antenna to the receiver, and is intended also for the serviceman or dealer who has to answer customers' questions regarding the various types of UHF converters.

# TEL-E-LECT



## DIGS THE HOLE SETS THE POLE

*WHERE AND WHEN YOU WANT IT*



OPERATES FROM A TWO MAN UTILITY BODY

## REACHES UP SLOPES
## REACHES DOWN GULLIES
## REACHES OVER MUD

Now you can cut days and dollars off every pole installation job. With a Tel-E-Lect Digger-Derrick, two men can handle the digging and pole setting from a small KING "F" type Utility Body as well as with heavier line construction body. The Tel-E-Lect reaches the hard-to-get spots (12-20 feet) away from the truck. Slopes, gullies, ditches and mud are no problem when you have a Tel-E-Lect. Derrick can fold back over truck when not in use—raises to working position in 30 seconds. Complete control is from truck cab. Second man acts only as Auger guide. Auger is carried on truck in convenient brackets. It may be attached and ready to dig in less than 2 minutes. The crew can set-up, dig the hole, set the pole and be ready to move away in less than 10 minutes.

*Write to us today for illustrated literature on this amazing utility tool.*

KING *Trailers* A NAME THAT CARRIES WEIGHT

**TRUCK ENGINEERING LIMITED**

**Woodstock, Ontario**

*See our exhibit at the International Trade Fair, Coliseum, Toronto, May 31st-June 11th*

There are various types of converters, ranging from the single-channel device to complete tuners which can cover the whole band. In the book, the units are grouped according to function—for example, all the single-channel units are described in one chapter, with details given of several commercial units, their operation and circuits. Full range converters are similarly treated in another chapter.

Other chapters discuss transmission lines, antennas and converter circuits. The Appendix lists various types of UHF test equipment produced by the different manufacturers.

**Welding, brazing and metal cutting.** E. Molloy, ed. London, Newnes, Toronto, British Book Service, 1953. 192 pp., illus., $3.50.

This volume, compiled under the editorship of E. Molloy, by a staff of technical experts in collaboration with several leading British firms, deals with the various methods of welding metals: electric arc (including Argonarc), electric resistance, gas welding, brazing and bronze welding, and also chapters on gas and arc methods of cutting metals are included.

The aim of the book is to help those engaged in, or studying, welding, brazing and metal cutting to master the techniques of the different hand and machine methods employed. Many illustrations, and much tabular information, are included.

The layout and methods employed in quantity welding as found in British shipyards and automobile factories are outlined in two chapters, and the final chapter discusses hard facing with "Stellite".

## BOOKS RECEIVED

**Bibliography of rivers and harbors and related fields in hydraulic engineering.** R. S. Rowe, Princeton University, Dept. of civil engineering, Rivers and harbors section, 1953. 407 pp.

**Blazing Alaska's trails.** A. H. Brooks. Washington, D.C., Arctic institute of North America, 1953. 528 p., $4.50 (U.S.)

**Design and construction of general hospitals.** U.S dept. of health, education and welfare, Public health service. New York, F. W. Dodge, 1953. 214 pp., illus., $12.00 (U.S.)

**Electrical year book.** 1954 ed. Manchester, Eng., Emmott, 1954 360 pp., diagrs., tables, 3/-.

**Elements of electrical engineering,** 6th ed. A. L. Cook and C. C. Carr. New York, Wiley, 1954. 682 pp., diagrs., $6.75.

**Exécution du beton précontraint.** L. Bourgine. Paris, Eyrolles, 1954. 116 pp., illus., $4.00.

**Flying saucers from outer space.** D. E. Keyhoe, Toronto, McLeod, 1953. 276 pp., $3.50.

**Glossary of terms used in petroleum refining.** New York, American petroleum institute, Division of refining, 1953. 188 pp., $6.00 (U.S.)

**Industrial electronics.** R. Kretzmann. Eindhoven, Philips' Technical library, New York, Elsevier, 1953. 236 pp., illus., $5.50 (U.S.)

**Industrial inorganic analysis.** R. S. Young. London, Chapman & Hall, Toronto, British Book Service, 1953. 368 pp., $7.25.

**An introduction to railway engineering.** R. A. Inglis. London, Chapman & Hall, Toronto, British Book Service, 1953. 200 pp., diagrs., $4.25.

**Introductory soil mechanics and foundations.** G. B. Sowers & G. F. Sowers. Chicago, Soiltest Inc., 1951. 284 pp., illus., $5.25 (U.S.)

**Mechanical world year book,** 1954 ed. Manchester, Emmott, 1954. 264 pp., diagrs., tables, 3/6.

**Principles and practice of management.** E. F. L. Brech. Toronto, Longmans, Green, 1953. 752 pp., diagrs., $9.00.

**Space travel: an illustrated survey of its problems and prospects.** K. W. Gatland and A. M. Kunesch. New York, Philosophical Library, 1953. 205 pp., illus., bibliogs., $4.75 (U.S.)

**Statics and strength of materials: an integrated presentation.** R. H. Trathen. New York, Wiley, 1954. 506 pp., diagrs., $7.50.

**Thermionic valves.** A. H. W. Beck. Toronto, Macmillan, 1953. 570 pp., diagrs., $10.25.

**Waves, tides, currents and beaches: glossary of terms and list of standard symbols.** R. L. Wiegel. Berkeley Engineering Foundation, Council on wave research, 1953. 113 pp., illus., $1.25.

**World almanac and book of facts for 1954.** New York, New York World-Telegram and Sun, 1954. 896 pp., $1.00 (U.S.)

## TECHNICAL BULLETINS AND PAMPHLETS RECEIVED

**Alberta. Dept. of mines and minerals.**

Annual report for the fiscal year ended March 31st, 1952.

**American association for the advancement of science.**

General program and directory for the 120th meeting of the association, December, 26-31, 1953.

**American institute of chemical engineers.**

Standard testing procedure for heat exchange. Section I—Sensible heat transfer in shell- and tube-type equipment. 1952.

**American society for engineering education.**

Proceedings. v. 60, 1953.

**American society for testing materials. Special technical publications:**

No. 141—Symposium on tin. $2.50. No. 147—Fifty years of paint testing. $1.25.

**Bell telephone system. Monographs:**

No. 2067—Optical aids for better seeing in industry, by F. G. Foster. No. 2073—Field emission microscope and flash filament techniques for study of metal surfaces, by J. A. Becker and C. D. Hartman. No. 2111—Outdoor exposure testing of racks and test fences, by K. G. Compton. No. 2112—Calibration of the rolling ball viscometer, by H. W. Lewis. No. 2129—Photometric determination of silicon in ferrous ferromagnetic nickel and copper alloys, by C. L. Luke. No. 2131—Solubility and diffusion coefficient of carbon in nickel; reaction rate of nickel-carbon alloys with barium oxide, by J. J. Lander, H. E. Kern and A. L. Beach. No. 2132—Dynamic methods for determining the elastic constants and their temperature variation in metals, by M. E. Fine.

**Bosch und die Zündung.** Bosch-Schriftenreihe Folge 5. 1952.

**British electrical and allied industries research association. Technical reports:**

No. G/T247—Contactors: contact wear and heating tests on 400 A., 75 A., three-phase models, by H. W. Baxter. No. G/T263—Contact wear of 440 v., 150 A. three-phase contactors, by H. W. Baxter and B. Hopwood. No. G/XT135—Air-break arc chute circuit breakers: discussion of published information on modern types, by M. P. Reece. No. T/T48—Meter and instrument jewels and pivots. Fourth interim report, by G. F. Shotter. No. Z/T88—The general solution of a special case of a non-linear differential equation, by H. Goldenberg. No. Z/T93—The self-adjusting arc and controlled arc welding processes. A review of published information, by W. G. Hull and J. C. Needham.

**CCH Canadian Ltd.**

Guide du contribuable Canadien. 1ère ed., 1954. $3.75.

**Canada. National research council. Technical translation:**

No. TT-382—A report on permafrost surveying (Manchuria, 1943) by Ukichiro Nakaya and Juji Sugaya, tr. by E. R. Hope.

**Canada. National research council. Division of building research.**

Bibliography of soil mechanics literature published during 1951-1952, comp. by W. J. Eden.

......Research paper:

No. 8—Capillary absorption of some Canadian building bricks, by T. Ritchie and H. R. Meincke.

......Technical report:

No. 9—Damage to houses, Red River Valley flood, 1950, by D. H. Rutherford and A. Baracos.

**Canada. National research council. Canadian government specifications board. Specifications:**

37-GP-17—Asphalt; hot application, for dampproofing and waterproofing. 37-GP-19—Cement; plastic distilled coke oven tar cutback. 37-GP-20—Roof coating; unfilled distilled coke oven tar cutback. 37-GP-21—Roof coating; filled distilled coke oven tar cutback. 39-GP-14—Handles; tool, agricultural.

**Dominion fire prevention association.**

List of officers and executive committee, 1953-1954.

......Minutes of executive committee, January 27, 1953.

......Resolutions adopted at annual meeting, May 15, 1953.

**EUSEC Bulletin Nr. 4, July 1953. Engineers' council for professional development.**

Twenty-first annual report, for year ending September 30, 1953.

......Engineering: a creative profession

**Iowa. State College.**

Bulletin No. 16. Numerical analysis of continuous frames in space, by J. Michalos. Numerical analysis of frames with curved girders, by J. Michalos. (Engineering Report 18 of the Iowa Engineering Experiment Station).

**Lefroid, Louis.**

Abaque d'extration de racines et d'élevation aux puissances d'un nombre quelconque. 1953.

**National fire protection association.**

General motors fire, Livonia, Mich., August 12, 1953.

......Tentative fire prevention standards for homes, buildings and camps in forested areas.

**Sams, H. W. & Co.**

Planning guide for instructors in radio, television and electricity.

**Statens Kommitte för Byggnadsforskning. Meddelanden:**

Nr. 22—Strength, safety and economical dimensions of structures, by A. I. Johnson.

**United States. National research council. Highway research board. Bulletin:**

No. 77—Right-of-way problems.

## STANDARDS REVIEWED

**Canadian standards, Canadian standards association, National research building, Ottawa, Canada.**

**C.S.A. C21-1953—Control cable for electrical power plant equipment,** 2nd ed. 75c.

This specification covers single- and multiple-conductor cable for the control of electrically-operated power equipment and metering circuits operating at potentials not exceeding 600 volts. The various types of insulation and covering which may be used are listed, but it is noted that for single-conductor types, rubber insulated and braid-covered cable is the normal type, whilst for multiple conductor types, the cable is usually rubber-insulated with lead outer covering, or thermoplastic-insulated with thermoplastic outer covering.

The specification covers the material, stranding and insulant to be used in conductors, the various means used to identify them, and their construction, including lay-up, fillers, binding tape, and covering.

This second edition supersedes the first which was issued in 1927. It covers new constructions, and includes the use of thermoplastic as well as rubber-insulated conductors. Polychloroprene and thermoplastic coverings have also been added.

**C.S.A. C22.2 No. 51-1953—Construction and test of armoured cables and armoured cords,** 4th ed. $1.25.

This fourth edition of the standard covers essential requirements and minimum standards for the construction and

# Progress *is no accident...*

Fifty-five years ago The Shawinigan Water and Power Company was incorporated. At that time the Company had no customers and no markets. By many the entire undertaking was considered risky and foolhardy.

That was fifty-five years ago.

For three bleak years the Company worked in the midst of a wilderness, engaged in the development of the water power at Shawinigan Falls and the direct transmission of electricity to Montreal over what was to be the longest and highest-voltage transmission line in America.

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In 1903, two 5,000 horsepower generators were placed in operation at Shawinigan Falls. Today, 43 generators in eight plants within our 16,000 square mile territory are capable of producing 1,562,700 horsepower to serve more than 200,000 homes, farms, stores and industries in the province of Quebec.

Today, the power generated and transmitted by the Company is the life-blood of scores of urban and rural centres. It is a factor in attracting new industries to this great Province of ours . . . in raising our standard of living and in developing Quebec's incalculable natural wealth.

In 1898, "Shawinigan" knew that progress would be no accident . . . and that impossibilities would recede as experience advanced.

That is why "Shawinigan" looks ahead today with the same unfailing confidence in Quebec and its people that it had fifty-five years ago.

CHEMICALS • ENGINEERING
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WATER AND POWER CO.
ELECTRIC POWER

associated and subsidiary companies

test of armoured cables and armoured cords for use in lighting circuits in accordance with the rules of Part I of the Electrical code. The requirements are based on test and field experience, and are subject to revision.

The specification details the material, joints and sizes, fibrous covering, polarity identification, and lay-of-twist requirements for insulated conductors of armoured cables and armoured cords. Details are also given for fillers and lead coverings.

There are tables showing the minimum thickness of the metal strip used for the armour, for the minimum internal diameter and the nominal external diameter of armour, the minimum weight of single-strip steel armour, and of aluminum armour. Details are given of the size of the armour, its weight, the tension which it should be capable of withstanding, the amount of elongation permitted, flexibility, and dielectric strength. The methods of test for the last four are also given.

**C.S.A. A82.30-1953—Gypsum plastering, interior furring and interior lathing. $1.50.**

"Following the development of the C.S.A. A82.20 Series (Gypsum) and the C.S.A. A82.40 Series (Lime) in 1949 and 1950, requests were received from several groups, including Government Departments, for the preparation of a Standard covering Gypsum plastering and its allied constructions, Interior Furring and Interior Lathing. Accordingly, an appropriate Committee was appointed late in 1951."

The preliminary work was based on British Imperial Standard CP 211 and American Standards Associations Standards A42.1 and A42.4, but a new format and more detailed arrangement have been developed. The differences in the chemical and physical characteristics of some of the Canadian materials concerned has necessitated the development of new sections with the new requirements.

The Specification describes minimum acceptable standards only, and other materials and methods may be used if their load-bearing and other physical characteristics are at least equivalent to that of those described.

The section on interior furring covers both wood and metal furring. Gypsum, fibreboard, wood and metal lath are included in the section on Interior lathing, as are solid plaster partitions.

The sections on gypsum plastering include labour, materials, services, equipment and scaffolding.

**C.S.A. C22.2 No. 95-1953—Construction and test of arc-welding cable. 75c.**

This is No. 95 of a series of approvals specifications issued by the Canadian standards association under Part II of the Canadian electrical code. The specification applies to rubber or polychloroprene-sheathed electrode holder cable intended for use with arc welders in accordance with the rules of Part I of this Code.

Details are given for the conductors used, materials, sizes, number of strands, lay-of-twist, splices and separator.

The materials to be used for the sheath are listed, and a table given of the physical properties, and there are sections on physical test apparatus and procedure, and accelerated aging tests and procedure. A table gives the over-all diameter of the finished cable. The markings to be used are also specified.

**British Standards British standards institution, 2 Park Street, London, W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.**

**B.S. 2061: 1953—Phosphor bronze spring washers for general engineering purposes. 2/6.**

This British Standard for spring washers manufactured from phosphor bronze supplements that for steel spring washers, B.S. 1802.

Although these washers have a more restricted field than the steel type, they have a definite advantage where resistance to corrosion, non-magnetic or similar distinctive properties are required.

The range of nominal sizes for the three types in the tables, i.e. single coil, square and rectangular sections and double coil, varies from 10 BA to ¾ in. for the first and 6 BA to ¾ in. for the other two.

A number of manufacturing and testing requirements are given and the highly important feature of the material is provided for by a complete analysis of the phosphor bronze.

The general adoption of the range of wire sections presented in this new specification would be of immense assistance to the manufacturers of spring washers in that they would thus be enabled to reduce, considerably, the large number of different sections they have been compelled to carry in the past.

With the exception of the aircraft industry, for which the washers are not intended, users in the wide field of general engineering will find in this Standard and its companion, B.S. 1802, spring washers eminently suitable for all normal sizes and requirements.

**B.S. 308: 1953—Engineering drawing practice.** 10/6.

The engineer enjoys the advantages of expressing his ideas through the medium of the drawing, which is basically a universal engineering language, though its vocabulary is still somewhat limited and its grammar rather indefinite.

Any progress towards a universal drawing practice is, therefore, of profound importance to engineers, and the publication by the British Standards Institution of a new and far more comprehensive edition of B.S. 308—Engineering drawing practice—is undoubtedly a prominent milestone on the road towards such a world-wide understanding.

The need for a new standard was particularly felt during the second World War, when munition manufacture had to be sub-contracted to works of all kinds in all parts of the country, and indeed all over the world. The equipment available varied from the finest precision machine tools installed in ultra-modern shops to second-hand plant of doubtful age in back street garages. In these circumstances it became more and more evident that the dimensioning and tolerancing of many engineering drawings, however well they conformed to accepted standards, did not always ensure that components would assemble or function correctly. Not only were dimensions applied without proper regard to the functional requirements, but far too much reliance was placed on workshop discretion or "know-how" by the omission of tolerances on a large proportion of dimensions, and by an almost universal failure to provide any guidance whatever in regard to surface finish or to accuracy of geometrical form, e.g., straightness, flatness, parallelism, squareness, concentricity, symmetry and position.

These difficulties led to the formation in 1944 of an Inter-Services Committee on Dimensioning and Tolerancing of Drawings. This Committee was responsible for the publication in 1948 of the manual. Dimensional analysis of engineering designs, which laid down a number of fundamental principles which have, in general, been applied in the drafting of the new B.S. 308. In the later stages of the work of the Inter-Service Committee, several members of the B.S.I. Drawing Office Practice Committee were co-opted, and in 1949 a document on Dimensioning and tolerancing was presented to the B.S.I. Committee with the suggestion that it should be widely circulated to obtain the views of engineers and particularly of industry.

This document was accordingly issued as a draft of B.S. 308 Part II: 1949, but had a very cold reception. Some of the practices recommended aroused strong opposition from industry, and the manner in which the subject was presented did not commend itself to the majority. There was evidence, however, that even the strongest opponents recognized that most of the principles involved were basically sound.

It was therefore decided to make an entirely new approach to the subject, and a B.S.I. Sub-Committee was formed in September, 1950 to undertake a complete revision of B.S. 308:1943, including a detailed consideration of the dimensioning and tolerancing aspect.

The new B.S. 308 is divided into two sections. Section One (General Practice) is based on the previous B.S. 308:1943, but while the section has been amplified in some respects, it has been considered advisable to confine the standard to recommended principles and methods to be followed in the preparation of engineering drawings. Subjects such as architectural drawings, survey plans, graphs, reproductions of drawings, and the nature and handling of drawing materials have been excluded, as such matters are more fully and appropriately dealt with in other British Standards. For these reasons it has

been considered appropriate to alter the title of the standard from Engineering drawing office practice to Engineering drawing practice.

Section Two (Dimensioning and tolerancing) is entirely new, and presents a great advance in the technique of drawing statement. It lays down a number of general principles, of which the most important are that the drawing should define the finished product as required by the designer, and that dimensions which affect the function of the product should be expressed directly on the drawing. It also deals with ways of indicating dimensions, tolerances and notes on drawings, and with the dimensioning of common features, including a special section on the difficult subject of tapers.

The latter portion of the standard is devoted mainly to the principles and methods of expression of Geometrical tolerances for straightness, flatness, parallelism, squareness, angularity, symmetry, concentricity, roundness and position. By the judicious application of these methods, it will be possible in future to define precisely acceptable limits of geometrical form, instead of relying on individual judgement or conjecture.

The standard concludes with the dimensioning and tolerancing of profiles, and the indication of machining and surface finish. It is worthy of mention that the "tick" symbol (√) has been chosen to denote machining. It is also used as a vehicle for surface finish indication, and, as such is already American standard practice. Canada and the International organization for standardization (I.S.O.) are also likely to adopt it in the near future.

The whole standard is profusely illustrated by diagrams, and a number of typical drawings are appended to illustrate the principles and practices recommended.

The standard soon to be published by the Canadian Standards Association will agree with B.S. 308 in its essentials, and Australia has also expressed the intention to follow it. Further, the American standards association has been working for more than a year on proposals for dimensioning and tolerancing. In the Continental field, many of the basic principles and practices of B.S. 308 have been adopted for inclusion in a proposed I.S.O. Standard.

**B.S. 1133: Section 19: 1953 — Packaging Code. Use of desiccants in packaging. 3/-.**

The deterioration of the contents of packages is of concern to all packers, but in particular to exporters. Metal goods are liable to corrode in damp and humid climates, and materials such as textiles, leather and paper are subject to other forms of deterioration. Some articles can be given protective treatment during manufacture, and others can be protected by the application of corrosion preventives, and by other means. Some, however, such as delicate instruments, cannot be given any such treatment, and for these it is essential to ensure that the humidity within the package remains reasonably constant.

The type of packaging which achieves this is known as a desiccated package, and this method is dealt with fully in this new British Standard.

This section describes the method, deals with factors governing the choice of desiccant, the determination of the quantity needed and other general packaging considerations.

The new section completes that part of the Packaging Code which deals with protection of contents against deterioration.

**B.S. 1568: 1953 — Magnetic tape sound recording and reproduction for programme interchange. 2/6.**

The British Standards institution has recently issued a revision of B.S. 1568: the new standard being entitled Magnetic tape sound recording and reproduction for programme interchange.

The Standard specifies the requirements for recording on magnetic tape and of the associated recording and reproducing equipment which are necessary for the successful interchange of recordings for broadcasting or similar purposes.

The recording and reproducing characteristics are those adopted by the Comité Consultatif Internationale Radiophonique, (C.C.I.R.)

One of the new features in the revised standard is that it specifies dimensions for an adapter to allow European machine fitments to accept the N.A.B. (National Association of Radio and Television Broadcasters of America) type of hub, thus enabling both European and American tape recordings to be played on the same machine.

# BUSINESS & INDUSTRIAL BRIEFS

*A Digest of Information*

*received by*

**The Editor**

## Appointments and Transfers

**Sales Office Transfer.**—Dow Chemical of Canada, Limited, has changed its Western district sales office from Regina to Winnipeg. The new address is—Confederation Building, 457 Main Street, Winnipeg 1, Manitoba.

●

**General Motors Diesel Limited.** — Robert E. Hunter, director of sales of General Motors Diesel Limited, London Ont., recently announced the appointment of Ronald J. Beath as London sales manager and Harold F. Shepherd as parts manager.

●

**Steel Fabricating Group.** — James A. Gairdner, chairman of the board of the Bridge and Tank Company of Canada, Limited, announces the appointment of Alex B. Hill as president. The new organization designed to provide nation-wide steel fabricating service to Canadian industry, unites the operation of Hamilton Bridge Co. Ltd., and Vulcan Iron and Engineering Ltd., Vulcan, Ford-Smith Ltd., Ford-Smith Machine Co. Ltd., and Vulcan Machinery and Equipment Ltd.

H. O. Jones, formerly general manager of Vulcan Iron and Engineering Ltd., has been elected vice-president of that company with head office in Winnipeg.

●

**Automatic Electric Staff Appointments.**—C. R. Hughes, president of Automatic Electric Sales (Canada) Ltd., announces three staff appointments to supervise the company's sales activity from coast to coast. C. L. Littler is named manager for telephone sales; R. C. Fawcett, manager for carrier sales; and E. E. Hucal, manager for communication wires and cable sales.

●

**Douglas Robinson, Q.C.**—Appointment of Douglas Robinson, Q.C., as a vice-president of Canadian Oil Companies, Limited, is announced.

Mr. Robinson originally set up Canadian Oil's legal department and has served in recent years as general counsel and secretary of the company.

●

**John S. Thorp.**—W. A. Shapland, president of Innes Equipment Quebec Limited, construction and road building equipment suppliers, announces the appointment of John S. Thorp as vice-president. Mr. Thorp joined the company as manager in September, 1952.

●

**Robertson-Irwin Limited.**—The appointment of Frank C. Manchee as marketing manager is announced by Robertson-Irwin Limited, Hamilton, Ont., manufacturers of building and industrial metal products. Mr. Manchee has served as a member and chairman of various specification and building code committees in Ottawa, and was formerly manager of the technical sales division of Canadian Gypsum Co., Ltd.

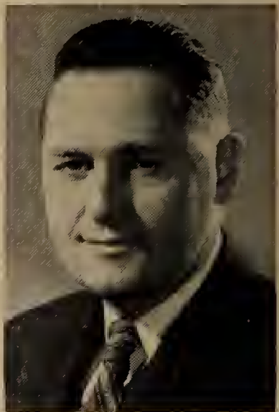
●

**Canadian Arsenals Limited.**—The appointment of Brigadier Frederick Campbell Wallace, president of Canadian Pittsburgh Industries Limited, as a mem-

*(Continued on page 534)*

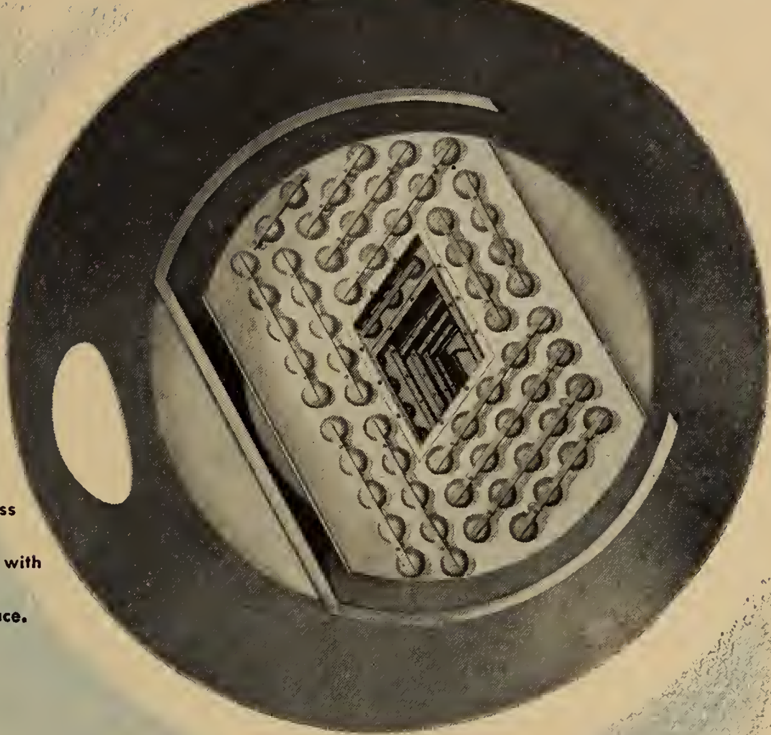
**Alex B. Hill**

**James A. Gairdner**

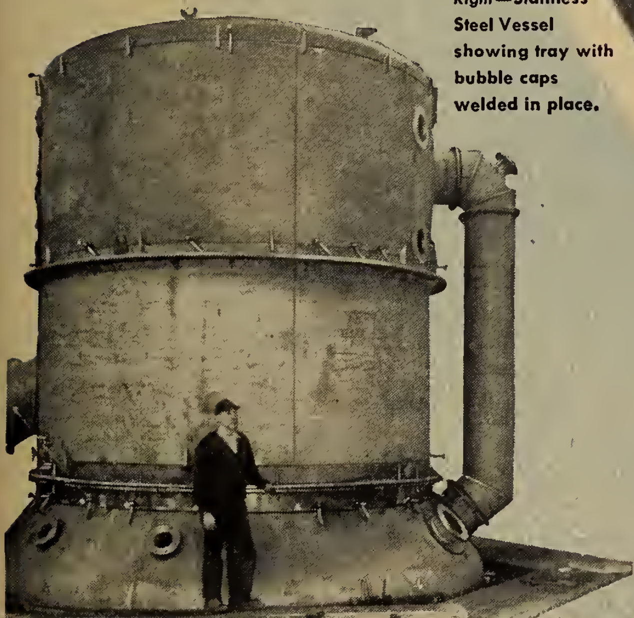


**H. O. Jones**

# Stainless Steel Vessels



*Right*—Stainless Steel Vessel showing tray with bubble caps welded in place.

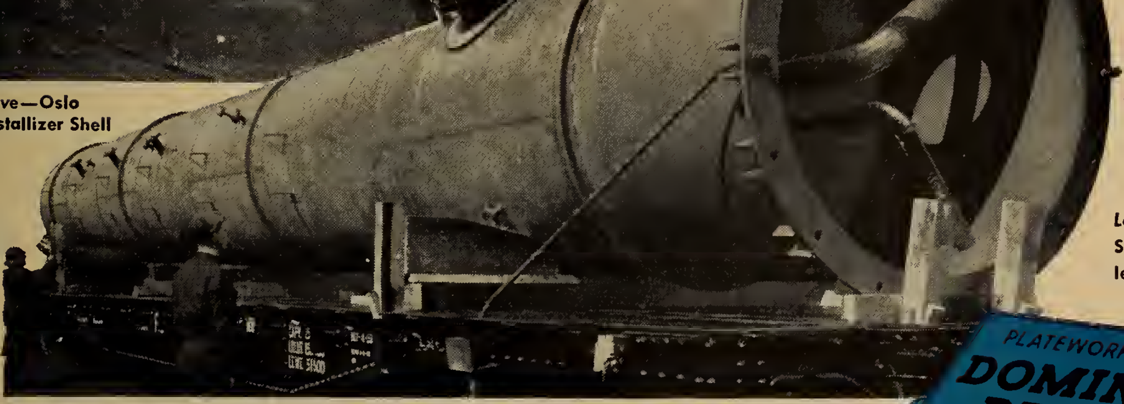


The manufacture of stainless steel vessels is a specialized business demanding considerable metallurgical experience, faultless workmanship and the employment of the most modern equipment for the close control of every stage of fabrication. Dominion Bridge—Canada's oldest steel fabricators—have long been recognized as a leader in this specialized field.

Constant research, unrivalled technical resources and exacting standards of workmanship are inherent features of the Dominion Bridge platework service.

*Write for illustrated brochure No. PF-100*

Above—Oslo Crystallizer Shell



*Left*—Stainless Steel Tower—length: 65 ft.

*Other Divisions:* *Boiler* • *Mechanical* • *Structural* • *Warehouse*

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*Assoc. Companies at:* AMHERST • QUEBEC • SAULT STE. MARIE • EDMONTON

PLATEWORK DIVISION
**DOMINION BRIDGE**
COMPANY LIMITED

J. R. Harvey

(*Continued from page 532*)

ber of the Board of Directors of Canadian Arsenals Limited, has been announced by the Right Honourable C. D. Howe, Minister of Defence Production. Brigadier Wallace, whose appointment was made final at a meeting of the Board on March 9th, replaces Roy G. Peers whose resignation as a director of the Crown Company was recently announced.

**Sales Appointments.** — Announcement has been made by Babcock-Wilcox and Goldie-McCulloch Limited, Galt, Ont., of two important appointments in their sales department. H. E. G. Dupuy, formerly manager of the company's western sales office in Calgary, has been appointed manager of eastern branch sales with offices in Montreal. Mr. Dupuy succeeds R. E. MacAfee who is retiring.

J. R. Harvey has been appointed manager of western sales with offices in Calgary, Alta.

(*Continued on page 536*)

H. E. G. Dupuy


TRANSF. 2D.
C B A


*(Continued from page 534)*

**Canadian Marconi Company.** — J. J. Kingan, General Manager of Canadian Marconi Company in Montreal, has announced the appointment to the company's research staff of Leslie L. Hill. He will hold the position of senior research physicist.

•

**R. V. Glaysher.**—Canadian Johns-Manville Co., Ltd., announces the appointment of Robert Vernon Glaysher as industrial products specialty salesman for the Toronto area. Mr. Glaysher will replace Noel Lavell, who has left the company to take up residence in the United States.

•

**John Inglis Company, Limited.**—Two new appointments in the general engineering division of John Inglis Co., Ltd., have been recently announced. W. A. Montgomery has been appointed general manager and K. S. LeBaron is to be general sales manager.

•

**Canadian General Electric Co., Ltd.**—Two appointments within the industrial products division of Canadian General Electric Company have been announced by vice-president J. S. Keenan, general manager of the division.

A wire and cable department has been established within the division with W. H. Prevey appointed as manager.

R. M. Love has been appointed manager of the construction materials department.

•

**E. R. Carter.** — E. R. Carter has been appointed warehouse manager, Ontario division, of the Dominion Bridge Company, Limited, it has been announced by G. P. Wilbur, vice-president and manager of the Ontario division. He succeeds the late E. E. Woods.

In his new duties, Mr. Carter will be responsible for the supply of plain steel requirements to the many industrial customers of Dominion Bridge.

•

*(Continued on page 538)*

E. R. Carter

*(Continued from page 536)*

**Canadian Resins and Chemicals Limited.** — R. J. Southwell, general sales manager of Canadian Resins and Chemicals Limited since 1948, has been appointed a vice-president of the company, it was announced recently by V. G. Bartram, president. Head office of the company is in the Shawinigan Building in Montreal, and the plants are in Shawinigan Falls.

●

**Canadian Westinghouse.** — Ralph E. Hendershot has been appointed sales manager of the Canadian Westinghouse Company's lamp-tube division. Formerly manager of manufacturing services in the company's electronics division, Mr. Hendershot has been engaged in lamp-tube operations for the greater part of his 19 years association with Westinghouse.

●

**Bamfords Diesel Distributor Appointed.** — International Selling Corporation of New York has been appointed exclusive distributor of the Bamfords slow-speed diesel engines in the United States, Canada and Mexico, it was recently announced by Bamfords Ltd. of Uttoxeter, England. Plans are now being made by International Selling Corp. for extensive territorial distribution utilizing established diesel sales and service agencies throughout the North American countries.

●

## New Equipment and Developments

**Canadian Industries Limited.** — The entire operations of C.I.L. will be continued in two new companies. In one of these Imperial Chemical Industries Limited of the United Kingdom will be the principal shareholder and E. I. du Pont de Nemours and Co. of the United States in the other.

The new company in which I.C.I. will be the principal shareholder will be known as Canadian Industries (1954) Limited and it will be headed H. Greville Smith, now president of C.I.L. The new operating company in which Du Pont will be the principal shareholder will be known as Du Pont Company of Canada Limited. Its president will be Herbert H. Lank, now a C.I.L. vice-president.

The manufacturing operations of C.I.L. will be allocated so that the agricultural chemicals, chemicals, explosives and ammunition, paints and coated fabrics, and plastics departments (including the business of polythene resin flake), will be transferred to C.I.L. 54. The films and textile fibres department comprising the business of nylon and cellophane will be transferred to Du Pont of Canada.

●

**Canadian Subsidiary.**—Bulldog Electric Products Co., Detroit, Mich., recently announced the formation of a Canadian subsidiary, Dominion BullDog Limited, with plant and office located at 80 Clayson Road, Toronto, Ont., for the manufacture and sale of BullDog electric prod-

*(Continued on page 540)*

MAKING THE THINGS THAT MAKE THE THINGS YOU NEED


# gives you a real interest in CANADIAN VICKERS

No matter what your station in life, you are living a better life than your grandparents. Greater comforts and more leisure to enjoy them; better food with less preparation; better fabrics to keep you warm or cool; better care for the unfortunate sick . . . in every way, you live a better life.

This is due mostly to the wonderful machines which produce the good things of life at great speeds and in huge quantities thus lowering costs and raising the standard of living of all Canadians. And this fact gives you a real interest in Canadian Vickers Limited because Canadian Vickers designs and builds the machines that manufacturers use to make the things that help you live the good life.

Mining machinery that processes raw ore into the metal of which so many good things are made; Chemical Process Equipment needed to produce plastics or nylon and other fabulous fabrics; Industrial Boilers, Paper Machinery . . . machinery and equipment of every kind to make the good things that you enjoy. And more, Canadian Vickers builds ships and ships' engines that enrich Canada by carrying Canadian goods throughout the world. Yes, you live a better life because of the machinery, equipment and ships made by . . .

CANADIAN VICKERS LIMITED MONTREAL

IF INDUSTRY NEEDS IT . . . CANADIAN VICKERS BUILDS IT . . . BETTER

(*Continued from page 538*)
ucts in Canada. Robert R. Farrell, of Hamilton, is vice-president and general-manager of the Canadian subsidiary, and James H. Wilson of Toronto, is secretary-treasurer and general sales manager.

**Robertshaw-Fulton Controls Company.**—Robertshaw-Fulton Controls Company has recently announced the incorporation of a wholly-owned subsidiary to be known as Robertshaw-Fulton Controls (Canada) Limited. Plans for Canadian manufacture and distribution of selected lines of the company's products are well underway. The plant of Robertshaw-Fulton Controls (Canada) Limited will be located in the Toronto area.

Robertshaw-Fulton is a manufacturer of thermostats for domestic gas ranges, water heater thermostats and automatic pilots. It also supplies a substantial volume of thermostats for electric ranges and other home appliances, automotive thermostats, and electronic recorders and controllers. The company also produces bellows and bellows assemblies.

**The Asbestos Industry Expands.**—In an official statement, Hon. Tancrede L'Abbe summarized plans for an immediate outlay of $20 millions on a new producing unit in Canada's asbestos industry.

The new mine is located below the water of Black Lake in Megantic County. The lake will be drained to turn the deposits into an open-pit project.

The project will involve the removal of Black Lake itself and the creation of a new lake approximately one mile and a half downstream. The first mill to be erected at the property would have an output of 5,000 tons daily. This initial mining-milling operation would provide permanent employment for 400-500 workers.

The project has been launched by United Asbestos Corporation, and the additional investment to bring it to production, estimated at $15 millions to $20 millions was being made by American Smelting and Refining Company. The Canadian and American companies would operate jointly.

**Anti-Seize Thread Compound.**—A new high temperature thread compound that protects against the welding action of threaded connections subjected to prolonged exposure to extreme heat has been developed by Crane Packing Company, Limited, of Hamilton, Ont. Known as "Thred-Gard", it is said to eliminate seizing and galling at operating temperatures up to 1200 degrees F. The compound is non-hardening and acts as a lubricant to allow easy disassembly of threaded connections, even after lengthy service under the most severe conditions.

**Construction.** — Drayton Construction Equipment Limited, a new Canadian company in the construction field is now in operation. Located at 58 Pelham Avenue, Toronto 9, Ontario, the new company will specialize in sales and service of a complete line of equipment for the mixing, placing and compacting of concrete on construction jobs and for the manufacture of pre-cast concrete products in plants.

In addition to its own line of Drayton dumpers, bin batchers, weighbatchers and mono-rail equipment, the company will also distribute, throughout Ontario, weatherill front-end and overloading shovels, Ace hoists and immersion concrete vibrators, and Trianco block-making machines.

**New Contact Welding Electrode Available from C.G.E.**—A new contact electrode providing high-speed welding and great operator appeal is available from Canadian General Electric Company's apparatus division.

Best suited for work on mild and medium carbon steel, the new rod is ideal for welding machinery, low pressure storage tanks, and light structural work.

It is suitable for many welding operations requiring AWS classes E6012 and E6020 electrodes.

The relative high-speed quality of the new electrode was established in the G-E welding research laboratory, where engineers conducted a series of actual work tests. Results showed that the new product consistently produced a higher rate of weld footage than conventional electrodes.

Encased in a rutile-type covering enriched with iron powder the new electrode can be used effectively on horizontal and flat position fillets and laps, single and multiple pass butts, and deep

(*Continued on page 542*)

(*Continued from page 540*)

grooves and cover passes on multiple-pass butt welds.

Since the electrode is of the contact type, less physical effort is expended in welding. For the same reason, less welding skill is required of the worker.

The contact electrode develops up to 80 per cent less spatter than other welding rods, and resultant weld slag is easily removed by a light tap.

●

**Injector Tip Concentricity Gauge.**—To check concentricity between the injector tip and injector nut after assembly, an injector tip concentricity gauge has recently been added to its line of Diesel service tools by the Kent-Moore Organization, Detroit.

Bearing the catalogue number J 5119, the gauge is applicable to injectors used in General Motors Series 71 Diesel engines.

To insure correct clearance between the injector spray tip and the cylinder-head injector hole tube with the injector properly installed, the spray tip must be concentric to the injector nut within 0.008 in.

The "run-in" of the injector spray tip may be measured by placing the assembled injector in the gauge, then setting the dial indicator at zero, and rotating the injector in a complete circle and noting the total reading.

If the total indicator reading is greater than 0.008 in., the injector should be removed from the gauge, the injector nut loosened, the spray tip re-centered, the injector nut tightened, and the "run-out" re-measured.

Orders should be addressed to the Kent-Moore Organization, Inc., 5-105 General Motors Building, Detroit 2, Michigan.

●

**Stelco New Blast Furnace.**—The additional pig iron capacity provided by the new 1,400 ton per day blast furnace of The Steel Company of Canada, Limited, Hamilton, now assures a permanent supply of iron for the foundry trade.

Stelco "Easymelt" pig iron owes a fine reputation to the fact that one control exists over the production from the source of raw materials to the finished pig.

Grades being produced are No. 1 foundry, No. 2 foundry, malleable bessemer and special grades to specification all well below the .05% maximum sulphur permitted by the American Iron and Steel Institute. Stocks of regular grades are being maintained to service the needs of the trade more adequately.

Further details may be secured upon contact with the company's sales divisions in Hamilton and Montreal.

●

**Compressible Liquids.** — Revolutionary, compressible liquids known as Wales Comproils used in Wales hydra springs have just been made available by the Hydra spring division of Wales-Strippit of Canada Ltd., Hamilton, Ontario, specialists in machines and compressible liquids.

This new development combines the new principle of liquid compressibility at ultra high pressures with lubricity. One of the widest uses of Wales Comproils is in cushioning applications. These Wales Comproils also have varied usage in hydraulic systems.

For complete information on Wales Comproils, write to the Hydra Spring Division, Wales-Strippit of Canada, Ltd., 1105 Main St., E. Hamilton, Ontario.

●

**Shawinigan 56th Annual Report.** — A 40 page document with illustrations in full color is the form of the Shawinigan Water and Power Company's 1953 report.

The cover picture of this report is an aerial view, in full color, of the company's development at Shawinigan Falls on the St. Maurice River. Page one has a reproduction of a painting by the Canadian artist Franklin Arbuckle, R.C.A., O.S.A. "The artist has caught in remarkable perspective the 240-mile sweep of the St. Maurice from the Laurentians to its juncture with the St. Lawrence at Trois-Rivieres."

A feature of the report is a section entitled "20 Years of Progress", which in a series of statistical charts shows the company's expansion since 1933. The comparative balance sheet for the past 10 years shows assets of $304,455,-000 at the end of 1953, compared with $187,501,000 in 1944.

●

**Heating Controls.**—A new line of simplified home heating controls for all makes of domestic oil burners is available from Canadian General Electric Company's appliance control sales, component products department.

The line includes nine devices: A room thermostat, master control with bimetallic helix, flame detector and companion master control, transformer relay, fan and limit control, temperature limit control, water immersion temperature control and steam pressure control.

According to the manufacturer, all are designed for fast, easy installation and fewer-service call-backs. They may be mounted in any position without levelling.

●

**Gas Turbines for Industrial Use.** — Engine weight of only ½ to 1 lb. per

(*Continued on page 544*)

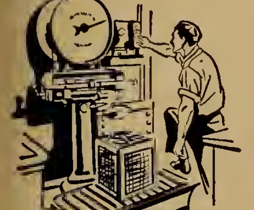
# the Chemical Engineer and FAIRBANKS-MORSE

In the centre of Canada's industry, in great oil refineries, pharmaceutical houses and other chemical plants . . . there you will find the Chemical Engineer . . . designer, operator, consultant. His work is close to the roots of industrial progress, for few industries operate successfully without the benefit of his knowledge.

In the twentieth century's mechanization the engineer is a key figure, harnessing and converting to man's most expedient use the basic elementals of our world . . . seeking new processes . . . new manufacturing techniques, which can enrich our daily living.

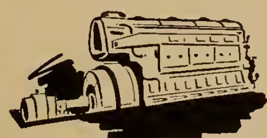
In the development of Canada's chemical and allied industries, Fairbanks-Morse has played an important role. Through sixteen branches the "Departmental Store for Industry" supplies all types of machine tools, industrial supplies, and materials handling equipment; Fairbanks-Morse scales, Diesel engines, pumps and electrical equipment; steam goods, railway and contractors' and automotive equipment.

THE CANADIAN
**FAIRBANKS-MORSE**
COMPANY LIMITED
Sixteen Branches Across Canada



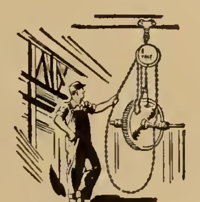
Fairbanks-Morse Scales built for every weighing purpose

Fairbanks-Morse Centrifugal Pumps at work in the field



Marine and Stationary Diesel engines and electrical equipment

Thor Industrial Precision-Built Electric and Pneumatic Tools



Yale Hand and Electric Hoists for every industrial requirement

(*Continued from page 542*)

horsepower, as against 10 to 15 lbs. per horsepower for a comparable diesel, is one of the outstanding features of Turbomeca engines, the first gas turbines for industrial use to be marketed in Canada.

The new engines manufactured by Blackburn and General Aircraft Ltd. of England, and distributed in Canada by Field Aviation Company Ltd. of Oshawa, Ontario, cover a power range of 150 to 400 horsepower. Similar engines with up to 1,000 lbs. thrust are also produced by the English company for powering jet aircraft. Every engine will operate without modification on kerosene, diesel oil or gasoline.

Shaft drive Turbomeca engines, either with single shaft or separate power turbines, are suitable for powering generators, boats, tractors, pumps, etc. The separate power turbine engine is in itself an efficient torque converter which eliminates the use of a clutch or change speed gear box. Their light weight, quick starting and compactness (one man can lift a complete 250 horsepower turbine) make these easily portable engines ideal for many auxiliary and emergency power applications.

●

# Publications

**For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.**

**Please mention *The Engineering Journal* when writing.**

**Alchem's New Publication.**—The Alchem Ltd. of Burlington, Ontario, recently issued the first publication of their new house organ, Alchem News, to be published quarterly in the interests of the field of boiler water treatment.

The first issue presents a brief history of the organization. Included also is a typical case history of treatment of feed and boiler water for relatively small plants operating at low pressure.

A list is presented of recent articles dealing with feedwater treatment problems. These articles are available by request from the company.

●

**New Gradall Service Manual.**—A liberally-illustrated manual devoted to the maintenance, servicing and repair of its mobile, multi-purpose earthmoving and construction machine has just been issued by the Gradall Division of the Warner & Swasey Company, Cleveland, Ohio.

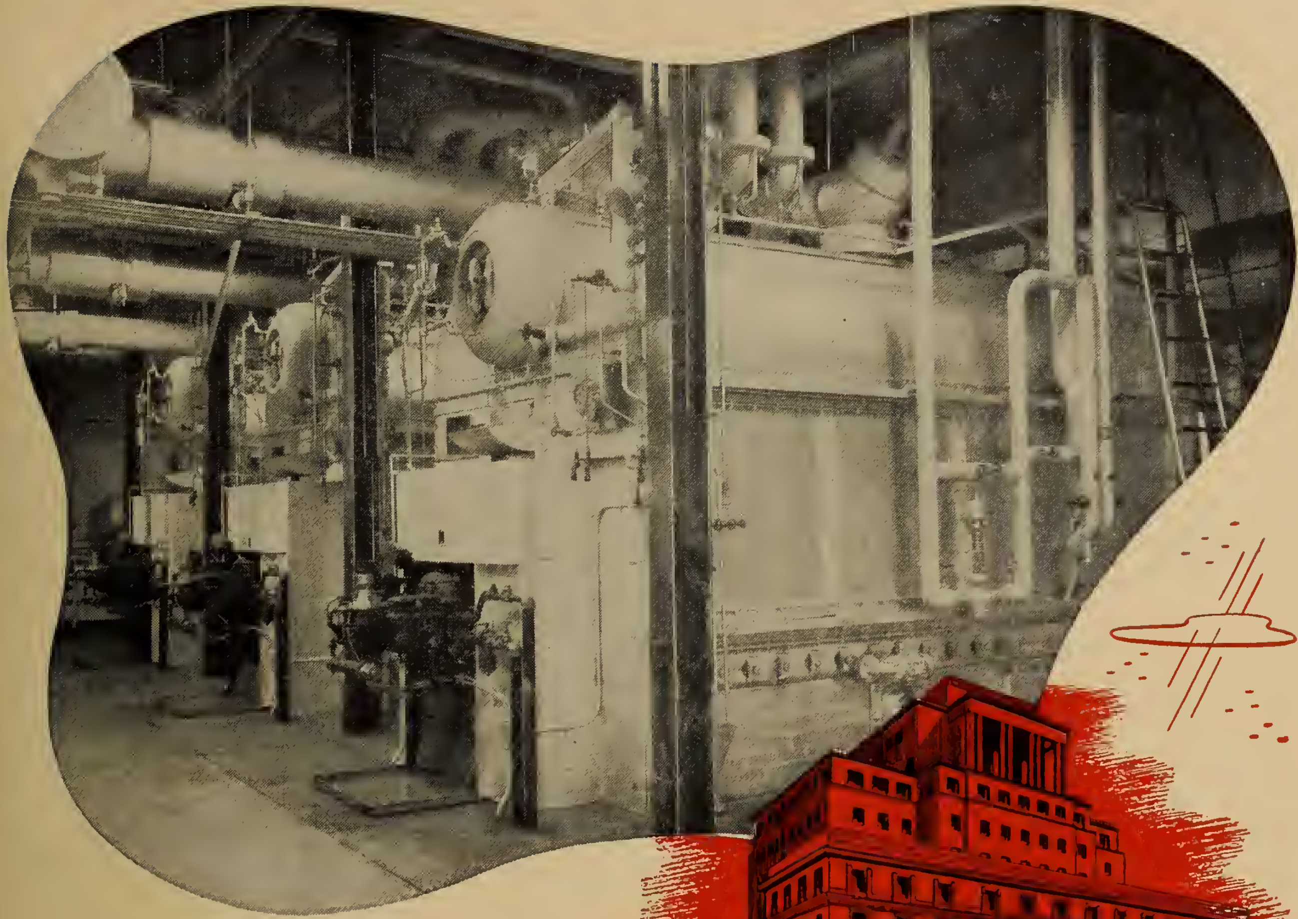
The 28-page manual includes a quick-reference guide to good Gradall maintenance and incorporates up-to-the-minute service recommendations and suggestions covering the company's improved Model M-2460.

Copies are available from the Warner & Swasey Company, 5701 Carnegie Ave., Cleveland, Ohio.

●

**Moisture Control in Compressed Air.**—"Moisture Control in Compressed Air", is the title of a new 4-page brochure, discussing types and quantities of impurities and methods for their removal.

(*Continued on page 546*)



# a new high in office accommodation...

MANUFACTURERS LIFE BUILDING

Architects: *Marani & Morris*
Consulting Engineers: *Wiggs Walford Frost & Lindsay*
Heating Contractor: *Canadian Comstock Co. Ltd.*

Here every possible resource of modern science is applied to provide a building where the business of a great Company can be carried on most effectively. To ensure year round working comfort, the latest European and American developments in radiant heating and cooling are employed. Three Inglis 150 H.P. V.L. Water Tube boilers, with a total capacity of 24,000 lbs. per hour, heat the structure. The VL boiler is easy to install, high in efficiency, and economical to operate. May we discuss your boiler requirements, whatever they may be?

## STEAM BOILER PLANT BY

**Inglis**
CANADA

**JOHN INGLIS CO. LIMITED**
**TORONTO, CANADA**

29-100-53

DISTRICT OFFICES: MONTREAL, WINNIPEG, CALGARY, EDMONTON, VANCOUVER

(*Continued from page 544*)

Information is set forth in a manner easy to read and understand. The Vi-speed method, units, and dessicant are clearly described along with results that can be anticipated. Copies are available from Van Products Co., 3736 West 12th Street, Erie, Pa.

●

**Aluminum Uses.**—A feature article in the Alcan Ingot, house-organ of the Aluminum Company of Canada, describes the versatile uses of aluminum in the construction of The Manufacturers Life Insurance Building in Toronto. Another article entitled "Sprinkler Irrigation for Better Crops", by H. D Ayers, asst. professor of agricultural engineering, Ontario Agricultural College, Guelph, Ont., outlines the advantages of the irrigation. Development of lightweight portable aluminum alloy pipe has played a big part in this.

Correspondence should be addressed to The Aluminum Company of Canada, Limited, c/o Department of Information, 1700 Sun Life Building, Montreal, Que.

●

**Better Drilling.**—"The Guide Book for Better Drilling" is a manual recently issued by the Canadian Blower & Forge Co. Ltd., Kitchener, Ont. The manual contains basic information on types of drills; twist drill materials; definitions and twist drill points with illustrative drawings.

Statistical tables on speeds, feeds and required lubricants for the drilling of all materials are also included and arranged for handy reference.

The manual is being distributed by Canadian Blower & Forge Co., Ltd., and may be obtained by writing to the company on your letterhead.

●

**Transmission Belting.** — An illustrated 16-page booklet on transmission belting has been issued by mechanical goods division, of the Dominion Rubber Company, Limited.

The booklet discusses factors to be considered in the proper selection of transmission belting for best performance. Types of transmission belt drives are shown, and necessary formulae and tables are given for the specification of an appropriate transmission belt for any particular set of operating conditions. The booklet also gives information on the complete line of Dominion transmission belts.

Copies of the booklet are available upon application to any Dominion Rubber Company branch office.

●

**Kellog Publication.**—How combination processing can slash more than 20 percent from investment costs in building today's new oil refineries is revealed in Kellogram No. 1 (1954) just published by the M. W. Kellogg Company, New York City.

Combination processing means the integration of a number of different refining steps into a single, continuous, centrally-controlled operation without intermediate storage.

A detailed analysis of these savings is presented in the Kellogram. The booklet is available from Kellog's Refinery Process Division, 225 Broadway, New York 7, N.Y.

●

**Making Colour Work.**—How colour can be used to improve the skill, health, comfort and morale of people in working areas is explained in an illustrated booklet published by the paint and varnish division of Canadian Industries Limited.

Entitled "Making Colour Work", the publication deals with the psychological effects certain colours have on people. It shows examples of scientific colour conditioning in industrial plants, schools, hospitals, offices, hotels, restaurants and institutions.

One section explains "brightness engineering"—the correct relationship between light reflective values of different surfaces within the field of vision in any working area. Emotional reaction to colour, colour complementation, the safety colour code and use of colour in the identification of piping systems are also dealt with.

The booklet is available from any district office of the C.I.L. paint and varnish division across Canada or by writing the Paint and Varnish Division, P.O. Box 10, Montreal, Que.

●

**A New Bulletin on Wheelco Instruments.**—A new bulletin F 5633-1, describing the complete line of Wheelco instruments for industrial process control application is now available. Of special interest is a discussion of the Wheelco electronic link, a simple no-contact linkage between the precision, direct measuring unit and the automatic control and recording system which gives instantaneous control and recording action. Also included in the new bulletin is a brief description of the flameotrol. Write the

(*Continued on page 548*)



Municipal waterworks pumping station control panel. System includes automatic level control of elevated water tank, water flow and pressure records and instruments to assist operator in continuously checking clear-well level and pump suction pressures.

(*Continued from page 546*)

Wheelco Instruments Division, Barber-Colman Company, Rockford, Illinois for your free copy of this catalogue.

●

**Air Classifier.**—Hardinge Company, Inc., York, Pennsylvania, has just published Bulletin AH-449 describing the new line of Hardinge "Gyrotor" air classifiers, a four-page booklet which illustrates the operational details of the new classifier plus its operational advantages over the conventional types, and flow sheets showing various applications. The Gyrotor is used for continuous separation or sizing, of a mixture of coarse and fine air-borne particles in a closed circuit dry grinding operation, or in any moving stream of air-solids mixture.

●

**Generator Alignment.**—A new method for aligning generators, turbines, shafts, bearings, etc. by means of optical instruments has been developed by the Farrand Optical Co., Inc. in co-operation with the Consolidated Edison Company of New York. A brochure issued briefly describes the new method as contrasted with the old and indicates the extent of time saving that can be accomplished.

A comprehensive bulletin No. 815 contains more detailed information and lists instruments and accessories. This bulletin is available upon request from the Farrand Optical Co., Inc., Bronx Blvd. and East 238th St., New York 70, N.Y.

●

**Piping and Fitting.**—A new 304-page fittings catalog and piping handbook has recently been announced by Ladish Co. of Canada Ltd., Brantford, Ont. It gives detailed dimensional data and specifications on complete line of controlled quality seamless welding pipe fittings, forged ASA flanges, large diameter and tema flanges as well as screwed and socket welding fittings. The catalog includes a 56 page technical data section. Copies may be obtained by writing to Ladish Co. of Canada Ltd., Brantford, Ontario.

●

**Atomic Energy.** — A newsletter about Canadian development of atomic energy for peacetime use is issued monthly by Isotope Products Limited, Box 127, Oakville, Ont. The newsletter describes developments of atomic energy uses in medical fields and in industry. Detailed procedures on specific problems that have arisen and their solution are given in this interesting newsletter. The letter also includes a section about people in the atomic industry.

●

**Air-Quenching Clinker Cooler.**—A 24-page bulletin released by the Canadian Allis-Chalmers Ltd. describes how a six-way saving can be effected in cement, lime and chemical industries through use of the company's shaking grate cooler.

A description of design features of the air-quenching cooler is included in the bulletin along with data on how a unit can be installed with little or no plant remodeling expense. A graph is provided to permit the plant operator to determine for himself how much fuel saving he can obtain by installing an Allis-Chalmers air-quenching clinker cooler.

Copies are available on request from Canadian Allis-Chalmers, Box 37, Montreal, Que.

●

**Exploring for Oil by Radioactivity.**—Upon request, the Radiac Co. Inc., 489 Fifth Avenue, New York City 17, New York, will furnish free literature concerning the use of geiger and scintillation counters in the exploration for oil by means of radioactivity association technique.

The following reprints are available: "Radioactivity in Geophysical Oil Search," Oil Forum, March 1953. "Now They're Hunting Oil with Atomic 'Guns'," Popular Mechanics, June 1953; and "Atomic Tools Seen Opening New Era in Geological Exploration," Texas Oil Journal, October, 1952.

●

**Ultrasonic Test Instruments.**—An illustrated 4-page folder just issued by Brandon Instruments, Inc., presents in organized form all the essential data necessary to an intelligent selection of the ultrasonic thickness-measuring instrument best suited to a particular problem or set of problems.

Copies of the Ultrasonic Specifications Folder are available on request from Brandon Instruments, Inc., 430 Fairfield Avenue, Stamford, Connecticut; or from their Canadian representatives, Messrs. Electrodesign, 209 St. Paul St. West, Montreal, Que.

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 37 | MONTREAL, MAY 1954 | NUMBER 5




"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

*16,100 copies of this issue printed*

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*Indexed in The Engineering Index*

*Labrador*

# Menihek Power Development


*by*

L. A. Carey, Jr.E.I.C.

*Resident Engineer,*
*Montreal Engineering Company Limited,*
*Consulting and Operating Engineers, Montreal,*
*Quebec.*



*A paper presented before the 68th Annual General and Professional Meeting of the Engineering Institute of Canada, Quebec City, May 12-14, 1954.*



The power development here described was built in the severe climate of the Labrador plateau, where only the months of June to September were frost-free. Dependable stream flow and maximum floods had to be estimated from records of rivers on adjacent watersheds and adjusted to the climate and geography surrounding the site.

Practically the entire tonnage of supplies and equipment was delivered to the site by airlift, on a scale never before attempted in Canada. Alternative earth dam designs had to be provided for placing fill on frozen foundations, though earth dams were actually built under summer conditions.

Choice of the site, determination of suitable installed capacity, equipment selected and methods of construction are discussed, as well as special measures taken for utilizing local aggregates and fill materials.


This paper describes the design and construction of the power plant built at Menihek in Labrador on the Ashuanipi River, to serve the new iron-ore mining centre of the Iron Ore Company of Canada near Knob Lake. The geographical location of Menihek is shown on Fig. 1. Preliminary investigations of possible sites for the power development were begun in 1950. Construction was commenced at Menihek in 1951 and the project will be completed ready for power production in mid-summer 1954.

Two features make this development unusual: the dam for the power project serves also as the bridge and approaches required by the railway to cross the wide Ashuanipi River, and a 330-mile air lift was necessary to transport men, supplies and equipment from Seven Islands during most of the construction period.

The new railway from Seven Islands to Knob Lake, the St. Marguerite power development near Clarke City, and the docks and loading facilities at Seven Islands were being built by the same contractor at the same time as the Menihek power project. The progress and difficulties of these other major undertakings, but more particularly the railroad, had a considerable influence on most stages of the work at Menihek with regard to the availability of construction equipment.

To suit the railway construction program, the Ashuanipi river-crossing over the dam had to be ready by the end of 1953. Work at Menihek was planned with that vital obligation constantly in mind. In fact, the dam and bridge girders were ready on December 10, 1953, sixteen days before the track-laying parties reached the south end of the earth dam, and twenty one days before tracks were laid across the river bridge.

The Labrador plateau has a severe climate. Temperatures ranging between 47 degrees below zero in winter, and 85°F. in summer were recorded at Menihek. High winds and the long season of cold weather had a profound effect on construction. Only the months from June to September are considered to be reasonably free from frost conditions.

Full protective measures had to be taken to permit placing of concrete under winter conditions in order to meet the scheduled date for completion of the work. The remote location and difficult access to the site constituted perhaps the greatest of all the problems on this project, and reference is made later to the arrangements for transport.

The assessment of load requirements at the mines was based on the assumption that an annual output of 10,000,000 tons of ore would require about 4,500 hp. for mining equipment, with mining operations taking place between the months of May and October.

At this time of year the mining settlement would require about 2,500 hp., but the extra heating and lighting load during the winter would result in a fairly balanced total demand throughout the year. After considering all relevant factors, an initial installation of 12,000 hp. in two units was finally chosen, with provision for adding a further 12,000 hp. in the future.

### Selection of Site

There are no suitable smaller rivers or high-head possibilities in the Knob Lake area which could be used at low cost for the comparatively small amount of power required in the mining area. Among the possible power sites investigated were Eaton Canyon and the Lower Gorge about 75 miles west of the Knob Lake camp, on the Kaniapiskau River. Both are magnificent power sites, where upwards of 1,000,000 hp. could be developed.

These large sites however, are not practical for the generation of small amounts of power. The cost of the diversion works would be high. So much frazil ice would be created throughout the winter by rapids upstream that the operation of small power plants would be difficult. It was felt that the development of these valuable sites should be de-

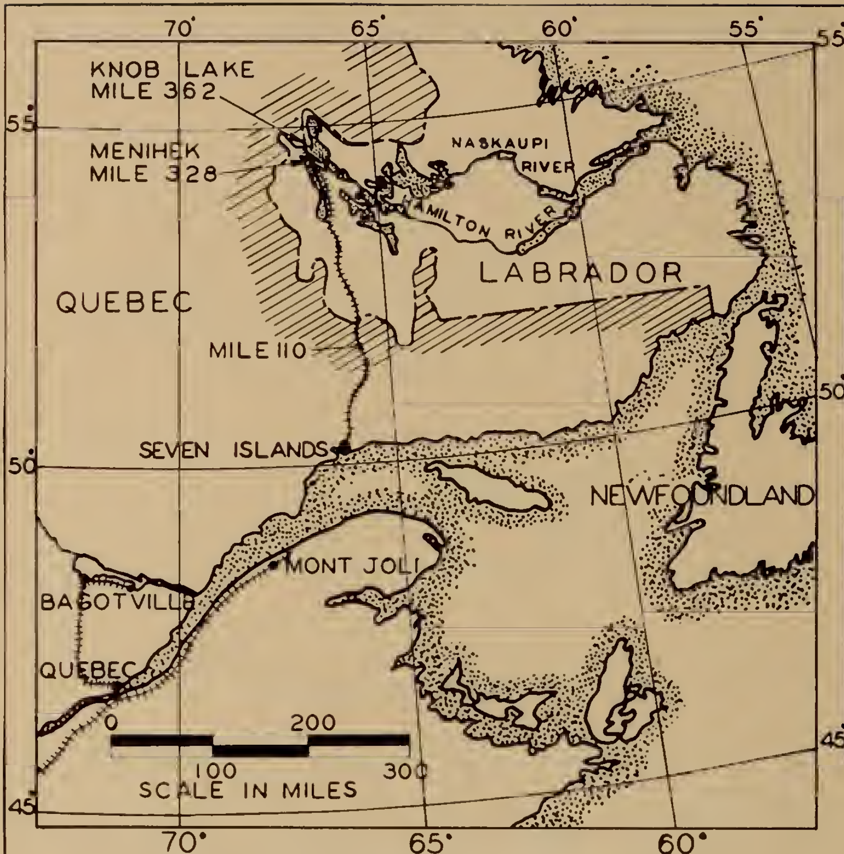


Fig. 1. The geographical location of Menihek.

ferred until enough power is required to justify their use on a major scale.

The railroad from Seven Islands to Knob Lake had to cross the Ashuanipi River in any case, and a suitable low head site existed where the line was to cross the river below the outlet of the Menihek Lake. The site offered several advantages:

(1) Ample storage could be created on Menihek Lake for an initial development of 12,000 hp., and additional storage could be made available at lakes in the headwaters if required later.

(2) The power potential of the river was considerably more than the immediate mining needs, so that development could be extended to meet future load growth.

(3) The power plant would be approximately 28 miles from the load centre at Knob Lake. The transmission line would in general run parallel to the line of the railroad which would thus provide access for construction and line maintenance.

(4) The concrete dam for the development would serve as a railroad bridge across the river, while the earth-fill dam would carry the railroad grade alongside the storage reservoir.

(5) Material for a homogeneous type earth-fill dam was available at the site.

The main disadvantages of the Ashuanipi were that it is a large river for the amount of power initially required, and prior to construction of the railway it was difficult to reach except by air. This, together with the low head available in this country of low relief, makes the first development expensive. Against this must be credited the economic advantage of combining the power project with the approaches and bridge for the railway crossing of the river.

### Physical Features of the Ashuanipi River Watershed

The Ashuanipi River, some 260 miles in length, forms one of the main tributaries of the Hamilton, Labrador's major river. Its main source is Ashuanipi Lakes, from whence it flows in a northerly direction for some 160 miles before veering sharply to the east to join the Hamilton River at Sandgirt Lake.

On the north and west its drainage area forms a portion of the boundary between Labrador and the Province of Quebec. The watershed is bounded on the south by a series of rivers flowing into the St. Lawrence River, and on the north by rivers flowing into Ungava Bay.

The country through which it flows is relatively flat, sparsely wooded, and has many lakes and swamps. Above Menihek Lake the river is more or less a series of large lakes, joined by rapids. The drainage area above the power plant is approximately 9,040 square miles.

### Description of Site

From Menihek Lake, with an area of 88 square miles, the Ashuanipi River flows through a series of rapids and small lakes (Fig. 2), dropping 32.3 feet in 3½ miles. The fall from Menihek Lake to the outlet of Range Lake was 13.5 feet, and a further drop of 14 feet occurred in approximately 3,300 feet from the outlet of Range Lake to Stoney Bay. The terrain on either side of the river is flat and rises slowly from the river's edge, so that long, low dykes were required at both ends of the river dam to raise the water level in Menihek Lake.

The bedrock is generally altered siltstone, overlain by varying thicknesses of unconsolidated glacial debris, some of which was suitable for earth-fill construction. Gravels are practically non-existent in the area. The rock at the powerhouse site on the north bank is a lamprophyric dyke, and contains thin veins of iron pyrite. Rock on the south bank is extremely fine grained altered siltstone.

Both types of rock are very dense, their specific gravities being 2.69 and 2.68 respectively, and water absorption figures were less than 1 per cent in each case. Loss due to 15 cycles of sodium sulphate tests was 0.26 per cent for rock at the powerhouse site and 1.12 per cent for rock on the south bank.

Table I—Ste. Marguerite and Outardes Rivers' Data

| River | Years Obs. | Drainage Area Square Miles | c.f.s. | Runoff c.f.s. per Square Mile | Runoff Inches on Drainage Area |
|---|---|---|---|---|---|
| Ste. Marguerite | 8 | 2,270 | 5,210 | 2.30 | 31.2 |
| Outardes | 27 | 6,300 | 14,000 | 2.22 | 30.2 |

## Water Supply

Due to lack of stream flow records on the Ashuanipi and adjacent rivers, it was necessary to estimate the probable run-off of the Ashuanipi from records of temperature, precipitation, and run-off records of the nearest rivers on which this data was available, adjusted to the climate and geography of the Labrador plateau. These records cover the Ste. Marguerite and the Outardes, which rise to the south west of the Ashuanipi and flow into the St. Lawrence River, and the Hamilton River on which partial records are available.

Table I lists data on the Ste. Marguerite and Outardes Rivers.

The mean run-offs from Table I, in terms of inches on the drainage areas, were then equated to the precipitation records nearest the source and, alternatively, nearest the mouth of the river to obtain the ratio of precipitation to run-off at two points on each river. Thus, an estimate of the ratio of average precipitation to run-off on both rivers could be made. The results of these calculations are shown in Table II. A run-off to precipitation ratio of 0.80 was selected for the Ashuanipi River.

The minimum annual precipitation on the Ashuanipi was taken as the lowest recorded at Sandgirt Lake, Knob Lake and Ashuanipi, giving a total of five years of records. The minimum recorded was at Knob Lake at 25.99 inches. Table III is a tabulation of the maximum, minimum and mean precipitation at selected points in Labrador and Quebec.

From Table III, it is apparent that the coast of Labrador and Quebec is a region of relatively high rainfall. Inland over the height of land the annual precipitation decreases. The minimum annual precipitation of 25.99 inches in the Ashuanipi district is equivalent to 20.80 inches, or 1.5 c.f.s. per square mile run-off at a run-off to precipitation ratio of 0.80.

At a minimum annual run-off of 1.5 c.f.s. per square mile, the dependable flow of the Ashuanipi River with 100 per cent regulation and a drainage area of 9,040 square miles above the power site would be approximately 13,500 c.f.s.

From a study of the temperature and snowfall data and a knowledge of the climate in the Ashuanipi area, the winter flow was estimated to extend from October 1 to May 31. From October 1 the run-off was assumed to be governed by the rate of lowering of the lakes, the lower-

### Table II—Ratio of Average Precipitation to Run-off

| River | Precipitation Gauge | Mean Runoff Inches on D.A. | Mean Precipitation Inches | Ratio Runoff to Precipitation | Mean Ratio Runoff to Precipitation |
|---|---|---|---|---|---|
| Ste. Marguerite | Clarke City | 31.2 | 41.12 | 0.76 | — |
| | | | | | 0.85 |
| Ste. Marguerite | Sandgirt | 31.2 | 33.00 | 0.94 | — |
| Outardes | Baie Comeau | 30.2 | 43.28 | 0.70 | — |
| | | | | | 0.76 |
| Outardes | Lake Manuan | 30.2 | 36.80 | 0.82 | — |

### Table III—Maximum, Minimum and Mean Precipitation at Selected Points in Labrador and Quebec

| Location | Years Obs. | Precipitation | | |
|---|---|---|---|---|
| | | Maximum | Minimum | Mean |
| Chute aux Galets | 20 | 53.60 | 33.32 | 42.20 |
| Lac Onatchiway | 23 | 59.23 | 38.05 | 48.90 |
| Passe Dangereuse | 7 | 56.76 | 44.04 | 50.01 |
| Portage des Roches | 24 | 44.99 | 32.94 | 38.38 |
| Shipshaw | 6 | 41.87 | 31.82 | 37.55 |
| Baie Comeau | 3 | 49.87 | 35.96 | 43.28 |
| Seven Islands | 5 | 49.36 | 36.35 | 41.99 |
| St. Felicien | 10 | 33.04 | 27.34 | 39.87 |
| Lake Manuan | 7 | 41.34 | 29.78 | 36.80 |
| Nitchequon | 7 | 40.30 | 24.17 | 30.40 |
| Sandgirt Lake | 3 | 38.77 | 31.52 | 34.92 |
| Knob Lake | 1 | — | 25.99 | — |
| Goose Bay Airport | 8 | 33.41 | 21.91 | 28.13 |
| Ashuanipi | 1 | — | — | 30.35 |
| Natashguan | 6 | 49.99 | 33.18 | 41.55 |
| Clarke City | 30 | — | — | 41.12 |

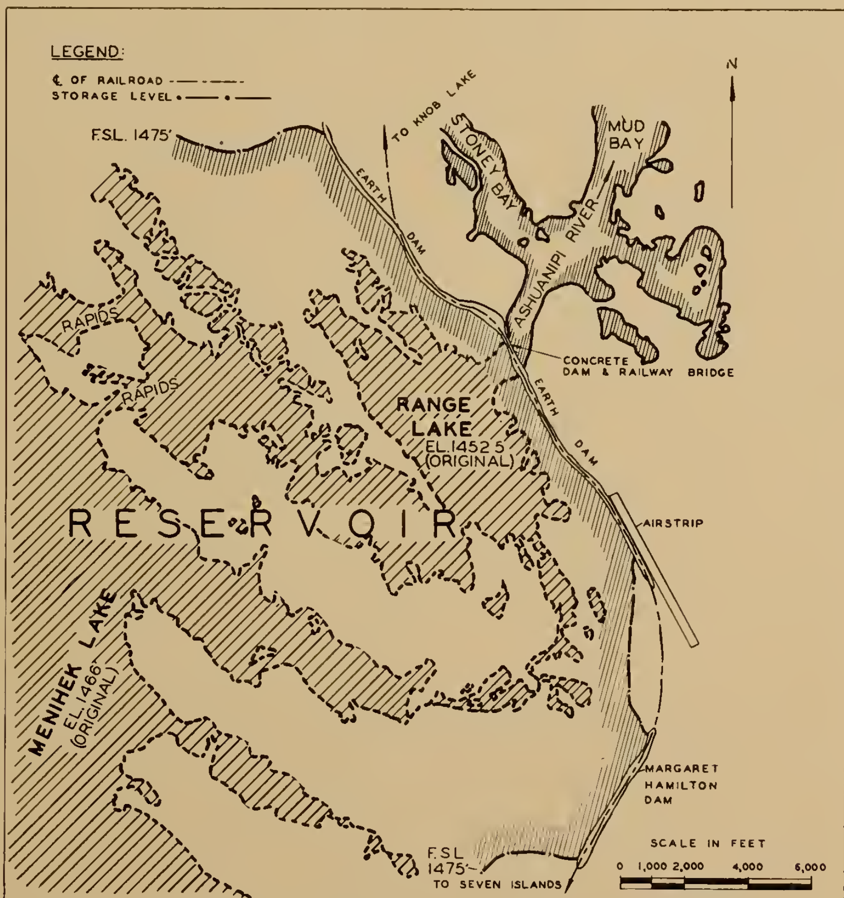


Fig. 2. The Menihek Lake area.

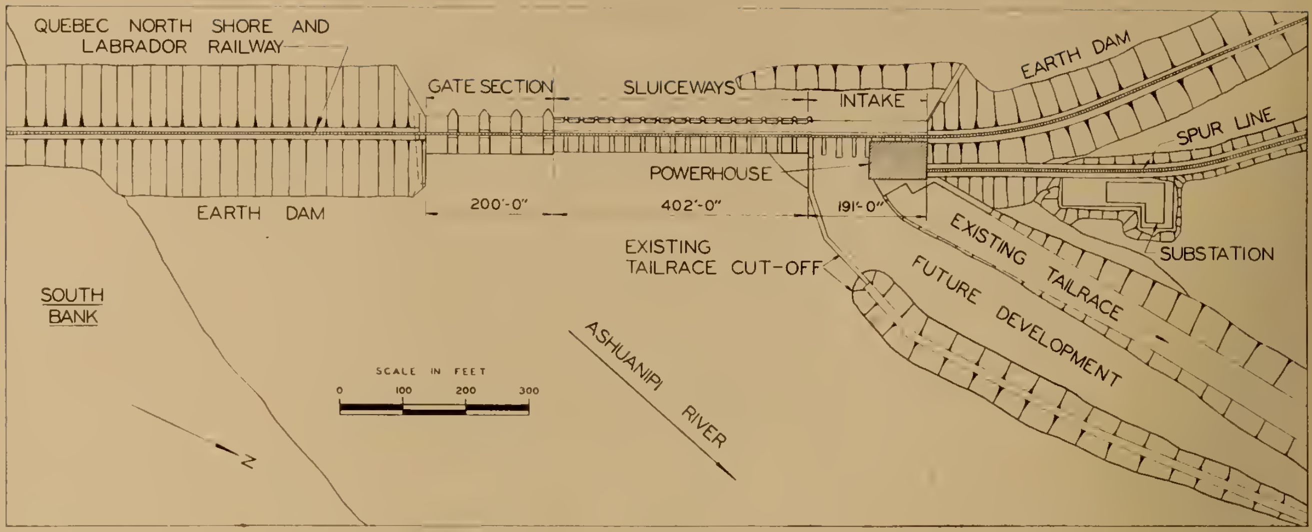


**Fig. 3. The general layout of the concrete dam and powerhouse.**

ing of the water table and the outflow from bogs, etc. The general shape of the hydrograph should thus be exponential.

Two points on the curve were determined from the discharge measurements at Muskrat Falls on the Hamilton River of 18,500 c.f.s. on January 1, 1949; and 9,800 c.f.s. on April 18, 1949. These are approximately in the ratio of 2 : 1, therefore assuming a minimum flow on the Ashuanipi of 0.25 c.f.s. per square mile (2,260 c.f.s.) on April 18, the flow on January 1 would be 0.50 c.f.s. per square mile (4,520 c.f.s.). The remainder of the hydrograph was then estimated from a plot on a logarithmic graph.

From the above analysis the dependable flow from October 1st to May 31st was estimated at 1,017,900 c.f.s. days. At a minimum annual run-off of 1.5 c.f.s. per square mile, the total annual run-off is equal to 4,940,000 c.f.s. days. Thus, the flow from June 1st to September 30th would be 3,922,000 c.f.s. days or a mean flow of 32,150 c.f.s.

The minimum flow may occur in May coinciding with the highest monthly load. With the storage full on May 1st, the minimum May natural flow augmented by five feet head of storage from Menihek Lake would give a regulated flow in excess of 6,500 c.f.s.

### Flood Flow

The lack of discharge measurements on the Ashuanipi and adjacent drainage basins makes the forecasting of flood flows difficult. In view of the wide, flat drainage basin with relatively large lake area, it is safe to assume the peak flow is below that experienced on the Ste. Marguerite or the Outardes Rivers. The maximum run-off on the Outardes in twenty-seven years of record is 15.0 c.f.s. per square mile. Commander G. H. Desbarats, Water Bureau Engineer, St. John's, Newfoundland, estimates the flood flow in the Hamilton at Muskrat Falls at 8.7 c.f.s. per square mile. Assuming 8.7 c.f.s. per square mile flood run-off on the Ashuanipi at Menihek Rapids, the flood flow would be 78,000 c.f.s. However, due to the uncertainty of the assumptions that had to be made to arrive at this figure, the adopted spillway capacity was 150,000 c.f.s., which is equivalent to 16.6 c.f.s. per square mile.

### Head and Power Available

The effective head between Menihek Lake and Mud Bay varied between 25 feet when the river was in flood, to 32.3 feet at times of minimum flow. The 4.8 feet of head between Stoney Bay and Mud Lake could only be obtained by a long, costly rock cut, which reduced the economic head to 27.5 feet.

With an estimated minimum winter flow of 2,260 c.f.s. this head could develop about 5,000 continuous horsepower which was insufficient to meet the load requirements. It was decided to raise Menihek Lake nine feet above low water level, to elevation 1,475. This is the highest elevation to which the lake could be raised without running into excessive railway grades and adding materially to the cost of the earth-fill dam.

While the head and storage so obtained were more than those needed at the present time, it was considered desirable to go to the ultimate storage elevation now rather than at a later date, when the work required to raise the head would be considerably more costly and would entail an interruption to railway service.

By raising the lake elevation to 1,475 and excavating the plant tailrace for a water elevation 1,441, a head of 29 feet at flood flow and 34 feet at minimum flow with the lake at full supply elevation was obtained. With full supply level at 1,475 feet, five feet of drawdown is possible without running into ice trouble at the plant intakes.

During the month of May when the load may reach a peak of 9,850 hp., the minimum river flow supplemented by the storage water drawn from the upper five feet of the lake would average 6,810 c.f.s. throughout the month. At the minimum average head of 31.5 feet at this time of year, 17,000 continuous horsepower could be produced during the month, or 28,000 horsepower at a load factor of, say, 60 per cent. The 100 per cent estimated regulated flow of 13,500 c.f.s. available on the river is equivalent to 34,000 continuous horsepower, or 56,000 horsepower at 60 per cent load factor.

### Structures and Equipment

The general layout of the concrete dam and powerhouse is shown in Fig. 3. The powerhouse is located in the cove on the left bank of the river some 1,300 feet below Range Lake. By reason of the site chosen, work on the powerhouse substructure could proceed uninterrupted by the seasonal changes in river flow.

A cross section through the intake and powerhouse is shown in Fig. 4. The powerhouse building is a steel framed structure with walls of asbestos sheeting on the inside of which asbestos fibre insulation has been sprayed to a thickness of two inches. Four hand operated gates are installed at the draft tube outlets.

The clear gate openings at the intakes are 15 feet by 17 feet. Each of the four headgates weighs nine tons, and is of the fixed axle roller type with electrical and manual hoisting gear. Heaters are fitted to the gate guides. Four more intake passages closed off by steel bulkhead gates and stoplogs have been constructed on the south side of the powerhouse. Thus the plant at some future date can conveniently be doubled in capacity.

The powerhouse accommodates two 6,000 hp., 150 r.p.m. fixed blade propeller type turbines, operating under a head of 34 feet. Power is generated at 6,900 volts by two 5,000 kva. generators and stepped up by two 5,000 kva. transformers for transmission to Knob Lake, a distance of approximately 30 miles, initially at 66 kv. and later at 115 kv.

The spillway, having a total capacity of 150,000 c.f.s., consists of four sluice gates 35 feet long and 26 feet high, each weighing 42 tons, as well as seventeen stoplog sluiceways each 18 feet wide. The gates, roller paths and sealing surfaces are electrically heated. The design of the sluice gates made allowance for an ice load of 5,000 pounds per lineal foot acting one foot below water surface level, which varies between elevation 1,475 and 1,470.

One set of stoplogs for the large gate openings is handled by an electrically operated hoist, running on a monorail beam fixed to brackets on the upstream side of the gate towers. A travelling gantry handles bulkhead gates and logs in the stoplog sluiceway section.

The earth dam with crest elevation 1,480 extends northward from the powerhouse for 6,800 feet to meet the 1,480 contour. To form a continuous dyke to elevation 1,480 south of the river section of the dam, two lengths of earth dam were required totalling 13,200 feet in length, the southern part being known after the nearby lake as the Margaret Hamilton dam.

After running for three miles on the dam, the railroad to Knob Lake branches off midway along the northern section of the earth dam. Designs for the earth dams are shown in Fig. 5. Lack of gravel for pervious embankments dictated the selection of a homogeneous type of dam.

Uncertainty in the delivery dates of suitable construction equipment made it necessary to be prepared for placing fill on frozen foundation material at the Margaret Hamilton dam. It was also necessary to provide for building the river section of the earth-fill dam during freezing temperatures, to ensure having the grade ready for the railroad. However, it was possible to avoid cold weather construction, and the earth dams were placed under summer conditions to the designs in Fig. 5 which are marked "As Constructed".

### River Diversion

A diversion channel on either side of the river between Range Lake and Stoney Bay would have entailed a large quantity of excavation, and it was therefore decided that all diversions during construction would be made in the width of the river, maintaining low head conditions to prevent flooding the low land on both banks.

Coffer-dam work was commenced in August 1951 to construct a line

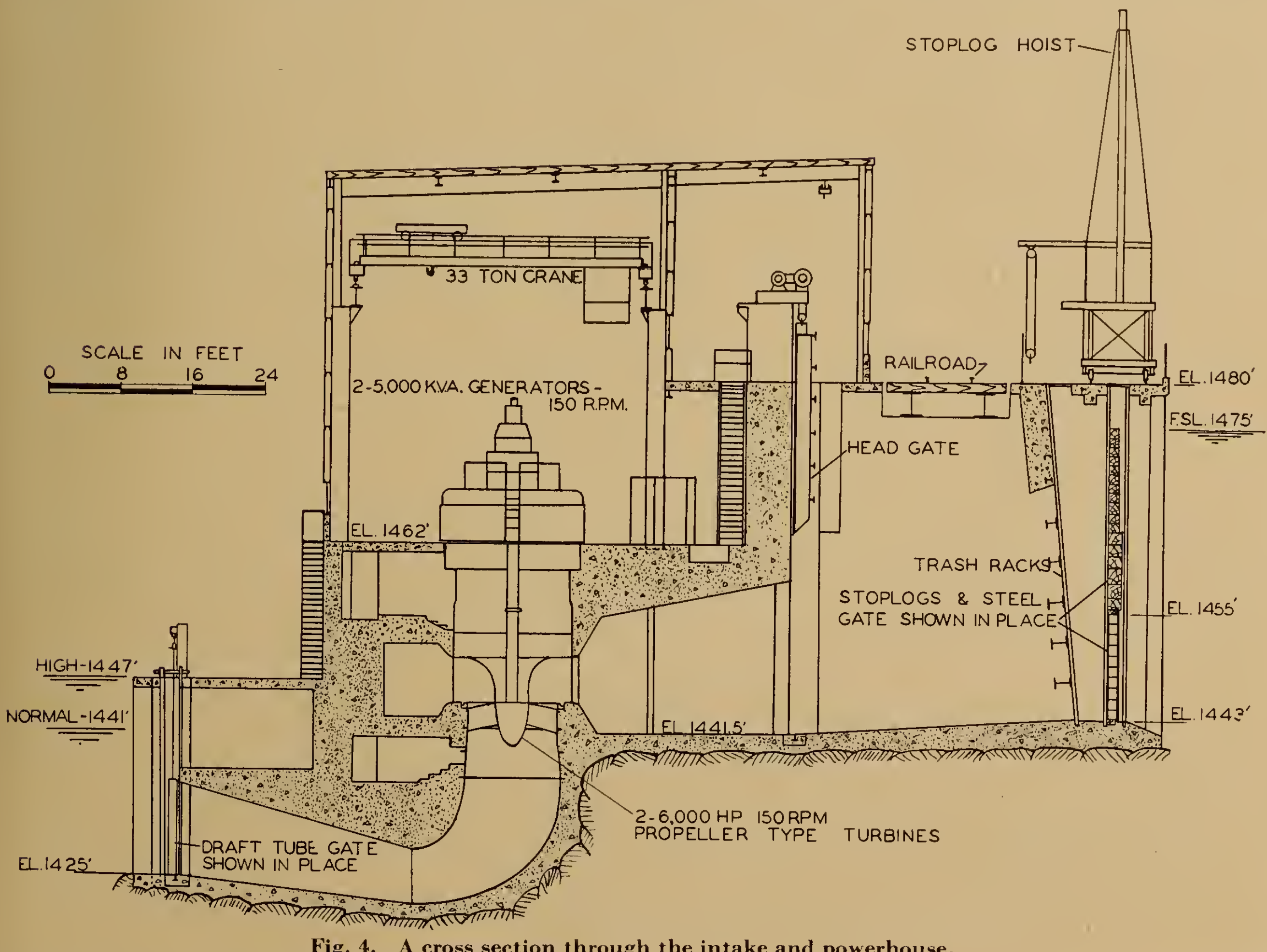


**Fig. 4. A cross section through the intake and powerhouse.**

Winter construction of the coffer-dams.

of rock-filled timber crib piers across the river. Water flowing between the piers was controlled by means of stoplogs. A timber bridge was built over the coffer-dam to give access to the airstrip on the south bank. However, an early spring thaw and a rainfall of 1½ in. in May 1952, resulted in an exceptionally heavy run-off, the peak flow at the damsite being estimated at 75,000 c.f.s.

Contrary to reports from those who had observed previous spring run-off conditions in the area, a rapid breakup moved the ice out of Range Lake. Huge rafts of ice swept down on the coffer-dam bridge, causing extensive damage and loss of the access to the south bank.

It was possible to seal off the stoplog sluiceway area, and by the end of the year all but one of the piers in this section had been completed. The concrete ogee sluiceways between the piers were omitted at this stage, to provide maximum spill capacity the following year when the remaining part of the dam was being constructed.

A further high flow of 32,000 c.f.s. occurred in October 1952, which was approximately twice the usual flow for that time of year. This delayed resumption of the coffer-dam work, and it was not until December that the flow fell below 10,000 c.f.s.

The upstream coffer-dam designed for overflow conditions in the spring flood was repaired and pushed southwards at elevation 1,455 across the river. At the same time the river flow was diverted through the stoplog sluiceway section. Six 50-foot spans of Bailey bridging erected upstream of the concrete piers, maintained access.

Some rock excavation in the central sluice gate area was completed before the 1953 spring flow overtopped the coffer dam as expected. In view of the size of the ice rafts seen the previous year, it was deemed prudent to build an earth-fill dyke to shield the concrete piers in the stoplog sluiceways from impact—a hazard occurring only during the construction period.

The maximum spring flood in May 1953 was estimated at 41,500 c.f.s., i.e. about 34,000 c.f.s. less than in the previous year. Break-up of ice in Range Lake took place gradually, and there was no large ice run. As soon as the falling river stage permitted, the rock-fill coffer-dam upstream of the sluice gates and earth dam was raised to elevation 1462, and water was diverted through the stoplog sluice section.

When the sluice gate section had been poured the upstream coffer-dam was removed, allowing water to flow between the sluice gate piers. Finally each sluiceway opening in the stoplog sluiceway section was unwatered in turn, to permit placing of concrete in the sluiceway ogees. This was done by fixing stoplogs temporarily in construction slots formed in the upstream and downstream ends of the piers.

### Concrete

Preliminary investigations for concrete aggregates indicated the presence of small deposits of sand and gravel in the river bed below the dam site, also on the shore line of Range Lake south of the camp, and in the ridge west and south of the airstrip. All of this was of poor quality due to tannic acid contamination, and sufficient total quantity was not found within reasonable hauling distance.

The search was then widened over a large area, and a sand deposit was discovered on the shore of Menihek Lake some 7½ miles from the job. This material was somewhat deficient in fines and called for a long, costly haul, but was otherwise satisfactory.

Samples of bedrock from the powerhouse site and the south shore of Ashuanipi River were tested for coarse aggregate. The rock tended to break into flat, sharp particles when crushed, and the samples from the powerhouse site, identified as dactic lava, contained varying amounts of iron pyrite.

By the fall of 1951 it was evident that no first class concrete aggregate existed in the Menihek area, and the best choice had narrowed down to a low ridge in Stoney Bay which, although largely comprised of dactic lava similar to that in the powerhouse site, also contained excellent quartzitic stones from the glacial drift. Once more the tannic acid contamination was found to be high.

Tannic acid in the soils and gravels is a common difficulty in many parts of Quebec Province, were the vegetation is largely restricted to moss and coniferous trees. This acid has been responsible for much poor concrete in the past.

Usually the concentration of acid decreases with depth in the gravel pits, and can be avoided by wasting several feet depth of the gravel. However, in the long shallow deposit at Stoney Bay there was no improvement with depth, or in the gravels excavated below the water level in Stoney Bay.

Considerable experimental work was done in the laboratory to find a means of neutralizing the tannic acid. Best results were obtained with large admixtures of hydrated lime which would have been costly to transport. In general, however, a practical method for making good concrete with any other admixture was not developed, due chiefly to relatively insoluble compounds formed by the tannic acid reacting with the iron oxides prevalent in this area.

Loss of the coffer-dam bridge in May 1952 made rock from the south side of the river and sand from Menihek Lake inaccessable. Tests were therefore concentrated on the Stoney Bay materials, establishing finally that even though the tannic acid could not be washed out with water, the greatest acid concentration was in the finer particles.

It was found that satisfactory aggregate could be made by scrubbing and crushing the larger stones to the required proportions, and by washing all aggregate below ⅜ inch size and wasting the finer particles. A deficiency in sand sizes then had to be made good by a sand-roll operation.

Aggregate from the pit was passed through a rotating drum scrubber. The ⅜ inch and smaller material was then put through a screw type washer, in which process practically all sand passing 30 mesh sieve was wasted as too highly contaminated. The remaining washed sand was fed once, and on occasions twice, through sand rolls. The 2 inch aggregate by-passed the impact crusher, which dealt with larger material up to 10 inch stones.

Sand recovered from the washer had a Fineness Modulus of about 4.0, and by use of sand rolls this was reduced to about 3.3. Each day the sand from the Eagle washer was tested for tannic acid, and where there were signs of contamination, the sand was re-washed before being passed through the sand rolls. Two high-speed 4 inch water pumps supplied some 80,000 gallons per hour to the washing operation.

The batching of aggregate and cement for concrete was by weight, and a typical mix for concrete having a minimum compressive strength of 3,000 pounds per square inch at 28 days, had a cement to aggregate ratio of 1 to 7.1 by weight and a water cement ratio of 0.60. A total of 31,000 cubic yards of concrete was placed in the works.

### Earth Dams

The prior claim of the important railway construction work progressing northwards from Seven Islands during the construction period at Menihek made it difficult to obtain enough suitable construction equipment, particularly for excavating and hauling earth and rock. After May 1953, however, adequate equipment became available, and the earth-dam work was completed on time.

The whole of the earth-fill dam, nearly four miles in length and containing 650,000 cubic yards of compacted material, was placed between May and October 1953, the rate of placement of material reaching a maximum of 46,000 cubic yards per week. Work was conducted on a 24-hour basis, and the average force of equipment in use at any particular time was:

North Bank

*Group 1:*

1—2 cu. yd. Dragline
3—10 cu. yd. end dump lorries (Euclids)
1—Tractor with sheepsfoot roller (TD 14)

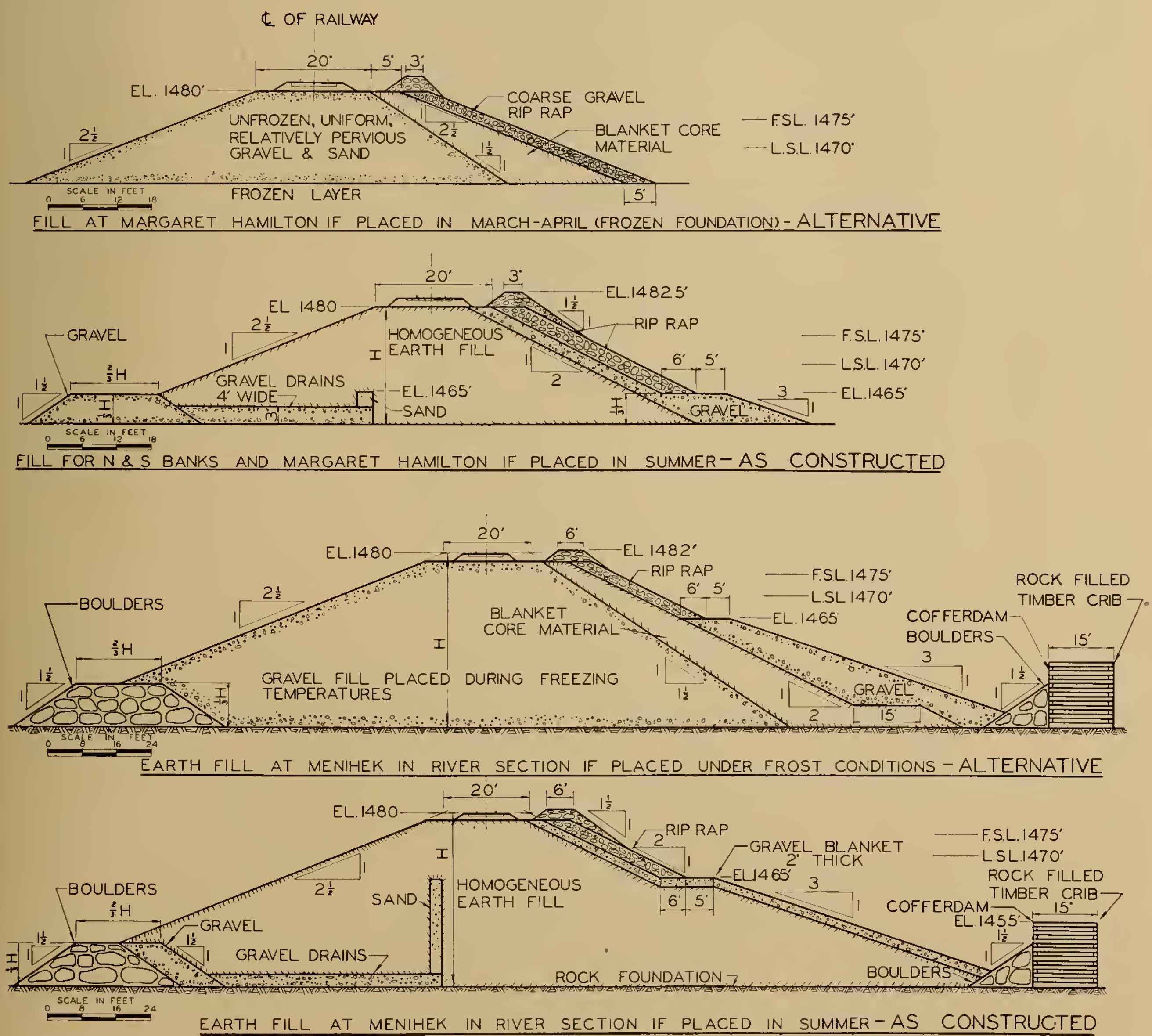


**Fig. 5. Designs for the earth dams.**

Upstream view of the site.

1—Tractor - spreading (TD 14)

*Group 2:*

3—12 cu. yd. scrapers with tractors (HD 20)
1—Tractor with sheepsfoot roller (TD 14)
1—Tractor at borrow pit (HD 20)
1—Tractor - spreading (TD 14)

South Bank

1—2½ cu. yd. shovel
3—23 cu. yd. end dump lorries (Euclids)
1—Tractor at borrow pit (HD 20)
1—Tractor with sheepsfoot roller (TD 14)
2—Tractors - spreading (TD 14 and HD 15)

Margaret Hamilton Dam

5—Pneumatic-tired tractors and scrapers (DW 10)
1—Tractor at borrow pit (HD 20)
1—Tractor with sheepsfoot roller (TD 14)
1—Tractor - spreading (TD 14)

As previously mentioned, weather conditions at the time of construction made it possible to adopt the designs in Fig. 5 marked "As Constructed". The transverse sand drains were placed at depressions crossing the axis of the earth dam, and the vertical sand filter was formed as a continuous drain in the dam where the head of water on the dam exceeded 10 feet.

The method of placing the filter was to spread and roll the earth fill across the full width of the dam in six to eight-foot lifts, excavating a trench in each lift with a ⅝ cubic yard backhoe and back filling with sand. It was decided to postpone placing the gravel facing, essential to prevent weathering on the downstream face, until suitable material could be brought to the site by rail in a later construction season.

Boulders from the river bed in the dam area were used for the downstream toe of the earth-fill dams, and rock for rip-rap on the upstream face was either quarried from outcrops or taken from the tailrace excavation. The total quantity of rock toes and rip-rap amounted to 64,000 cubic yards.

### Transportation

The magnitude of the problem of obtaining access to the site is apparent from an inspection of Fig. 1. When construction operations began in 1950, the nearest railheads were at Bagotville on the Saguenay River and at Mont Joli on the south shore of the St. Lawrence River. There were no roads anywhere in this part of Canada except a few local ones at the small and widely scattered settlements around the coast.

The dock and warehouse facilities at Seven Islands provided the base from which the great enterprise of the railway and power developments stemmed. Construction plans for work at Menihek, which is 330 miles north of Seven Islands, and at other camps along the line to be taken by the railway, relied upon an airlift operation carried out on a scale never before attempted in Canada. In this respect the power project at Menihek can claim to be unique.

Except for the comparatively small tonnage hauled on tractor-drawn sleighs in the winters of 1952 and 1953, the job at Menihek was wholly supplied by air transport. About 11,000 tons of supplies and equipment were flown to the site. At the peak period in the summer of 1953, cargo planes were making over 100 flights each week to Menihek airstrip, with a weekly total of about 600 tons.

All the cement requirements at Menihek (approximately 186,000 bags) were transported to the site by air, with a peak of 8,570 bags being flown in one week. Unloading crews and air crews became so proficient with cement loads that DC-3 aircraft were on the ground less than ten minutes on turn around.

In the winter of 1952, 580 tons of stores and construction equipment arrived at Menihek on tractor-drawn sleighs. Seventy tons had travelled overland the entire 330 miles from Seven Islands, and 510 tons had been carried by air for the first part of the journey and transported the last 167 miles by tractor-drawn sleighs.

(*Continued on page 563*)

Downstream, the powerhouse in the background.

# 7,000 Ton Forging Press

*by*

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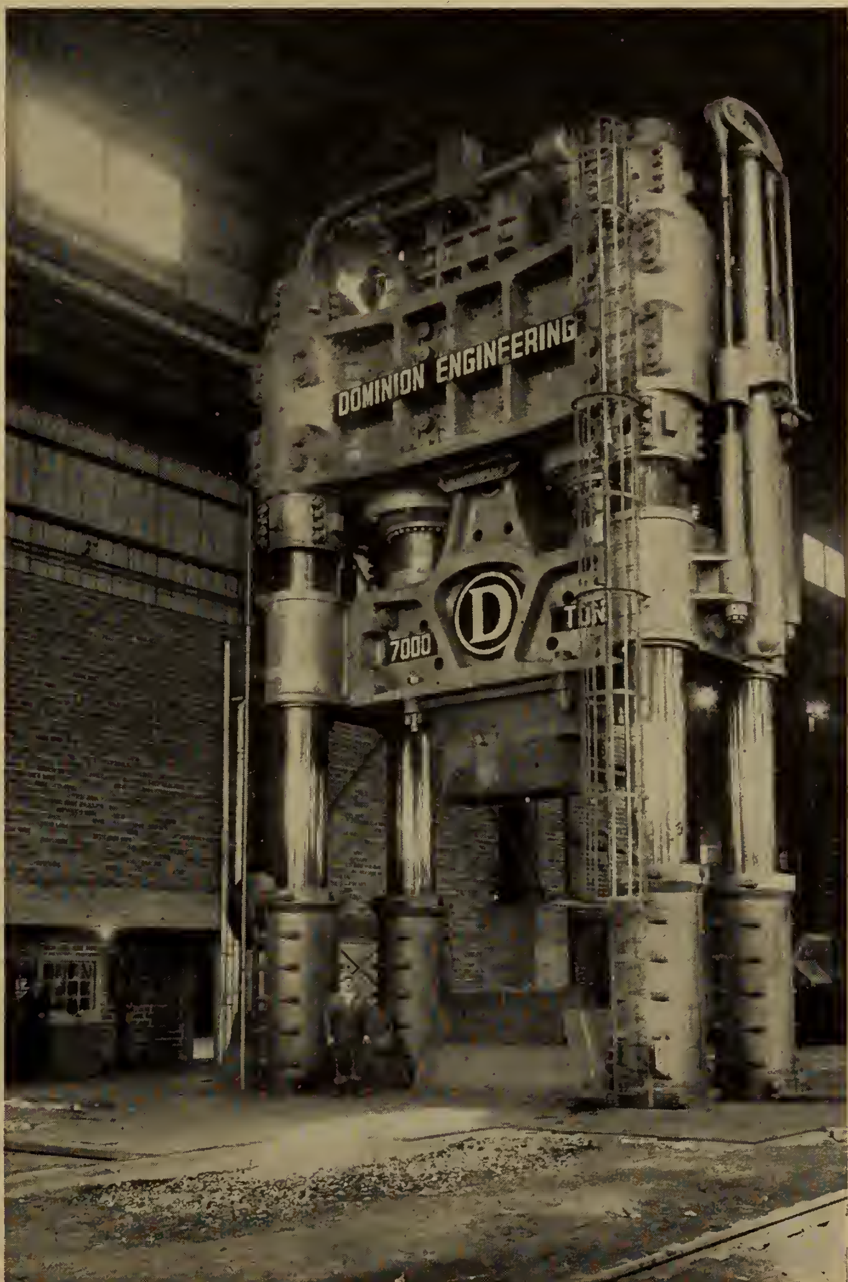
*A paper presented before the 68th Annual General and Professional Meeting of the Engineering Institute of Canada at Quebec City, May 12th to 14th, 1954.*

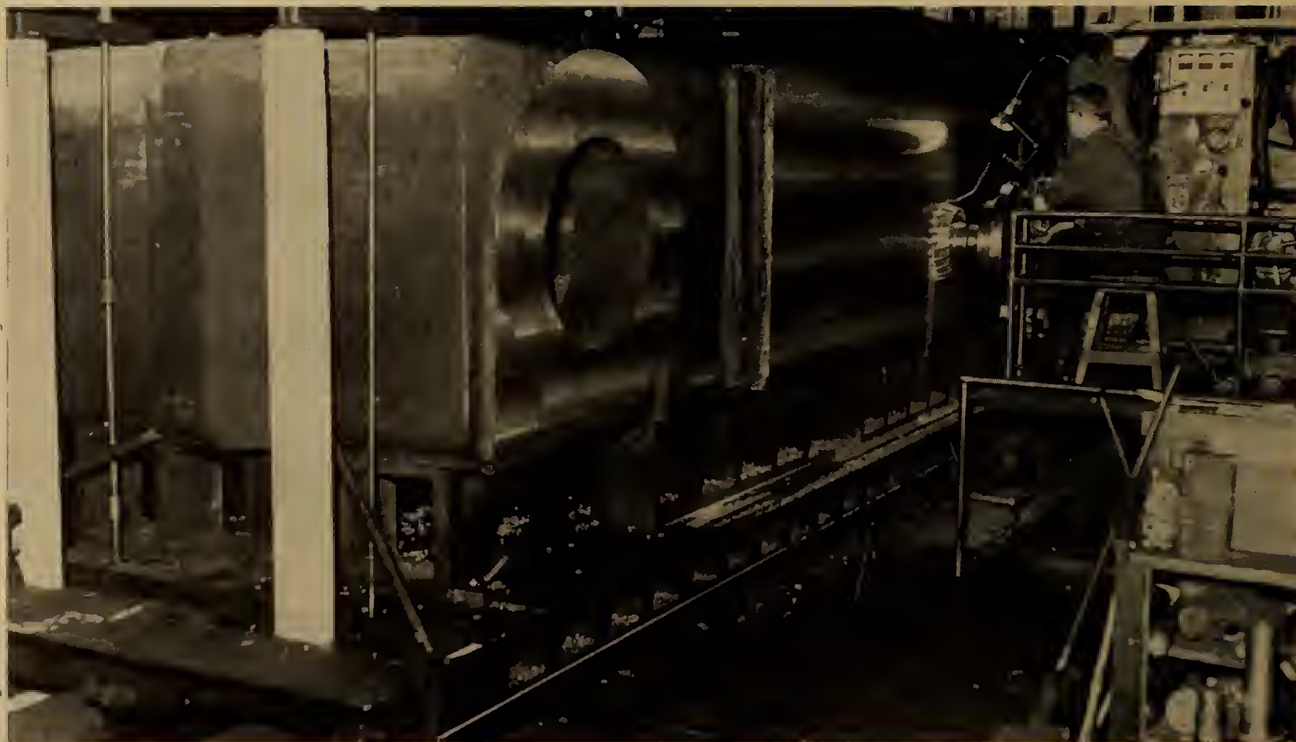
The 7,000 ton forging press described in this paper was designed for production of large ingots and billets, as well as for forming heavy plate. It is thus particularly suitable for Canadian industrial and defence production, and makes a significant contribution to Canada's productive independence. The author notes its rigidity, and discusses thread design, pressure fluid, pumps, accumulator and valves. The simplicity of operation is emphasized.




In the period since the end of the war, hydraulic presses, and particularly large forging presses, have caught the imagination of the public. The important role played by these tools in the manufacture of aircraft became almost common knowledge, especially when the unit capacity rose to 50,000 tons and more, and the costs began to affect defence appropriations of public funds.

The availability of the hydraulic press for the fabrication of steel forgings is less spectacular but even more important. Specifications as to size, weight and strength of steel and its alloys grow tougher to meet the requirements for modern machine elements, such as steam and gas turbine rotors or propeller hubs for aircraft engines. It is thus timely to discuss Canada's large forging press installation at Trenton Steel Works Limited, Trenton, Nova Scotia.

The forging plant installation consists of the 7,000 ton press, complete forging tools, mandrel stands and racking equipment for moving the tools in and out of the press. The power unit includes three triple plunger-type pumps for supplying high pressure fluid to the press, each



Machining of a bottom crosshead casting.

driven by a 1,000 hp. synchronous electric motor through a speed reducing unit.

A dead weight loaded accumulator is included for storing medium pressure fluid, for operation of auxiliary equipment and press return, storage tanks, valves and, of course, operator's control stand and operating control gear. The plant is further equipped with a 75-ton manipulator and a 75-ton overhead travelling crane for handling the large forgings, which are heated in a new oil fired furnace.

#### Step towards Canadian Productive Independence

The press and its power plant are modest in comparison with the 25,000, 35,000 and 50,000 ton giants in the U.S.A. and other countries. Yet it is a giant in its own right, for it has many features incorporated which make it particularly suitable for Canada's industrial and defence requirements. It is a big step forward on the road to productive independence. This country's needs are as varied as in any other, although they may be smaller quantitatively and would not warrant a special press of such magnitude and costs for every type of major product.

The press is, therefore, arranged for a variety of uses. It is designed primarily to work on large ingots and billets. These require not only diameter reduction by forging, but also shortening of length by upsetting to achieve the specified metallurgical qualities, hence the high daylight of 20 ft. and the long working stroke of 10 ft. The press is secondly arranged for forming heavy plate, such as armour plate of moderate thickness. This is the reason for the wide spread of the columns, which have centre spacings of 20 ft. sideways and 8 ft. front to back.

The wide range of application which this press must cover called for large overall dimensions, thus the machine is unique, and should be rather compared with a 14 to 20,000 ton unit. The press stands about 45 ft. above the operating floor, and has a depth of 12 ft. below the floor. It occupies, including the tool racking devices, 54 by 80 sq. ft. floor space and has a total weight of about 1,500 tons not counting the equipment in the pump room.

This press is of the down stroking, open column type, having two single acting plunger type rams for the power stroke. It has an inverted T ram-crosshead, arranged for guidance in the top entabulature and on the four columns. The return stroke is obtained by means of push-back cylinders, fitted to the top crosshead and equipped with single acting rams and connecting members to the moving crosshead. The press is oil-operated by direct pumping at 6,000 lb. per sq. in. into the main cylinders and by 2,500 lb. per sq. in. pressure from the dead-weight accumulator in the push-back cylinders.

#### Design and Assembly

The design and manufacture was completely carried out by our company, in Lachine, except for the purchase of large steel castings and forgings, pumps and motors, and smaller standard auxiliary equipment. The mechanical design and hydraulic layout are based on well proven methods dating as far back as the 1860's and 1880's, when Sir Joseph Whitworth and Davy Brothers of England perfected the press to a lasting and dependable tool.

Indeed, a study of modern presses shows that time has brought no marked improvement in principle or basic design. Leading designers are still divided with regard to the type of hydraulic power plant for driving presses. The choice is more of an economical problem than a technical one. After full investigation it was decided that direct pumping was preferable for the Trenton installation, rather than indirect pumping through air-loaded accumulators.

This press is noteworthy because of its size, versatility and ease of manipulation which involved many design and manufacturing problems. Its distinction is due also to the use of modern auxiliary equipment and the employment of oil in the main hydraulic circuit. Material procurement for such a large press was not easy during the busy days of 1951 and 1952. The company was forced to go far afield to find suppliers who could meet the required delivery dates. The moving crosshead of T shape was cast at Sheffield, England. Top and bottom entabulature castings came from Le Creusot, France. Other important castings came from well-known Canadian foundries, including our own in Lachine.

The accompanying illustrations indicate the large size of the component parts, as well as the big tools and handling equipment required for fabrication. It can be readily understood that neither height nor lifting power was available for complete shop assembly of the press, and that sub-assemblies had to suffice. The weights of the assembled top, moving and bottom crossheads are 300, 120 and 400 tons respectively. The first and final assembly was made at the site and, to the credit of the builders and erection crews the parts went together without a hitch.

### Rigidity Important

One of the first requirements for a well-operating press of such magnitude is permanent rigidity. All major bolting and tie rods are shrunk in place to clamp component parts into one solid body, which cannot separate and move at the joints under any stress or abuse short of breaking. Heavy usage is inseparable from forging plants, not only due to the rugged men at work, but more so due to heat, shockloads and scale dust. Auxiliary equipment is, therefore, extra heavy, and all guide and bearing surfaces are extra large to reduce the rate of wear.

Rigidity is most important for protection of the seals in the main cylinders against excessive side load and wear. Any side sway of the top entabulature, or non-parallel movement of the ram crosshead in relation to the base, causes misalignment of the rams and side thrust on the packing. The packing is of the automatic chevron or V type. The rams press on the horizontal legs of the T head through sphere shaped bearer plates. This arrangement provides considerable self-alignment and reduces the sidethrust.

The top and bottom crossheads are inherently very stiff bodies. The weakest links in the whole frame as to rigidity are the columns. They, and the means for clamping them to the heads, require special consideration. Our company's practice for all presses is to pre-shrink the columns to the fixed crossheads. This is done by heating the portion of the column inside the heads with steam for temporary elongation, and by setting of the nuts to a suitable distance apart, which results in a clamping effect corresponding to about 150 per cent rated load when the assembly has cooled off.

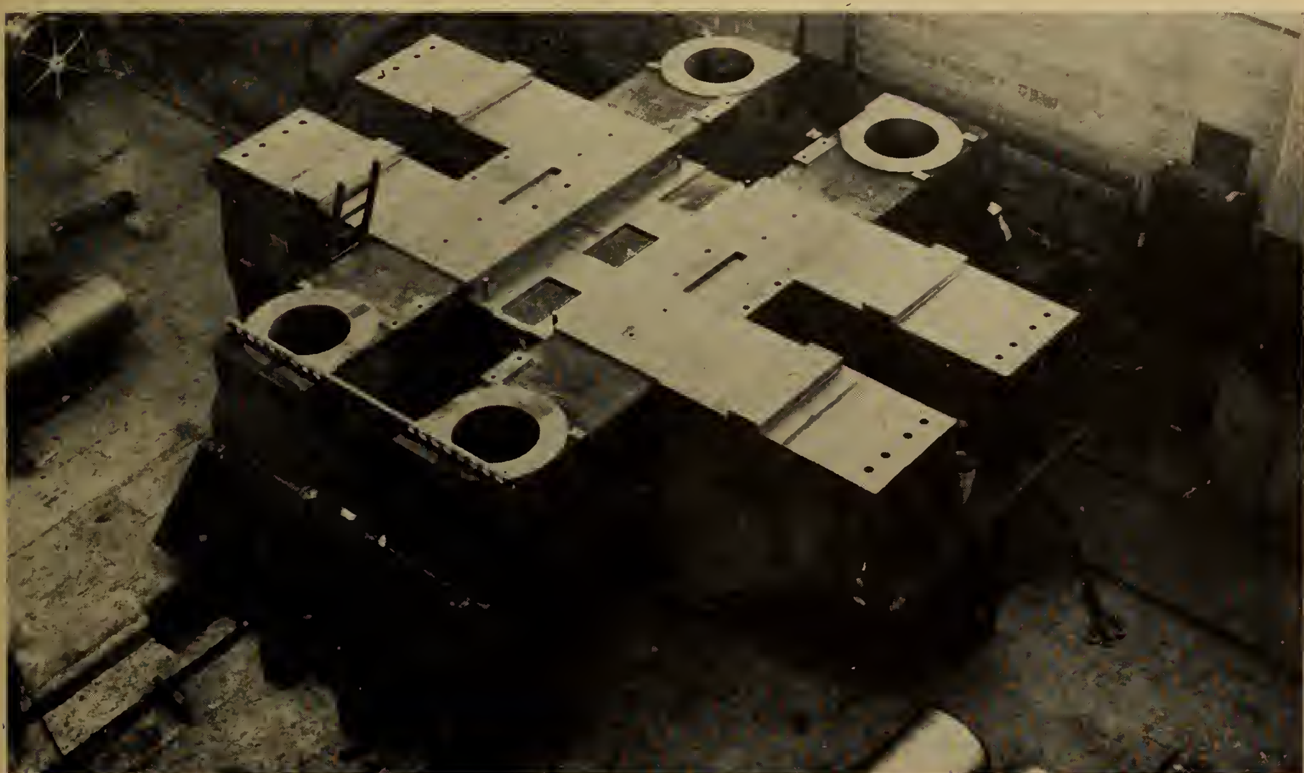
Many years of operating experience with all kinds of presses has shown that the above method of column mounting is notably free of column breakage.

Each column is 55 ft. long, 30 in. diameter, hollow bored to function also as piping for the oil flow from the bottom to the top of the press. This feature eliminates separate piping, which would be large, cumbersome and would require special precautions with regard to strains due to heat and pressure expansions, and particularly to press sway which occurs when forging eccentrically.

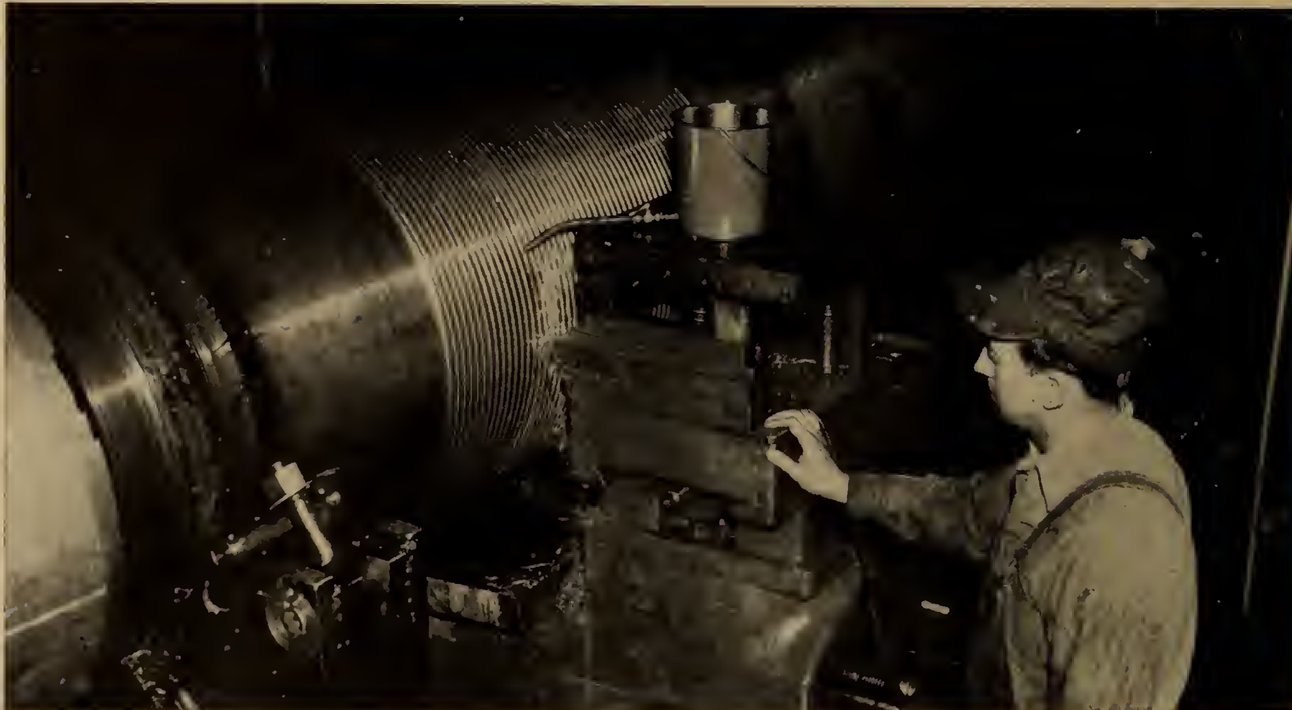
### Thread Design

Each column nut is of cast steel, in halves bolted together, 30 in. long, weighs 5 tons and needed much thought regarding permissible stress and strain in the threads. Our field experience with large threads for forging press applications was limited at the design stage to 16 in. diameter of standard ACME form. It is well known that, in standard nuts, only a few bottom threads engage the bolt due to compression and elongation of the two parts. Obviously, there must be a limit for geometric step-up when employing the same material at the same nominal stress. This is because the shear strain would increase at the critical places proportionately to size, and would eventually cause failure due to excessive stress concentration.

This problem has been solved by the press industry for high powered units in various ways, which however are not generally published. In



**Shop assembly of bottom crosshead.**



Machining of column thread.

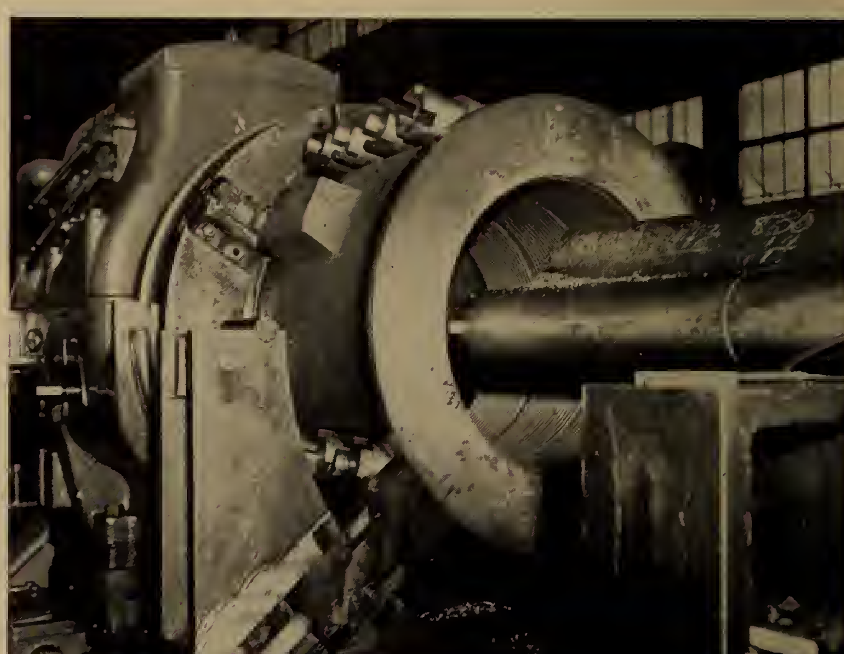
some cases the thread design was abandoned, in other cases a modified thread was adopted. A possible correction for spreading the load over the length of a standard unit would be a progressively varying pitch of the column thread.

The equivalent, except for certain reservations, could be readily obtained on lathes with normal lead screws, by machining on the column an ACME thread with tapering pitch diameter, and on the nut with constant diameter. Thread dimensions and taper would be chosen so that the unstressed assembly would have no clearance at the top of the nut, and towards the bottom progressively increasing clearance of calculated amounts, which would be taken up under load. This type of correction is surprisingly large for 30 in. threads, and would be applicable only on very coarse threads, with well rounded fillets at the root. Its purpose is to cope with the large beam stress at the small end of the taper, where the pitch diameter of nut and column differ most.

The engineers, after consideration of all aspects of the problem, including existing material and shop facilities, adopted another type of thread modification in the nuts, combined with standard threads on the columns. The thread in each nut is divided by an undercut into three portions of equal length. The top portion is standard, the middle portion has the working face relieved a constant amount at normal pitch, and the bottom portion the same of a larger amount.

The relief is chosen so that the column engages progressively from the top for each third of nominal load, the next lower set of threads near the bottom of each portion. It should be noted that this method is a compromise, and that the pitch of all threads in the lower portions of the nut and column differ by various amounts, due to deformations upon loading the portions above. The modifications, however, are calculated so that the strain in these 30 in. diameter threads would be similar to the strain in existing 16 in. diameter threads. Consequently stress concentrations would be no more than is presently in successful use.

Prestressing of the columns and the nuts improves the sway stability, and prevents any relative movement between the nuts and crossheads. The static friction between these members resists the shear force set up by the column in reaction to the



Machining of column nut.

moment due to eccentric forging. Secondly, the intimate contact between the nut and column threads restrains the expansion of the column inside the nut, which would otherwise occur because of the loop tension set up by the oil pressure, and cause relative movement and eventual wear between these parts. Thirdly, prestressing protects against fatigue failures.

#### Advantages of Oil Pressure Fluid

As already mentioned, the pressure fluid is oil. It has many advantages over water, although it is more compressible and often considered inflammable. Many years operation of the war-time 2,000 ton forging press at Trenton and of the scores of oil-operated, high-speed shell forging presses working hot metals, have shown that the danger of fire is practically non-existent. This is especially true if an inert heavy oil is used and the machinery is reasonably well maintained.

The compressibility of oil may introduce some time lag between operating phases, additional to the time lag caused anyway by expansion of piping and pressure vessels. On the other hand, this compressibility breaks the sharpness of front of pressure waves in the system and, thus, permits compensation for the time lag by faster valve action. When discharging water under high pressure through partially opened valves and orifices one always finds cavitation, and eventually cavitation damage such as pitting, cutting and erosion.

Oil may cavitate too, but in all these years not a valve or any other part has come to our attention that showed signs of damage as mentioned above for water. Oil has the advantage of lubricating moving parts of its own circulation system, and of protecting the surfaces against deterioration. This is quite contrary to the action of water. Oil absorbs air readily and foams easier than water, but this is not much of a drawback in a direct pumping system.

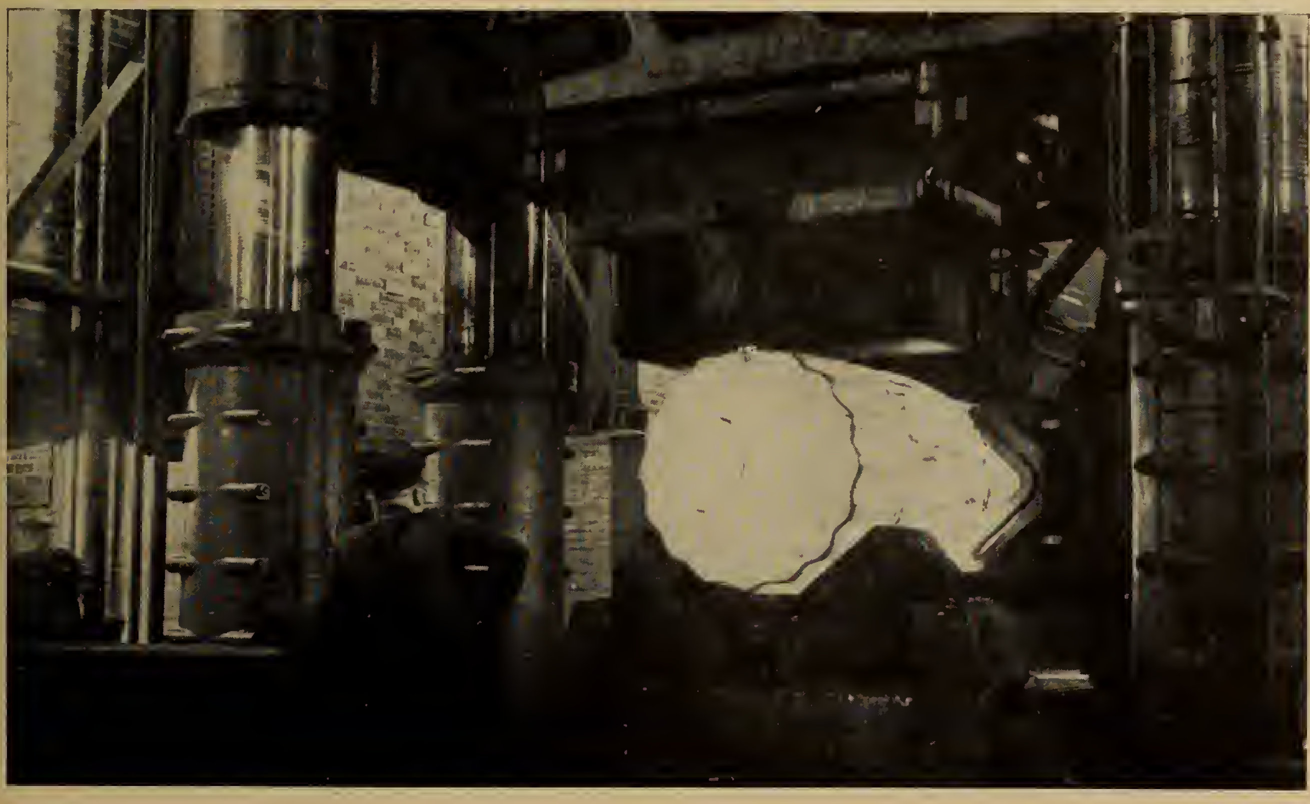
Many years ago it was discovered that a steady force at moderate penetrating or squeezing speed produces better forgings than impact blows, hence the modern use of presses rather than steam hammers. The rating or tonnage of presses is determined by the maximum size of ingots or billets, and by the type of forging operation, such as upsetting. It should be noted that the rating covers the upper limits and not necessarily the bulk of production, which may be much smaller pieces. The forging speed is in direct proportion to the pump capacity. Metallurgical consideration and sensitivity of the press control do not usually limit the maximum rate of forging, which may be as high as 15 to 20 f.p.m. The chosen rates of forging are more often limited to lesser speeds by economical aspects.

#### Power Plant

The economy of the largest press in a forge shop is subject to many items, such as availability of smaller units, flow of work or down time, first cost and maintenance, reheating costs of forgings or amount of work done between heats, price of sudden and short-timed power. Considerations like these and many more have a direct bearing on the size and type of power plant, and consequently on the squeezing speed of the press in particular.

The hydraulic power plant of the 7,000 ton press is similar to the existing 2,000 ton plant. The maximum forging speed with all three pumps in operation is a moderate 8 f.p.m. The rated approach speed of 50 f.p.m. and the return of 35 f.p.m. provide a fairly short time for completion of each forging cycle. They also suffice for planishing. These ratings are neither startling nor overmodest, but provide a plant which fulfills the aim of the project at reasonable expense.

The main hydraulic system forms a closed circuit, with a reservoir pressurized to 30 lb. per sq. in. by means of compressed air. This feature provides for positive pressure in the piping, surge suppressors and prefill valves on the top of the press. It is sufficient to prevent any



**Forging.**

local pressure drop below atmosphere, when the main rams fall by gravity during approach stroke and planishing operation, and drag with them the long column of oil from the reservoir to the top of the press.

The three main pumps are of the fixed displacement plunger type, each having a capacity of 270 Imp. gal. per min. and 6,000 lb. per sq. in. maximum working pressure. Each pump is equipped with valve boxes for spring loaded suction and discharge checks, relief valves, and manifolds for direct connection to the reservoir and the main valve, which directs the flow to the press or to exhaust.

The pumps are arranged for operation in parallel. The main valve may be set by means of pilot control for oil delivery to the press from one, two or all three units. This provides for the choice between three pressing speeds at the convenience of the forgemaster and his operators. The third pump automatically delivers oil to the accumulator during the periods of press return and press holding.

#### Accumulator

The dead weight loaded accumulator has a working capacity of 135 Imp gal. at 2,500 lb. per sq. in. pressure. It supplies oil for the pilot valve service, press return and racking equipment for the anvil and mandrel stands. It consists essentially of a stationary ram, supported in a foot flange on the foundations, and an inverted cylinder carrying the ballast tank. The total weight of the moving parts is about 405 tons, while the stroke is 10 ft. The ballast is made up of relatively long sections of steel rails and pig iron, which are horizontally stacked so that they do not shift and burst the tank open when it bumps against the stops.

At the speed of 35 f.p.m. press return the accumulator weight drops at the rate of 44 f.p.m., which corresponds to 340 ft. tons kinetic energy for the dead weight alone. Obviously, there are limitations as to weight, speed and rate of energy dissipation, which have a direct bearing on the practicable capacity of the accumulator. Special shock absorbers, compressibility of the oil, expansion of the system and leakage passing valves and rams function as dashpot, and soften the blows when a pilot operated valve stops the flow to the push-back rams.

The volume of oil flowing from the accumulator to the press at rated press speeds is larger than the third pump can supply during the available periods of time. The shortage of oil is made up by a separate 150 h.p. pump. This delivers oil directly and independently of press operation into the accumulator system, at a rated capacity of about 85 Imp. gals. per min. It was more expedient to install this pumping unit than to reduce the push-back cylinder volume to the capacity of the main pump, and to compensate correspondingly with a pressure increase from 2,500 to 3,500 lb. per sq. in. Standard auxiliary equipment and operating experience for such elevated pressures were, at the time of press construction, not available for hydraulic control gear.

The moving ballast tank provides for automatic control of accumulator refill by operating limit switches at the ends of the working stroke. Solenoid operated pilots actuate full flow valves, which direct the pump discharge to the accumulator or to exhaust. A mechanical trip operates a safety valve in case the normal devices fail. Failing this, a further rise of the weight would uncover exhaust ports and spill any additional oil. The same safety valve also automatically isolates the accumulator in case of a pipe line break. It directs pump delivery to exhaust whenever a predetermined pressure loss across the valve occurs, which may be due to excessive flow or surge.

The accumulator and push-back cylinders are equipped with fixed orifices at the main pipe connections for throttling of the oil passage. These orifices allow full pressure to be transmitted at rest, for quick acceleration of the masses and for reducing the effective pressure automatically when desired speed is attained. The headloss through these orifices is a source of heat in the oil, which, however, is in this installation of little importance. Of more importance is danger of cavitation, which causes gases in the oil to come out of solution, makes the oil foam and thus become highly compressible. This danger is largely overcome with special orifices having a number of small holes of 10 to 15 diameter length.

Hydraulic friction maintains high pressure at the orifice inlet, and thus restricts formation of cavities during orifice discharge into a low pressure zone.

The duty of these orifices is twofold. The total effect is chosen so that the rated speed of press return is obtained. The individual effects are chosen for limitation of the rate of free fall of accumulator weight and press ram crosshead to about 200 to 120 per cent of rated top speed respectively, in case of a pipe failure. The inherent hydraulic losses in the system should be small relative to the losses of the orifices, in order to obtain adequate effect of the latter for protection of the installation.

#### Valves and Fittings

Difficulties of interconnection between component parts of a hydraulic system including sections rated at 6,000 lb. per sq. in. pressure and up to 810 Imp. gal. per min. flow are generally not appreciated. Each item is large, heavy, costly to fit and to make leakproof. It is, therefore, expedient to cluster as many valves as practicable together into one valve body, and to reduce the number of external connections to a minimum.

The main pump by-pass valves with necessary pilots, checks and interconnections, and the accumulator main control valve, are in this manner grouped together in one block of forged steel measuring 39 in. x 28 in. x 23 in., and weighing about 3¼ tons. Similarly, the cam operated pilot valves are arranged in one steel body. The method and sequence of valve operation for press control and accumulator supply is patented.

The flange connections of the 6,000 lb. per sq. in. lines are sealed with neoprene "O" rings and leather back-up rings, which protect the former against extrusion if the metallic contact between mating parts should be imperfect. The flanges of the 2,500 lb. per sq. in. lines are sealed with "O" rings only, and the 30 lb. per sq. in. lines with ordinary gaskets. The installation was made without loss of oil and remained free of leaks under all operating conditions.

Without going into too many details, it may be of interest to note that the 6,000 lb. per sq. in. pipe line of 3 in. wall thickness, 9¾ in. inside diameter and 36 ft. length was fabricated from wartime surplus stock of naval guns. The right-angle fittings at the ends of this line are machined out of forged steel blocks. They connect to the main by-pass valve and the bottom of one column which leads the oil to the top of the press. The connection to the two main cylinders is made up of movable fittings over a manifold. This arrangement provides for self-alignment, and protects the piping against strain due to deflections of the cylinders and top entabulature under load.

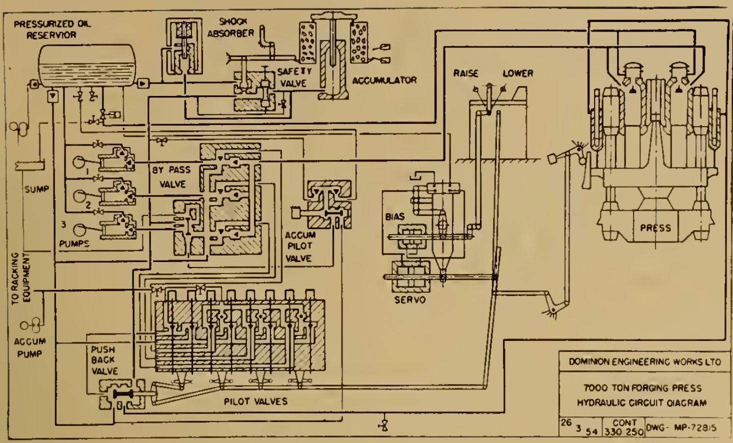



Diagram of hydraulic circuit.

Oil flows at the rate of over 5,000 Imp. gals. per minute from the reservoir into the two main cylinders during the rapid approach stroke of the press. It returns at the rate of 3,500 during the raising stroke. Pressure rise, and drop due to quick arrest and acceleration of the oil flow are minimized by a surge suppressor on top of each main cylinder. These are tanks with spring-loaded domes, and are equipped with spring and pressure cylinder operated prefill valves. These valves are checks which open automatically on pressure differential across the valve or pressure in the push-back cylinders. They close on ram contact with the forging and build-up of pressure in the main cylinders. Each surge tank is connected to one of the columns which form part of the 14 in. piping to the reservoir.

### Simple Operation

The operation of this powerful press is extremely simple. Movements of the press-ram up and down, or holding it stationary, are achieved by means of one single hand lever. It actuates a 3-way valve serving a servo piston, which provides the power for operation of the control gear through a floating lever. One fulcrum of this lever moves in conformity with the ram by means of cam and follower. This restores the control gear and servo valve to neutral at any press-ram elevation corresponding to the preset position of the hand lever.

Operation of the hand lever is restricted by a bias piston, which is pressurized in parallel with the servo piston. It exerts a restrictive force proportional to the pressure differential in the servo, thus, providing for a feel in the hand of press movement. It also restores the servo valve to neutral and stops the press to holding position upon release of the hand lever. The control gear consists principally of cam operated pilot valves and a pressure operated push-back valve, which are linked together and to the floating lever. The pilot valves and push-back valve are co-related by a second floating lever.

The complete mechanism provides for a sensitive control of the press ram movement, from creeping to rated top speeds at each phase of the pressing cycle and holding at any ram elevation. A large dial, with hands which are rotated by the moving press ram, is in front of the operator. The graduation of the dial corresponds to the stroke of the ram in quarter inches and the sweeping hands indicate position, direction and speed of the ram.

### Tooling

The tooling for a 7,000 ton forging press is necessarily heavy. Anvil stands, upsetting blocks, etc., require a large footing area and considerable height for spreading adequately the concentrated load on the forging over the supporting members. The press is therefore equipped with powerful racking mechanisms, one for transverse operation and one for longitudinal. The former is used for adjustment of the anvil stands. The latter is for moving mandrel stands and generally heavy equipment in and out of the press between working position and a place accessible to the overhead crane. The racking devices are arranged below floor level. These consist of horizontal double-acting cylinders, secured to the press frame. Pistons with rods attached to drawbars and heavy plates carry the tools and slide on suitable ways. Each racking device has 15 ft. stroke, and is operated by oil pressure from the accumulator and controlled by a four-way valve from the pulpit. √

## MENIHEK POWER DEVELOPMENT

(*Continued from page 556*)

The winter haul in February and March of 1953 was organized on a larger scale. By that time it was possible to convey stores and equipment by rail as far as Mile 110, and from that point 969 tons completed the journey to Menihek overland. A further 938 tons were hauled on sleighs to Mile 134 and were then lifted by cargo planes to Menihek. Transportation of the heavy hydraulic and electrical equipment was deferred until completion of the railway to Menihek.

The camp and storage facilities at Menihek were sited on the north side of the river to adjoin the principal part of the construction works. Unfortunately, the air strip was on the south side, which necessitated hazardous hauling over the ice of Range Lake in the winter and barge transportation during open water conditions. As a consequence, the arrival of stores by air did not bring the problems of transport to an end.

It was not until the upstream cofferdam and Bailey bridge had been completed after the spring flood of 1953, that a continuous road access existed between the north and south banks of the river at Menihek.

### Acknowledgements

The Menihek project was constructed for the Iron Ore Company of Canada, for whom Montreal Engineering Company, Limited, were the engineers responsible for the designs and supervision of construction. The contractors were the group known as C.M.M.M.K. comprising Cartier Construction Company Ltd., McNamara Construction Company Limited, Mannix Ltd., and Morrison-Knudson Company of Canada Ltd.

Donald Inspection Ltd. carried out tests on the suitability of aggregates for concrete, and of soils for the earth dams. They also gave advice on the design of concrete mixes and performed concrete strength tests.

The author acknowledges with thanks the permission of W. H. Durrell, general manager of the Iron Ore Company of Canada, to present this paper and reproduce photographs taken during the progress of the work. √

# NATURAL RESOURCES and THE ENGINEER

*by*

J. L. Van Camp

*General Manager,*
*Canadian Forestry Association,*
*Montreal, Quebec.*

Many of our members are concerned directly or indirectly with our natural resources, but know little about any except those with which they have to deal. More co-operation among all interested professions is indicated to the end that such resources may be intelligently developed. Mr. Van Camp's paper, delivered at the Quebec Annual Meeting on May 13, 1954, is a survey of the present state of affairs in this field and an account of some co-operative ventures in it which have worked out well.

Canada is one of the few nations possessing such an abundance of natural resources that Canadians still tend to be careless with these gifts. We accept this bounty as freely as we do the air that surrounds us. Abundance has tended to lull us into a state of complacency, not fully justified by the physical state of our soils, waters, forests, wildlife, or even of the air we breathe, in many portions of Canada.

The time is ripe for all educated and thinking citizens of this country to take full stock of its situation. We may then use our best training and ability to improve the resources which we have and to meet demands which will steadily be made upon them by increasing population and industry.

In this brief paper time requires us to limit the subject to renewable natural resources. This does not in any way imply neglect of the large section of our economy based upon minerals and other nonrenewable natural resources. Also, it is to be understood that the people of Canada, our greatest natural resource, will be always in the forefront of our consideration. The resources we shall discuss, therefore, include soils, waters, forests, fish and game, and the recreational and aesthetic uses made of our natural resources by the Canadian public and by our visitors.

#### Engineers Need Versatility

The professional life of most engineers is spent in the development, improvement, manufacture or transport of our natural resources. This is especially true of the engineer engaged in hydro-electric development, in soil or irrigation works, or in the forest industries. It is almost equally true, however, of the engineer engaged in the construction of roads, buildings or mechanical equipment, because such construction is generally for the development or use of products of our basic natural wealth.

The specialist tends to concern himself with projects in hand, rather than with the consideration of fundamentals, or with future problems. The highway engineer, for instance, is rightly concerned with the mechanical and cost factors involved. The transport of millions of dollars' worth of raw material over his highway to a pulp mill assures a vital flow of cellulose to the mill. However, the larger program is not his personal responsibility, and frequently it fails to enter his thinking.

#### Basic Training

Basic training in college allows little time to develop a nation-wide viewpoint. The necessity of crowding detailed technical training into

the scant space of four or five years on a college campus is paramount.

I hesitate to discuss factors in the training and background of an engineer, but may perhaps be permitted to express some opinions because a forester has close association with engineers during his own training. In his first two years, the forestry student spends much time with students in civil engineering in surveying and drafting courses. He also takes some of the basic courses in geology, mineralogy, and sometimes soil science that the engineering students receive. Beginning with his third year, he becomes increasingly concerned with land management, including the growth and management of crops of trees. The young engineer likewise begins to specialize about then. The tendency to continue a specialized interest after graduation, sometimes during his entire professional career, frequently prevents the technical graduate from fully understanding the work of his neighbours. The necessity for making use of knowledge and experience from other professions has been graphically brought home to the forester within the past twenty-five years. Radical improvements in forest management have come about through the application of mechanical methods to logging and lumbering, to fire protection and to the manufacture of pulp, paper and other forest products.

It has been aptly said that the medal for the greatest progress in forestry in North America during the past quarter of a century might well be given to the inventor of the crawler tractor. This is undoubtedly true. Crawler tractors have revolutionized the making of roads. Logging of otherwise inaccessible timber tracts has resulted from lower access costs. In addition, crawler tractors, with the bulldozer blades, have revolutionized forest fire fighting, from the pine lands of the southern United States, to the northern interior of British Columbia. Advances in mechanical loading of pulpwood; the use of aircraft, including helicopters, in aerial forest surveys; and many other uses of mechanized equipment in forestry have contributed to this revolution. Ten thousand power saws are in regular use. Such is the present situation in an industry once dominated by the horse-drawn vehicle and the lumberjack with an axe and a hand saw.

Almost the same results may be seen in agriculture. It is quite unlikely that the grandfather of the present farmer would know how to do the chores on his home farm, if he were suddenly brought back after an absence of fifty years. Whereas he used to light a kerosene lantern to carry a milk bucket to the barn, he would now have to connect and operate a complicated milking machine. He would need to start electric motors to operate the feed grinders, perhaps after having adjusted the automatic thermostat for the oil burner in the farmhouse. Confronted with the modern tractor, combine, corn picker or silo filler, he would be completely baffled. His ten-year-old great-grandson operates some of these mechanized farm devices with ease and ability.

These conditions are sincere tributes to the contributions made by engineers in the development of our natural resources of soils, waters and forests. Real credit is due them for improvements in the efficiency

and the economies in our farm and forest operations, by the development and use of special mechanical equipment.

#### Conception of Opportunities Necessary

A full conception of the opportunities still waiting in natural resource industries is a valuable asset to the engineer. A prime requirement in salesmanship is a good knowledge of the customer's needs, plus the ability and ingenuity to satisfy these needs better than they have been cared for previously. Inherent in this service to the customer, in the case of natural resources, is also the need for realization of the perishable, but renewable, nature of these resources. Appreciation of the biological factors involved is useful. A knowledge of the purely mechanical and physical forces with which the engineer is accustomed to deal is necessary, but not *all* that is necessary. The absence of one factor in an equation makes the solution difficult or perhaps impossible.

The close relationship between natural resources and engineering is shown in the work of many chemical and mechanical engineers. Their part in using wood raw materials was described in the John Stadler Memorial Address (1), given by Dr. John S. Bates, M.E.I.C., before the fortieth meeting of the Technical section of the Canadian Pulp and Paper Association. Dr. Bates stressed the opportunities available to foresters and engineers for greater production and wider utilization and for a guarantee of perpetual returns from the forests of Canada.

In a paper by C. E. Rogers (2), given at the same meeting, it was shown that in sulphite pulping, a shift from calcium-base to magnesium-base is one profitable method of recovering organic solubles, to avoid stream pollution. Col. J. H. Jenkins outlines several methods for closer utilization of wood at a profit (3). Adoption of improved methods would help conserve our raw materials. Opportunities are available to the engineer-forester-biologist group for research in and application of these methods.

#### Social and Community Interests

A relevant item on training was recently brought to my attention by Dr. J. B. Challies, M.E.I.C. The item to which I refer is from the winter issue of the "Report" of the Renssalaer Polytechnic Institute (4). It is about to attempt a broadening of the social and community interests training of its students to improve their capabilities as leaders. These qualifications are needed by engineers and scientists, the "Report" states, because scientific men have to a large degree created our present civilization. They will therefore increasingly be required to take the lead in explaining the altered society in which we live. They must also assist in managing it for the benefit, and even the continued existence, of their fellow-men in this country and in other parts of the world.

President Livingstone W. Houston, of Renssalaer, states that a group plan of organization has been devised, to produce graduates more highly qualified to enter an era of increased responsibility for engineers and scientists. The program decentralizes academic authority. There are now four key administrators, operating a number of departments. Those departments dealing with engineering form one group, a second deals with science, another with general studies and a group including architecture makes up the fourth. Group heads report directly to the dean of the faculty.

> "Conserving and improving our land and water resources is high priority business for all of us . . . Such a program is indispensable to maintaining and improving our standard of living as we make the future secure for a growing America."
>
> *President Dwight D. Eisenhower.*

I am certain that those of you who are concerned with engineering education have considered similar proposals and have perhaps already taken some steps along these lines. The objectives are desirable. Future engineers and scientists must be equipped as far as possible with perspectives which will fit them more readily into participation in the affairs of their communities and of the world at large. Engineers and scientists may then assume the full responsibilities of leadership which are theirs.

This may be a good place to leave the subject of broader training for professional people. It has been debated, discussed and experimented with in many countries and in every educational institution of any consequence. One point which should be emphasized is the advantage of some biological knowledge and appreciation in the training and equipment of engineers. This need is becoming increasingly felt by certain foresters, especially those who specialize in logging engineering or production in mills or in industry. They recognize a lack of first-hand, daily contact with the dynamic natural processes to be found in every acre of Canadian land or water.

It may be that one of the best places to instill this living knowledge in the consciousness of the citizens of Canada is in the schools, through what we call "conservation education". Detailed and specialized knowledge in biology is not required. The appreciation that nature has been functioning for millions of years, and is a partner who pays dividends when we work with her, may help us to use her laws and long-developed patterns. A head-on collision with natural laws is seldom profitable.

Recognition of the importance and value of this type of training is given in a recent item from Roberts Mann, an educator who works in the heart of Chicago. He provides a glimpse of nature's wonders and values for the citizens of one of our great asphalt jungles. Thirty-five thousand acres in the Cook County Forest Preserves, which Chicago has been far-sighted enough to maintain within easy reach of the 'Loop', are his classroom. Nature Bulletin No. 374 (5) contains as clear a statement of a desirable program as I have seen condensed into four paragraphs.

#### Cooperation

The Engineering Institute of Canada is fortunate in having a strong national organization, supported by equally strong branch units in most of the important centers of the country. Such an organization performs two distinct functions for its membership. The maintenance of national standards and objectives and coordination of activities in the various provinces across Canada come first. The second, but equally important function, provides for frequent meetings of engineers from a given locality. Improvement of professional knowledge and information on the problems and interests of their fellow engineers are thus achieved.

An additional activity of many branches is the introduction of guest speakers from other branches or territories, or even from neighbouring countries, when opportunity affords. I am especially interested in the program followed by some branches of the Engineering Institute whereby speakers from other professions address the members. Such action helps provide first-hand knowledge for E.I.C. members of activities and objectives paralleling those of the engineering profession.

I have occasionally had the good fortune to speak before branches of the Engineering Institute of Canada, particularly in our western provinces. The keen interest taken in forest conservation topics and the wealth of questions following an illustrated talk on this subject have been most revealing.

#### Popularly Written Books Needed

There is apparently a real need for a popularly written, factual account of Canada's natural resources. Such a booklet should be available for quantity distribution through schools, libraries, colleges and other outlets. The booklet would be useful not only in Canada, but also in the United States and in other parts of the world, including all sections of the British Commonwealth, where information about Canada is chiefly remarkable by its scarcity.

A booklet prepared by a member of the Engineering Institute was the outstanding publication in this field. "Canada's New Northwest" (6) was developed and written in cooperation with Dr. Charles Camsell, M.E.I.C., by M. W. Maxwell, M.E.I.C., former chief of Industrial Development for the Canadian National Railways. As a bulletin available from the Queen's Printer, the publication gave useful economic data on the soils, waters, forests, minerals, wildlife and tourist resources of northern Alberta, British Columbia and the Northwest Territories. Information was accurate to 1946. The booklet was in such demand that the original supply was soon exhausted; it has not been reprinted.

A project strongly recommended is to have this booklet revised. A limited number of inquiries have already been made by the executive committee of the Canadian Forestry Association as to the possibility of such a reprint. Two have appeared. Bringing "Canada's New Northwest" up to date from the statistical standpoint and having it reprinted would be worthwhile, but this would leave the rest of Canadian resources undescribed.

Perhaps an all-Canadian resources report might be considered for joint development by the Engineering Institute of Canada, the Canadian Chamber of Commerce, agricultural and forestry organizations and other interested organizations. Writing the text would require coordination of existing information from many government departments and industrial organizations. The result in popular form, of reasonable length for publication and well edited, would be a valuable work.

The successful conclusion of the recent National Resources Conference in Ottawa (7) indicates organizations which might be grouped in such a worthwhile project. If these suggestions are developed, the Engineering Institute has a real opportunity to contribute a public service. Information on resources is useful to E.I.C. members, the Canadian public and our friends abroad.

Something of this sort was suggested as long ago as 1940 by Dr. J. J. O'Neill, M.E.I.C., in an address to the Geological Section of the Royal Society of Canada and again in 1951 in his presidential address to the same society. Also the Committee on Reconstruction, headed by Principal F. Cyril James, of McGill University, in its report to the Federal Government pressed for the collection and publication of data on our natural resources.

> "The forests of Canada are one of our greatest national assets and their conservation and use for the benefit of Canadians, present and future, is of great importance to all citizens everywhere."
>
> *"Alexander of Tunis"*.
>
> September 25, 1950.

#### Cooperation

Examples of cooperation among professional groups in various parts of Canada are not lacking. One which comes to mind is a series of joint meetings over the past two years between the professional foresters and the professional agrologists of Saskatchewan. The question of land use, especially in areas newly colonized or under consideration for such development, is vital to both groups and to the public. Land use studies *in advance* of colonization are most important. They have equal influence on the activities of foresters, agriculturalists and every other section of the general public.

Our agricultural lands are not unlimited. In a recent statement by P. O. Ripley (8), Chief of the Division of Field Husbandry at the Central Experimental Farm, Ottawa, the remaining undeveloped agricultural land in Canada is listed as approximately seven per cent of our land total. This includes land which will become available for cultivated crops, or for pastures and grazing lands.

To consider this problem in advance and thus to avoid many of the mistakes made in older sections of the country, the two Saskatchewan professional groups have met in conference and in field meetings. They have attempted to find a working definition of true forest soils and of those economically suitable for cultivated crops or pastures.

From the agricultural standpoint the problem is two-fold. There is a constant demand by young Canadian farmers for land which they may purchase and use. The home farm can be subdivided only for one or two generations, and still permit economic management. With increasing population and despite heavy population trends toward the cities, there is still a demand for agricultural land for our younger citizens. In addition, we accept immigrants, many of whom have a great land hunger. They frequently have the agricultural training and background to make a success under favorable circumstances.

The second half of the problem is to prevent people from clearing and attempting to cultivate land which is too rough, stony, infertile or too far removed from markets to make successful farming possible.

Foresters are also deeply concerned with land-use planning. In many cases clearing of timber in new territories is done without supervision. This raises problems which are far reaching in extent. If the land is not suited for permanent agriculture, clearing timber removes an actual or potential forest crop. Unwise clearing of such lands is often accompanied by settlers' fires, frequently spreading far beyond the point of origin. Tremendous injury to forests, soils, waters, game and recreation results. These disasters recur, reducing the values otherwise produced by forest-type land, which occupies such a high percentage of Canada's land.

The meetings in Saskatchewan

brought two groups of serious-minded citizens into alignment, where before there had been mutual suspicion. In some cases there had even been a feeling that one group was in direct opposition to the other. It was soon discovered that each was equally concerned with good land use. Studies by competent soil scientists, reporting on new areas before they are opened to agricultural settlement or forest operations, are welcomed.

No agronomist wishes to initiate new agricultural rural slums. Likewise, no forester invites additional problems by recommending retention of large tracts of timber on soil which is fundamentally and economically suitable for cultivated crops or pasture. The problems still awaiting him in the immense areas of true forest land in Canada are sufficiently pressing, and will require generations for satisfactory solution. On agricultural soils a percentage of tree cover for soil and water protection is desirable, and helps produce wood crops as well. The area of agreement here is well established.

#### Coordination With All Citizens

The consideration of coordination between professional groups leads automatically to consideration of the need for cooperation with all citizens. The development and permanent operation in full production of all our natural resources, including the minerals, which are treated so sketchily here, is a national requirement. Long-range planning inside municipal areas, and for our larger agricultural and nonarable regions, requires the best thought and most complete cooperation on the part of all Canadian citizens.

Water has long been known as a universal solvent. It is at least a factor of universal importance to all citizens during every day of their existence. The latter part of this paper may therefore well be devoted to comment on a few phases of water management, as one reason for participation and leadership by engineers in community, provincial and national programs, transcending mere professional employment.

#### *Water Management*

In southern Ontario, studies have been made of what may be called "small water-sheds," although they may cover several hundreds of square miles in some of the fifteen areas already examined. The Ontario Department of Planning and Development has been instrumental in establishing conservation authorities, which are legal entities, with representation from each municipality concerned. Boundaries are defined by the drainage basins of certain selected rivers or streams. In Ontario a river valley authority deals with all the land from which water drains into a river, such as the Saugeen or the Grand, from its ultimate sources to its discharge point into one of the Great Lakes.

The reason for intensive studies and increased intensity of land management in these areas was originally the need to solve extremes of water flow. These follow the familiar pattern; excessive floods in springtime and a chronic shortage of water or severe drought conditions in summer. Following the initial period of gathering data on soils, forests, waters, fish and game, recreation, history, population and business and industry for each area by members of the Department of Planning and Development, an intensive period of education is undertaken. Land owners and the voters are shown the extent and seriousness of the problems. Remedies well within their powers and their ability to pay are presented.

Much has been accomplished in these areas to reduce the primary problem of floods. Changing to better farming methods and reversing the trend of forest and woodlot devastation have helped start a restoration of soil moisture reserves. Slowing down the run-off, thus reducing the intensity of spring floods, and increasing infiltration, to alleviate summer drought conditions, go far toward restoring original natural water regimes.

The professional men most useful in these early developments are the engineer, the agriculturalist and the forester. The first structures built are usually flood-control dams, requiring comparatively large outlays of municipal, provincial and federal funds. These are recognized however, as only one factor in the rehabilitation of the river valley. Progress is most rapid where every land owner is conscious of his responsibility and improves his land-use practices as quickly as possible. Improved practices include systems of crop rotation, which have been recommended by agricultural representatives and extension workers from agricultural colleges for over a quarter of a century. Such comparatively simple things as cultivating on the contour instead of up and down the slope; the maintenance of cover crops; longer rotations; reduction of rapid run-off; and increased percolation of water into the soil are stressed in conservation authority programs. Areas which have been denuded of trees, and those found unsuitable for agricultural crops or pasture, are replanted. Existing woodlands, an equally important factor, are brought to full production and full water-holding capacity by removing livestock-grazing, fire, over-cutting or other hindrance.

It is a remarkable fact that good common sense, applied to the use of each acre of land, will, in the course of time, repair the mistakes of generations of land abuse. Good land management likewise reduces the necessity of large engineering projects for flood control. Natural vegetative cover and forest-soil infiltration reduce the peaks of the water cycle and check silting, erosion and flood damage.

An article (10) in the January, 1952, issue of the *Journal* of the Engineering Institute, brings out some of the values of vegetative cover. This doctrine is becoming increasingly well known in river valley authority areas, and in other territories where good agricultural and forest management information is accepted and put into practice by land owners.

The Canadian Forestry Association has popularized a program of forest land management called "Canadian Tree Farms". (11) Interest and action are stimulated by local committees, in the interest of improved production from tree farms. These are well-managed areas of privately-owned woodland, which receive special recognition by signs, certificates and ceremonies. Tree farms develop by community enterprise, to which local professional foresters contribute their services. They inspect prospective tree farms and advise on timber management and marketing. Other public-spirited citizens, such as newspaper editors and the radio station managers, give publicity to the program and enlist new participants. Education in the schools and through field trips is supported by trade organizations, civic clubs, and other interested groups. Farmers and owners of woodland are induced to join and to improve their standards of forest management and timber marketing under the stimulus of making more money in the process. A feeling of civic pride also enters into this type of cooperative effort. It is hoped that tree farming in Canada will in time be comparable to the program which now includes 27 million acres of this type of forest land in the United States.

#### Stream Pollution

Reverting to the subject of water, the need for professional leadership in the preservation of our water supplies is a prime responsibility of engineers. Prevention of stream pollution, through good city planning and engineering, and the provision of plentiful supplies of pure water for private citizens and Canadian industry are two phases of water management which affect us all. There are, of course, others as well, not mentioned here.

Prevention of stream pollution has been well covered in a paper recently given by Carson (12) in an address before the 1954 annual meeting of the Ontario Federation of Anglers and Hunters. Other studies and reports abound. The Canadian Chamber of Commerce lists some references in a news bulletin issued during 1952 (13).

Cities within range of mountain or hill country may develop large reservoirs the water of which does not need treatment. Most of us, however, use filtered water from streams. Unless these streams are large, comparatively clean and likely to remain so, we find water shortage and water purification problems greatly aggravated. If upstream management of these drainage areas is not practiced, as suggested in the discussion of river valley authorities, the future is not promising.

#### Forest Management

Illustrating partnership between forest management and the hydraulic engineer is the 30-year record of the city of Seattle, operating over 90,000 acres of forest land, on which their water supply originates. One of the most recent articles on this subject appeared in "The Timberman" for March, 1954 (14), and places understandable emphasis on the forest management practiced successfully on the watershed of the Cedar River.

Of the 91,500 acres in King County, Washington, the United States Forest Service operates 23 per cent, while the city owns 72 per cent or over 65,000 acres of the total. Five per cent is privately-owned. Even this small percentage of privately-owned land is being gradually reduced, as logged-over areas are traded for Forest Service land outside the unit.

Operations on the west coast are conducted under the Cedar River Logging Agreement, adopted in 1954. Orderly harvesting of the old growth timber is planned over a 40-year period. Every precaution is taken to avoid fire; injury from this cause has been kept to a minimum. Tops and branches from logging are left on the ground to decay and create additional organic material, filtering the rainfall into the soil and reducing surface run-off.

About 10 per cent of the area after logging requires artificial planting. This is done immediately with seedling trees from a two-acre forest nursery maintained within the area. However, over 90 per cent of the area reseeds naturally, producing continuous tree crops from the young growth left when the mature trees are removed. Trees and water are a dual return from the land.

The Cedar River reservoir area is designed to supply the water needs of a city of two million, which is looking some distance into the future life of Seattle. Nevertheless, this is the direction in which we must be looking, particularly if our future is directed by capable, professionally trained leaders with a full sense of civic responsibility. Engineers are taking an increasingly active part in making improvements over the wasteful methods of the past, which reduced our lands, forests, waters and soils below their full productive capacity. The ideal of permanent full production from each acre of land for the greatest possible benefit to the largest number of people, is a goal of the engineer, as it is of the forester, the agriculturalist, the wildlife manager and even the average citizen. Few will recognize this objective as fully as do the members of the Engineering Institute. They are trained and are dedicating their skills and abilities to the betterment of this magnificent and still resource-rich country, in which we Canadians have the supreme good fortune to be living.

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**The Editor invites discussion on papers appearing in the *Journal***

# Rotary Wing Aircraft Development

*by*

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Call it "Flying banana", "Whirly bird", or what you like, the helicopter seems destined to fill a gap in air transportation which the fixed wing craft cannot fill. Its development has been rapid since the late war and commercial operation of helicopters is about at its beginning, so far with promising results.

In this paper, Mr. Schaefer reviews the history of rotary wing aircraft, describes present machines in general terms and makes a few cautious predictions as to their future.

The story of man's struggle to conquer the third dimension and to achieve controlled flight is a matter of common knowledge. The fixed wing type of aircraft has benefited from the research and development efforts of individuals, corporations and government agencies, and is now accepted as an efficient transportation vehicle and a powerful military weapon. Ranges have increased to the point where trans-continental and trans-oceanic flights are every day affairs. Flight speeds have increased to the point where military fighters are exceeding the speed of sound in diving, and research aircraft have exceeded sound speed in level flight. Aircraft efficiencies have reached the level where it is possible for the commercial operators to show a profit.

The fixed wing aircraft has made great progress since the time of the Wrights and, with the advent of turbine type engines, further progress may be expected. This type of craft has, however, shortcomings that restrict its operation in varying degrees.

Since the stationary wing depends on forward velocity through the surrounding air for the generation of lift, the fixed wing craft demands a ground run to reach the speed required to get off the ground. Similarly, a landing must be made in a glide wherein the aircraft speed must not be allowed to drop below wing stall speed before ground contact is made. Thus the fixed wing craft requires airport runways which vary in length from 3,000 to 10,000 feet.

Fixed wing craft have not, however, completely satisfied man's desires because of certain operating restrictions, such as:

1. Requirements for large airports for take-off and landing.
2. Inability to rise and descend vertically.
3. Inability to hover at any altitude and over a fixed point.
4. Inability to maneuver in all three planes in a confined area.
5. The potential crash hazard due to loss of engine power.

In the quest for improvement of the flying machine and in mitigation of the operating restrictions enforced by the fixed wing, the rotary wing principle holds out some measure of promise.

### Direct Lift Flight History

The earliest experiments in flying were along the line of a direct lift machine, as opposed to the somewhat simpler problem of flying with forward speed.

The truth of the Greek myth of Icarus, whose wings melted when he approached the sun is subject to some doubt. A factual story is that of the flight experiments of Leonardo da Vinci (1452-1519), among whose astounding talents was a brilliant engineering mind. Da Vinci conducted extensive research on direct lift by means of the ornithopter (flapping wing) and the aerial screw principles. One authority states that the first successful flight of a heavier-than-air powered machine was made in 1784 with a model helicopter devised by two French scientists, Launoy and Bienvenu. This model had two co-axial rotors made of bird's feathers and was driven by springs. The next recorded milestone was the appearance of the first full scale helicopter to leave the ground carrying a pilot. This occurred in 1907; the machine was designed by the French aeronautical engineer, Louis Breguet.

The Von Baumhauer 1930 helicoper was the forerunner of today's single rotor machine. Up to 1930 most designs depended upon multi-rotors to overcome reaction torque compensating tail-rotor.

The Breguet 1936 helicopter with co-axial rotors was the most successful of the type up to then. This machine set all helicopter world records until the advent of the Focke-Achelis FW-61 in 1937; the FW-61 records were: altitude, 11,243 feet; flight duration, one hour twenty minutes; speed, 76 m.p.h. This machine is generally accepted as being the first fully controllable helicopter.

Sikorsky, beside designing and constructing a memorable series of fixed wing aircraft, had an interest in helicopters dating back to 1900. By 1910 he had built two experimental machines and in 1939 produced his famous VS-300, which set a new endurance record of one hour thirty-two minutes. Sikorsky settled upon the single rotor and torque compensating tail rotor similar to those of the Von Baumhauer of 1930.

A German engineer, Anton Flettner, developed the Flettner 282, in 1939, the first helicopter to use two closely intermeshing rotors. This machine was put into quantity production during the war, but little is known of its accomplishments. During the war an Austrian designer, Doblhoff, produced the first jet-powered helicopter with pressure jets at the tips of the rotor blades for driving power. The first true twin-engined transport type helicopter was the Kellett XR-10 with 65-foot diameter, closely intermeshing rotors, carrying ten passengers and flown in 1947.

Canada entered the historical picture with the first helicopter to be designed, built, and flown here, a three-place single rotor craft developed by Bernard Sznycer and Selma Gottlieb, in 1947.

#### The Autogiro Era

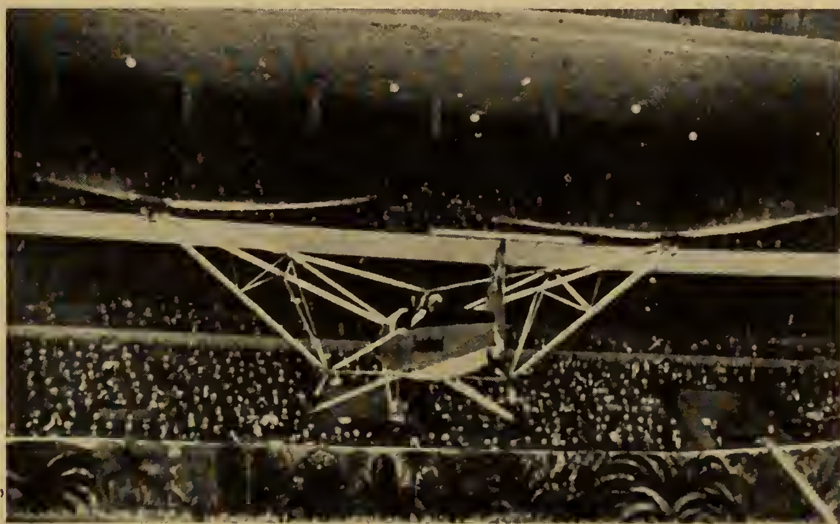
The autogiro of the 1920's and 30's was not a true vertical lift machine, but certainly has a place in any general discussion of rotary wing aircraft development. It was in effect an intermediate step between the fixed wing type and pure helicopter and the work carried out on the theories and principles governing the behavior of rotors in forward flight has been profitably applied to the helicopter.

The autogiro's rotor blades were not power driven; rather, the autorotative forces generated on the blades by the air stream caused rotation and thereby the generation of rotor lift. The aircraft then had to be in forward motion to have rotor rotation. Since the aircraft had a normal propeller to produce forward motion, the take-off procedure consisted of taxiing around the field until the rotor was up to speed and then making the take-off. Landing was accomplished by gliding. The early machines all had fixed wings in addition to the rotor, but on some of the later models these were left off.

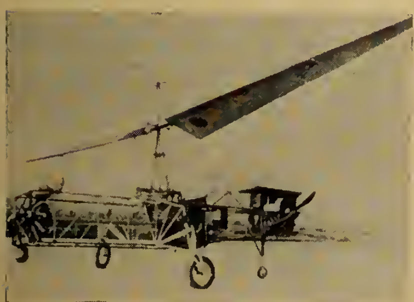
The guiding genius of the autogiro was the Spanish engineer, Juan de la Cierva, who began his work in 1920. His early attempts were unsuccessful, because the use of rigid rotors with fixed blade angles induced problems of unequal lift forces as the blades swept through a rotation. De la Cierva hit upon the idea of mounting the blades on

Historical Helicopters.

Da Vinci's Aerial Screw.

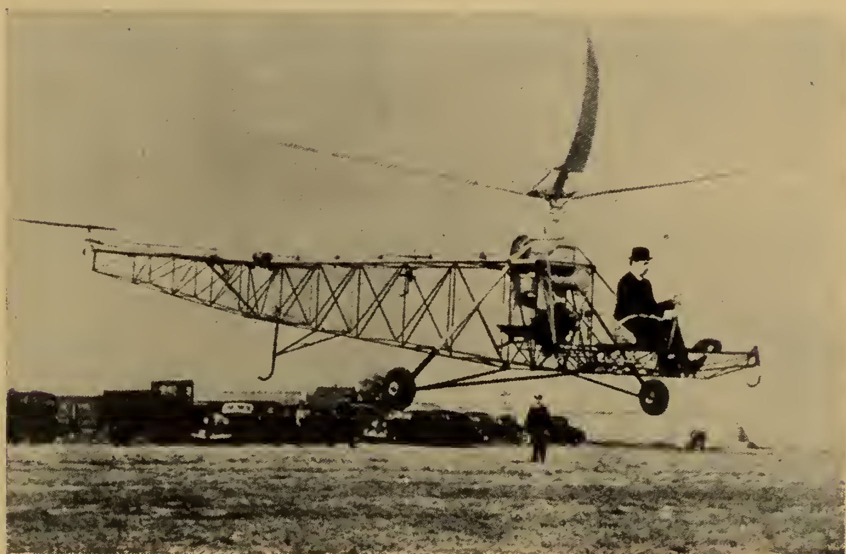


Focke-Achgelis FW-61 1937.

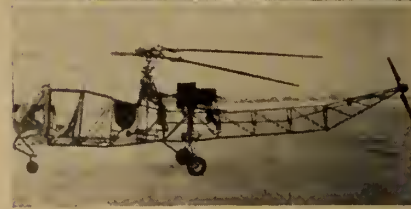


Von Baumhuer 1930.

Breget 1936.



Sikorsky VS-300 1939.



Historical Helicopters — Above: Kellett XR-10 1947; Upper Right: Doblhoff (during World War II); Lower Right: Sznycer-Gottlieb 1947.

horizontal hinges at the hub, thus permitting them to flap, thereby equalizing the lift moments on advancing and retreating blades of the rotor. The rotary wing field owes a great deal to Cierva's work.

Other pioneers in the field were Raoul Hafner, who developed a system for blade pitch control that applies to the helicopter, and E. Burke Wilford, who developed a gyroplane with cyclic pitch control that also applies to the helicopter.

The final development of the autogiro was an important one from the viewpoint of progress to the direct lift helicopter. The machines up to this time had to taxi around the field to get the rotor up to speed for a take-off. In final form, the autogiro did possess some ability for vertical ascent. This was accomplished by clutching the forward drive motor to the rotor, speeding up the rotor with zero lift setting thus storing kinetic energy, and, after uncoupling the motor drive, utilizing the stored energy to provide a short duration lifting force by advancing the angle of the blades to a high lift position. Once off the ground, the aircraft propeller put the craft into forward motion and kept the rotor in motion by auto-rotative forces. This was a significant step forward toward the practical helicopter.

### The Helicopter Today

There is more diversification in the appearances of the various helicopters flying today than is noticeable in conventional fixed wing craft. One of the reasons for this is the newness of the art. Each of the possible rotor configurations has attracted supporters and it is natural to have experimental machines produced for demonstration. It is also natural to expect that the field will narrow down to no more than two or three basic configurations as superior characteristics are clearly demonstrated.

Common rotor configurations are:

1. Single rotor—tail rotor.
2. Dual rotors—lateral arrangement.
3. Tandem rotors.
4. Dual rotors—intermeshing.
5. Co-axial rotors.

The two types most usually seen are the single rotor with tail rotor and the tandem rotors machines. All late Sikorsky models are of the single rotor—tail rotor type. All late Piasecki models are of the tandem rotors type. Bell designed all of its small machines with single rotor—tail rotor configurations, but the latest large Bell antisubmarine helicopter for the U.S. Navy is of the tandem rotors type. In the United Kingdom Bristol has paralleled Bell's practice, a small helicopter of the single rotor—tail rotor type and a large machine with tandem rotors.

To place some relativity on the expressions large and small Table 1 of dimensions, powers and weights has been prepared for several helicopters now flying.

The performance of most present day helicopters is limited in comparison to the fixed wing types, particularly with regard to forward speed and range. Of the craft listed in the table, the ranges run about 200 miles and the cruising speeds in the order of 75 to 90 m.p.h. As a matter of interest, in September, 1953, high speed records of 146.7 m.p.h. and 22,289 feet altitude were set.

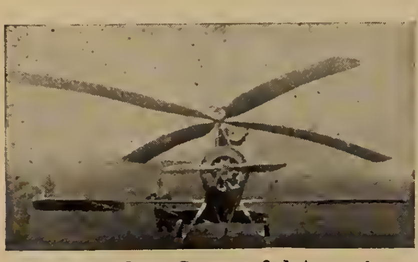
The helicopter has some remarkable achievements to its credit, a great many of which have been publicized, and most of which could not have been realized by the use of any other craft. Of interest is the work done in British Columbia by Okanagan Helicopters, Ltd., in conjunction with the construction of Alcan's Kitamat Project. The instances cited are eye-opening.

1. Site survey; a possible 3-year job by usual means accomplished in 10 days.
2. Triangulation for a water tunnel; estimated to take a ground crew of 12 two seasons, done with helicopters in 6 weeks.
3. Establishing camps, and supplying them before the snows had run off.
4. A Bell 47D record:

| | |
|---|---|
| Trips.......... | 235 |
| Number of passengers.... | 352 |
| Passenger weight | 65,364 lb. |
| Baggage weight. | 9,043 lb. |
| Freight weight.. | 48,478 lb. |
| Flying time..... | 135:10 hr. |

5. A Sikorsky S-55 record:

| | |
|---|---|
| Trips.......... | 95 |



Cierva's First Successful Autogiro 1923.

Kellett YO-60.

Bristol 173.

Number of passengers.... 232
Passenger weight 40,964 lb.
Baggage weight. 12,040 lb.
Freight weight.. 100,089 lb.
Flying time..... 54:45 hr.

Beside the numerous civil applications of the helicopter, the military services have found it invaluable for a variety of purposes, e.g., evacuation of the wounded, supply, search and rescue, troop transport, and communication and liaison.

The civil aviation side of the picture has been growing steadily. In addition to carrying mail from airport to downtown post offices in Los Angeles, Chicago and New York, passenger shuttle services are now being operated in New York between Idlewild, La Guardia and Newark airports. In Europe, Sabena Airlines of Belgium, has inaugurated a helicopter operation serving such routes as

Brussels-Antwerp-Rotterdam....... 70 miles
Brussels-Arlon-Luxembourg-Sarrebrük........ 185 miles
Brussels-Lille....... 65 miles
Brussels-Liege-Cologne-Bonn............ 130 miles

In the United Kingdom British European Airways is active in the field of helicopter shuttle service and Trans-Canada Airlines are seriously studying the potentialities of helicopter service. The extent of interest in the United States may be gauged by the fact that a total of 46 helicopter route applications have been filed with the Civil Aeronautics Board.

The interest of the airlines has been whetted by the possibilities of the helicopter both for airport to city center travel and for short line community service. Some of the salient features desired by the operators are:

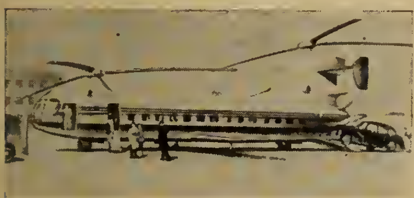
1. Operating costs at a low enough level to make reasonable fares possible.
2. Passenger capacity ranging from 30 to 50, depending on the route assignment.
3. A range of 200 to 300 miles carrying fuel reserves and maximum payload and making six intermediate stops.
4. Ability to take-off and land in areas from 300 to 400 square feet.
5. Speed as high as possible, consistent with good economy, with 150 to 160 m.p.h. a desirable goal.
6. The choice of engine type, i.e., turbine or reciprocating, to be left to the manufacturer, but for passenger transport a helicopter must be multi-engined and will require single-engine safe flight characteristics.
7. To be commercially profitable the helicopter service should be able to operate in weather conditions comparable to those that the fixed wing aircraft can now tolerate. This means anti-icing protection and blind flying capabilities similar to those of fixed wing craft.
8. Cabin ventilation and cooling will be necessary because of the helicopter's low level and up and down type of operation.
9. Quiet operation; this is a dual problem since both inside cabin and external noise must be considered. The problem of external noise is particularly important, since the helicopter is expected to operate in and out of crowded terminals.
10. Appearance: one airline official has put forward the sensible suggestion that the external appearance of the helicopter should not "amuse, confuse and frighten passengers".

At this point it is of interest to see what the designers are planning for

**Table 1. Helicopter General Specifications**

| Manufacturer | Model | Rotor Arrangement | Rotor Diameter | Gross Weight Lbs. | No. of Passengers | No. of Engines | H.P. per Engine |
|---|---|---|---|---|---|---|---|
| Bell | 47 | Single | 35′ | 2,350 | 3 | 1 | 200 |
| Bell | YH-12 | Single | 47′ 6″ | 6,600 | 8–10 | 1 | 600 |
| Bristol | 171 | Single | 48′ 6″ | 5,200 | 4 | 1 | 525 |
| Bristol | 173 | Tandem | 48′ 6″ | 10,600 | 15 | 2 | 525 |
| Piasecki | HRP-2 | Tandem | 41′ | 7,225 | 10 | 1 | 600 |
| Piasecki | H-21 | Tandem | 44′ | 13,250 | 22 | 1 | 1,425 |
| Sikorsky | S-51 | Single | 49′ | 5,300 | 2 | 1 | 450 |
| Sikorsky | S-55 | Single | 53′ | 6,835 | 10–12 | 1 | 600 |

**Modern Helicopters.**



**Saunders-Roe 40 Seater.**

**Fairey Rotodyne.**

**Piasecki YH-16.**


**Bell XHSL-1.**

supply to the civil market. In the class of larger machines, the Bristol 173 is now flying experimentally and is the first British multi-engine helicopter. It has been designed for internal service in the United Kingdom and is somewhat smaller than present thoughts indicate as desirable. The cabin has accommodation for 13 passengers and a freighter version is possible with a cargo capacity of 650 cubic feet. A later version of the Bristol 173, the MK3, recently made its appearance; the craft has now sprouted wings. This is a development toward what may be termed the "compound helicopter"; the purpose is to relieve the rotor of some of its lift requirements in forward flight and thereby to increase forward speed capabilities.

Another recent British design proposed by Saunders-Roe follows the idea of the compound type by including a fixed wing in addition to the rotors, and then goes one step further by adding a ducted fan installation for forward propulsion. This machine is planned to accommodate 40 to 50 passengers.

The Fairey Aviation Co. is reported to have received a contract for a 40-passenger compound helicopter in which a five-blade rotor is jet driven, and which also has two turbo-prop engines, mounted in nacelles under the fixed wings, driving forward propulsion propellers.

In the United States the pure helicopter, the Piasecki YH-16 transporter, has made several flights. This machine is cloaked in military secrecy as to exact details, but something has been published, so naturally educated guesses have been made as to its civil potential. Published dimensional data are:

| | |
|---|---|
| Fuselage length..... | 78 ft. |
| Overall length with rotors turning..... | 134 ft. |
| Diameter of rotors.. | 82 ft. |
| Gross weight....... | over 15 tons |

Accommodation is listed for the military version as "40 combat troops, 32 litters, or 3 jeeps". In the first prototype, two reciprocating engines of 1,650 b.h.p. each are located in a compartment under each rotor. The rotors are interconnected at all times. The second prototype is to be powered with turbo-prop engines rated at 2,750 equivalent shaft horse power each. The third machine may have higher powered turbo-prop engines rated at 3,750 effective shaft horse power each.

The Air Transport Association's Helicopter Committee, reporting on the probable characteristics of an airline version of the YH-16, estimates as follows:

| | |
|---|---|
| Engines, turbo-prop type. | |
| Number of passengers | 50 |
| Gross weight........ | 45,000 lb. |
| Cruising speed....... | 150 m.p.h. |
| Payload............ | 10,500 lb. |
| Range.............. | 230 miles |

Another large machine, designed by the Sikorsky Division of United Aircraft, is in process of manufacture. This, too, is a military helicopter, XHR2S, and only a small amount of data is released. The machine follows the company design trend by utilizing a single five-blade rotor with a tail rotor. The first version will be powered with two 1,800 b.h.p. engines (reciprocating type) mounted in nacelles at the outboard ends of stub wings located above the fuselage. The A.T.A. Helicopter Committee estimates that this machine in a civil version would show the following general data:

| | |
|---|---|
| Engines, turbo-prop type. | |
| Number of passengers | 50 |
| Gross weight........ | 34,000 lb. |
| Cruising speed....... | 160 m.p.h. |
| Payload............ | 10,000 lb. |
| Range.............. | 200 miles |

Another possible entrant into the commercial field might develop from the Bell. Navy anti-submarine helicopter, the XHSL. A Bell Aircraft Corp. spokesman in a recent interview stated that an airline version of this machine in the 20 to 25 passenger capacity was possible.

From the interest displayed by airline operators, the experience now being gained by helicopter commercial operations and the appearance of large size military machines capable of commercial adaptation, it does not appear too rash to expect airline operation of helicopters in the 1960's.

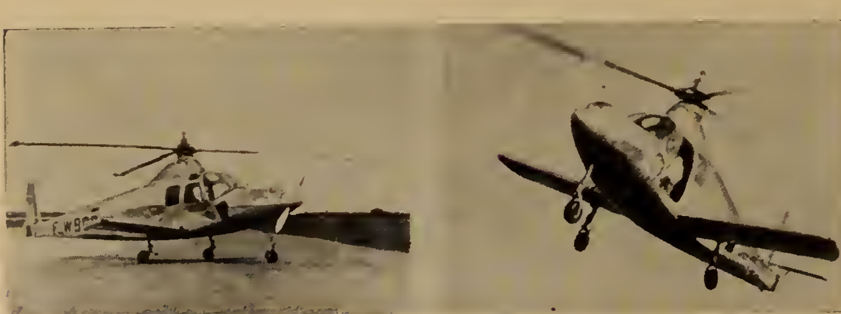
The possible impact of successful helicopter airline operation upon the field of air transport can be viewed as an important supplement rather than as a threat to the airlines system. The A.T.A. report hints at the probable airline business expansion possibilities by the use of supplemental helicopter services in the statement, "The helicopter has two major advantages: To operate from smaller terminal areas than fixed-wing aircraft, and to fly at very low speed. These will permit air transportation to expand into fields where the airplane cannot now compete."

A more recent A.T.A. long range forecast of airline traffic growth in the U.S. is quoted in Table 2.

The projected helicopter estimates include multi-engine machines on non-commutation, non-airtaxi intercity carriage only.

**Table 2. Forecast of Airline Traffic Growth**

| Year | Millions of Passengers | | |
|---|---|---|---|
| | Fixed Wing Aircraft | Helicopters | Percent of Total Carried by Helicopters |
| 1960 | 39.4 | 6.1 | 13.4 |
| 1965 | 40.6 | 18.2 | 31.0 |
| 1970 | 45.5 | 22.2 | 32.9 |



Rotor Converting to Autorotation.

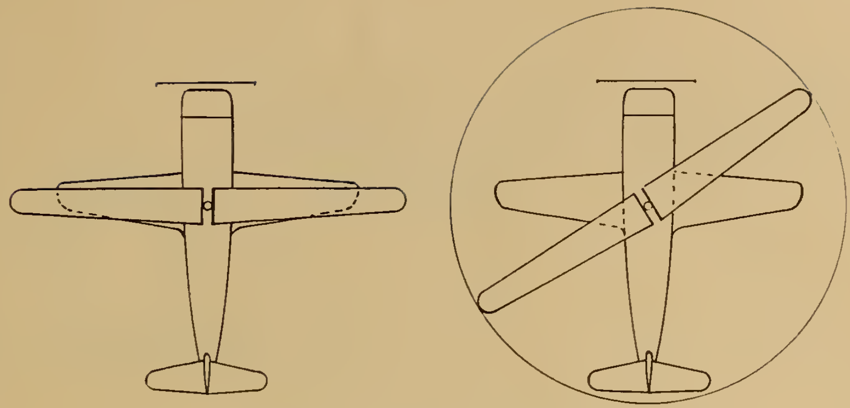
Rotors Converting to Props.

### Convertible Aircraft

A comparison of the general performance characteristics of the fixed wing aircraft and the helicopter quickly indicate some of the advantages and disadvantages of each. The A.T.A. Helicopter Committee report shows such a comparison as given in Table 3.

The fixed wing craft shows to advantage in two qualities, high speed and flight stability. In the others the helicopter has the advantage.

The comparison can be extended to cover two other important items. The first is the matter of range with full payload and there, of course, the fixed wing types excel for the longer ranges. The other consideration is one of safety in case of complete loss of power. Here the fixed-wing suffers in comparison, in that it must glide at fairly high approach speeds and cannot be as selective in choice of emergency landing areas as the helicoper, which, by virtue of lower required forward speeds in glide for autorotation of the lifting rotor(s) and touch down forward speeds approaching 0 m.p.h., possesses an additional measure of safety.



**Rotor Converting to Fixed Wing.**

**Table 3. Comparison of Helicopter vs. Fixed Wing Transport**

| Item | Fixed Wing Now | Helicopter | |
|---|---|---|---|
| | | Now | Foreseeable Future |
| Minimum Speed...... | 75 m.p.h. | 0 m.p.h. | 0 m.p.h. |
| Maximum Speed..... | 600 m.p.h. | 120 m.p.h. | 200 m.p.h. |
| Takeoff and Landing Area Length...... | 7,000 ft. | 150 ft. | 300–400 ft. |
| Maximum Climb Gradient......... | 5° | 90° | 90° |
| Stability............ | Good | Not yet Satisfactory | Expected to be Satisfactory |
| Maneuverability...... | Limited | Good | Good |

**Table 4. Comparison of Performance and Other Characteristics**

| Item | Helicopter | Convertiplane | Fixed Wing |
|---|---|---|---|
| Vertical Ascent......... | Yes | Yes | No |
| Hover................. | Yes | Yes | No |
| Vertical Descent........ | Yes | Yes | No |
| Overall Range.......... | Short | Greater than Helicopter, Less than Fixed Wing | Maximum Possibility |
| Cruise Speed........... | Limited | In Ultimate Form Equal to Fixed Wing | Maximum Possibility |
| Short Range Payload (50-mile City Center to City Center)...... | Maximum | Less than Helicopter | Cannot Operate |
| Medium Range Payload (300-500 Miles City Center to City Center) | Less than Convertiplane | Maximum | Cannot Operate |
| Medium Range Payload (Airport to Airport).. | Least | Less than Fixed Wing | Maximum |
| Long Range Payload (Airport to Airport).. | Cannot Operate | Less than Fixed Wing | Maximum |
| Airport Requirements... | Cleared Area only 400 sq. ft. | Cleared Area only 400 sq. ft. | Prepared Runways 3,000–7,000 ft. |

It is but natural then that designers consider ways and means of combining the advantages of each type into one machine. This is the basis for the convertible aircraft, sometimes called a "convertiplane". A recent definition of this type of craft states, "A convertiplane is an aircraft with fixed wing area sufficient to provide most efficiently the lift required at cruising speed and altidude, with a power driven rotating-wing system to provide lift for slow speed flight, take-off and landing."

In essence then, a convertiplane is a cross between the fixed-wing and pure helicopter types of craft. It has both a fixed-wing and a rotary-wing system or some combination thereof. The compound helicopter, previously mentioned is a step in this direction.

A comparison, Table 4, in which certain performance and other characteristics of the three basic types of aircraft (fixed-wing, helicopter and convertiplane) are shown in very general terms, serves to illustrate the potential of each.

The convertiplane is not merely a designer's dream, but is an idea in process of approaching reality. In the United States the Air Force has

*(Continued on page 585)*

# Unified Standards for Limits and Fits

*by*

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The author, who attended the Conference for the Unification of Engineering Standards held at Ottawa in 1945 as one of the Canadian delegates, has taken an active part in the work of the Canadian committee and the ISO and ABC Conferences since that time. In this paper he discusses the various national standard systems, and how they are fitted into the New Unified Standard through ABC agreements.

In the manufacture of engineering assemblies it is essential that the individual parts shall fit together with a pre-determined amount of either clearance or interference, in order that these assemblies will function in the manner required by the designer. It is also essential, especially if these parts are to be manufactured on a quantity, or mass production basis, to provide suitable tolerances and limits for the individual parts, so that they can be manufactured economically, and yet will, on assembly, produce a fit which will give the desired performance.

Suitable tolerances, limits, and allowances can, of course, be selected on a purely arbitrary basis, instead of being based on a suitable standard, and such methods have been used for many years by American and Canadian industry. There are, however, many advantages to be gained by standardization in this field. For this reason the new Unified Standards for Limits and Fits represent a new tool for engineers and designers.

Of the various standards in existence, the Newall System, published in 1902, was one of the first. Great Britain published a standard BS164 in 1924; the United States published a temporary standard, B4a, in 1925, which has since been abandoned. The International Standardizing Association (ISA) published a metric standard ISA Bulletin No. 25, in Jan. 1941, based partly on a German standard published in 1926. This ISA standard is widely used in Europe, and to some extent has been used also in Great Britain. It was translated into English (and converted to inches) for study purposes by the ASA committee in 1942.

Some individual companies have adopted modifications of these standards, or have set up other simple systems for their own use. However, none of these systems were considered satisfactory for use as a unified standard, yet no attempt was made by the ABC countries (America, Britain, Canada) to prepare a unified standard until the results of the lack of a common understanding were brought out so forcibly during the second world war.

This subject was discussed at the Ottawa Conference for the Unification of Engineering Standards in 1945, and since that time has been actively pursued by the standards bodies of the three countries. This culminated in an ABC agreement covering the technical details for unified standards, which was reached at the ABC Conference in New York in June 1953.

This article explains some of the deficiencies found in the existing systems; the criteria adopted by the ABC conference for a unified system; and how the ABC agreements, based on these criteria, form the technical basis on which the American, British and Canadian Standards on Limits and Fits are being, or have been, built.

#### Benefits of Standardization

The chief advantages to be gained by the standardization of limits and fits for engineering and manufacturing are as follows:

1. To facilitate the selection of fits, by providing a range of practical fits to cover all general needs, from which a suitable fit can be selected for any specific application. The alternative is to select fits on an arbitrary basis, or to use such ambiguous terms as working fit, or running fit, thus leaving the actual design to the tool maker or producer.
2. To facilitate the specification of fits, by providing a symbolic means of designating fits which can be used on design sketches, or for general identification.
3. To reduce the number of tools

and gages required, by producing fits by combinations of a small number of standard holes and shafts.

4. To promote understanding of specifications, by providing part of the common engineering language which is necessary to enable us to manufacture to other than our own drawings or specifications, or to understand and enjoy the technical literature, especially between the English-speaking countries.

### Some Fundamental Definitions

Realizing that there must be a common understanding of the terms used if a standard is to be effective and useful, one of the first actions of the ABC Conference in 1945 was to reach agreement on definitions of technical terms used in limits-and-fits engineering. These are still under study by the committees, and some minor changes may yet be made, but in the meantime they have been published both in the United States (ASA B4.1–1947) and in Canada (CSA B97-1948).

A few of these terms, which are essential to the proper understanding of this article, and to the evaluation of limits-and-fits standards, are defined below or are illustrated in Figures 1 to 3. Figure 1 also illustrates the derivation of the tolerance zone diagram, as used to illustrate engineering fits.

### Grade, Type, and Class

These terms, which are illustrated in Figure 4, are used in these standards in a somewhat restricted sense, as follows:

*Grade* refers to the relative magnitude of the tolerances and hence to the quality of the work.

*Type of fit* refers to the use to which the fit is to be put in a general way, such as running, clearance, interference, etc. This is explained in more detail under 'Criteria'.

*Class of fit* refers to the relative amount of the clearance or interference for each type of fit. Thus each type of fit is divided into a number of classes.

*Unilateral Tolerance* is a tolerance which is applied all in one direction from the design size, e.g. .250 + .005 − .000. The design size is normally the maximum metal size, which is the minimum size for a hole and the maximum for a shaft, and the tolerance is applied plus for the hole and minus for the shaft.

*Bilateral Tolerance* is a tolerance

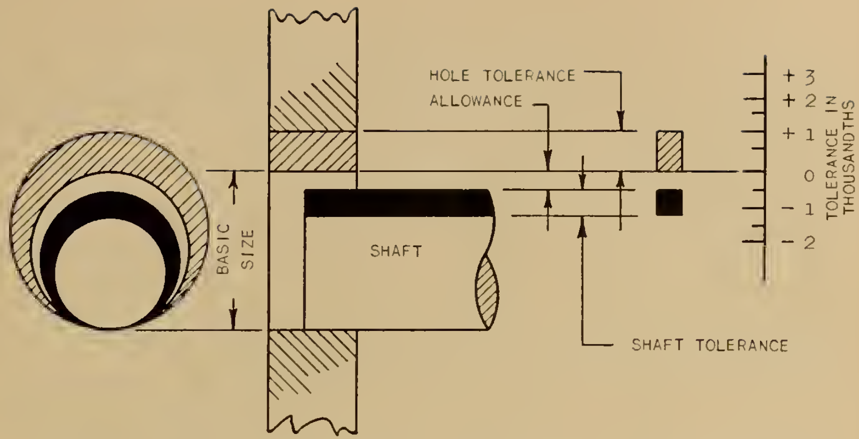


**Fig. 1. Clearance fit, and the derivation of the tolerance zone diagram.**

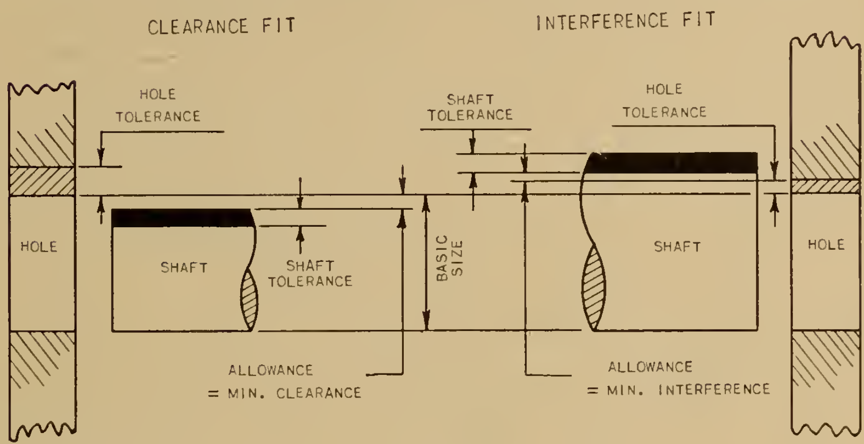


**Fig. 2. Fits in a basic hole system.**

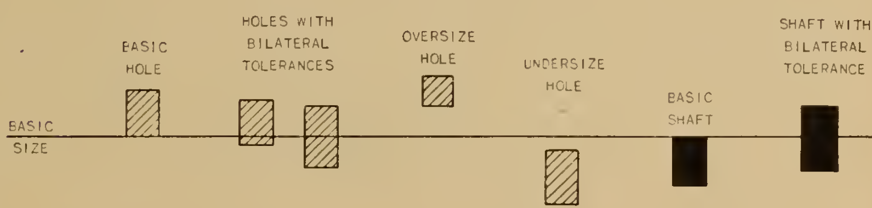


**Fig. 3. Tolerance zones for various holes and shafts.**

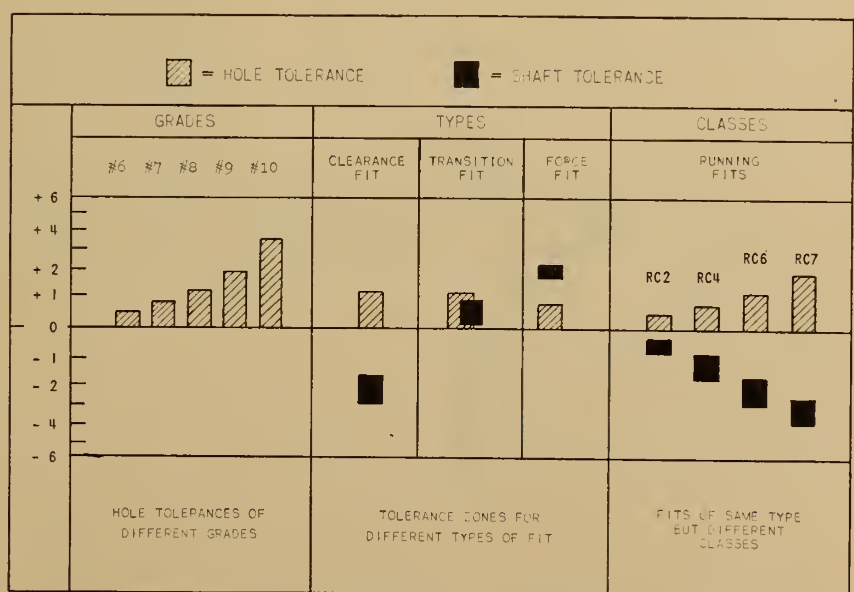


**Fig. 4. Grade, type, and class.**

**Table 1—Criteria for a New System**

As accepted at the ABC Conference in New York in June 1952

1. The system should include tables of allowances and tolerances which will permit a choice of fits suitable for practically all applications which are likely to be encountered in practice, from a loose clearance to a heavy shrink fit.
2. The system should cover a wide range of sizes, and be equally useful for the design of small instruments or large power equipment.
3. All values should be based on logical formulae, so that the ranges can be extended or values checked whenever necessary.
4. The formulae should be so designed that any particular class or grade will represent a similar quality, or result in similar performance, throughout the range of sizes.
5. The fits should be equally applicable for interchangeable manufacture or selective assembly, as conditions warrant.
6. The least number of tables and classes of fit, consistent with adequate coverage of normal requirements, should be provided, for simplicity or presentation and use.
7. While designers should be free to choose whatever class of fit they desire for any particular application, some assistance should be provided to enable a suitable choice to be made in cases where experience may be lacking.

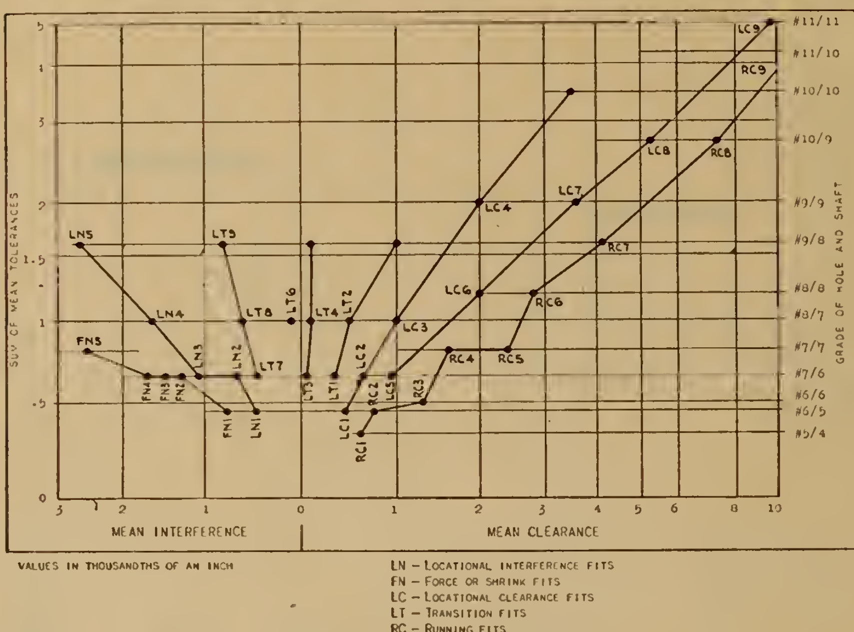


**Fig. 5. A series of standard fits.**

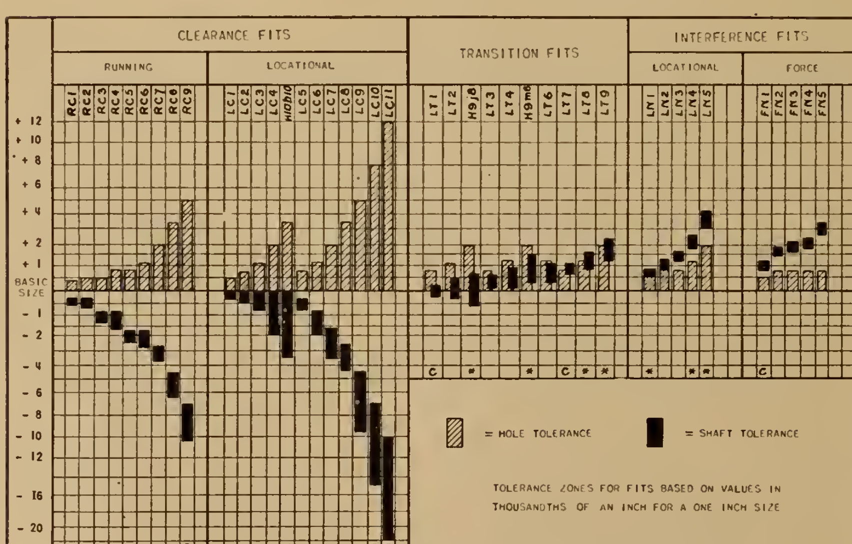


**Fig. 6. A series of standard fits in the basic hole system.**

All of these fits are included as standard fits in the ABC agreements, except those marked "C", which are additional fits in the Canadian standard, and those shown with an asterisk, which have to be derived from the formulae, or from the tables of hole and shaft tolerances, when required.

which is applied in both directions from the design size, though not necessarily equally in both directions, e.g. .250 ± .003 or .250 + .004 − .002.

*Basic Hole* (*or Shaft*) A basic hole is one in which the minimum size is equal to the basic size, and the tolerance is applied unilaterally in a plus direction. Similarily a basic shaft is one where the maximum shaft is the basic size, and the tolerance is applied in a minus direction.

*Hole* (*or Shaft*) *Basis System.* A hole-basis system is one using standard holes, which vary only in the amount of the tolerances, and various fits are obtained by varying the size of the shafts. The hole tolerances may be either unilateral or bilateral, but when basic holes are used it is known as a basic-hole system. Similarly, a shaft-basis system uses standard shafts and varying holes, and, when basic shafts are used, would be known as a basic-shaft system.

### Preferred System

A basic-hole system is generally preferred, because holes are usually produced with fixed-size tools and plug gages, and are more difficult or costly to produce in slightly varying sizes than are shafts, which are normally turned or ground.

There are many specific cases, however, when a bilateral hole tolerance is preferable, for example, when holes are produced with standard drills or reamers, which may wear slightly and produce undersize holes; or when a shaft-basis system is preferable, for example, where two different fits have to be produced on the same shaft. For this reason a standard, to be satisfactory for general use, should provide means for converting fits from one basis to another.

### Criteria for a Unified Standard

Soon after the ABC Conference in 1945, the Canadian Committee compiled a series of criteria for a satisfactory system to meet modern requirements, and these were accepted at the ABC Conference in New York in 1952 as a basis for determining the acceptability of the proposed ABC Agreements. These criteria, shown in Table 1, are discussed in more detail below.

Under Criterion 1, the system should include tables of allowances and tolerances which will permit a choice of fits suitable for practically all applications likely to be encountered in practice. The fits required to cover all engineering requirements can be conveniently divided into five types. For each of these types a series of classes of fit are required, ranging from precision fits to fits with large tolerances and allowances.

Adequate coverage would be given by about 9 to 12 classes for each of the clearance and transition fits, and about 5 for the interference fits. Figure 5 shows such a series of standard fits, which gives good coverage of the engineering field for most purposes. Each fit is here represented by the average hole and shaft tolerance, and the average clearance or interference. Figure 6 shows these same fits in a basic hole system, in the form of tolerance zone diagrams.

The five types of fit are:

1. *Running or Sliding Fits.* These are fits which provide clearance necessary to achieve the desired running or sliding characteristics, with suitable lubrication allowances. The tolerances are small, and the allowances increase slowly with increased diameter, in order to maintain the desired running qualities.
2. *Locational Clearance Fits.* These are essentially static fits, running from snug fits for parts requiring accuracy of location, to the loose fastener fits, where freedom of assembly is of prime importance. They have greater tolerances than running fits, and the clearances increase faster with diameter in the larger sizes.
3. *Transition Fits.* These are a compromise between clearance and interference fits, for applications requiring accuracy of location, but either a small clearance or interference is permissible.
4. *Locational Interference Fits.* These are used for parts requiring rigidity and alignment, where accuracy of location is important but control of bore pressure is not. Such fits are not intended to transmit frictional loads between mating parts by virtue of the tightness of fit.
5. *Force or Shrink Fits.* These are interference fits characterized by maintenance of constant bore pressure throughout the range of sizes. The interference varies directly with the diameter, and the tolerances are small to maintain the resulting pressures within reasonable limits.

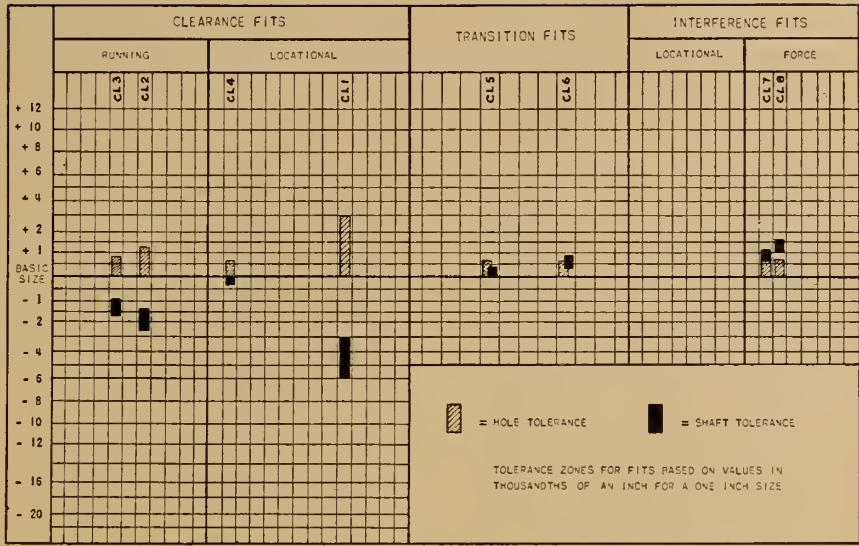


**Fig. 7. Fits in American tentative standard B4a-1925.**

This chart includes all of the fits in the American Tentative Standard B4a-1925, arranged in the appropriate spaces for comparison with Figure 6.

**Table 2—Recommended Fits in a Basic Hole System Provided by Various Standards.**

| Standard | Clearance Fits | | Transition Fits | Interference Fits | | Total |
|---|---|---|---|---|---|---|
| | Running Fits | Locational or Static Fits | | Locational Fits | Force or Shrink Fits | |
| American B4a—1925 | 3 | 1 | 1 | — | 3 | 8 |
| British BS 164—1924 | 13 | 19 | 19 | 5 | — | 56 |
| British BS 1916—1953 | 11 | 14 | 13 | 5 | 19 | 62 |
| Canadian B97—1954 | 9 | 11 | 6 | 5* | 5 | 36 |
| ISO (Metric) | 11 | 14 | 13 | 5 | 19 | 62 |
| Newall System (Bi-lateral Holes) | 2 | 4 | 1 | 5 | — | 12 |

*Three of the locational interference fits are not included in the tables in the present edition, but the formulae are included in the appendix, and values can thus easily be calculated.

**Table 2A—Standard Fits under Criterion No. 2.**

| Type of Fit | Designation Symbols | Number of classes of fit provided |
|---|---|---|
| Running or Sliding Fits | RC1 to RC9 | 9 |
| Locational Clearance Fits | LC1 to LC11 | 11 |
| Transition Fits | {LT1 to LT4, LT6 to LT7} | 6 |
| Locational Interference Fits | LN1 to LN5* | 5 |
| Force or Shrink Fits | FN1 to FN5 | 5 |
| | | TOTAL 36 |

*Three of these are not given directly in the tables, and have to be determined by the formulae.

Under Criterion 2, the system should cover a wide range of sizes and be equally useful for the design of small instruments or large power equipment. Most of the existing standards cover a range up to 8 to 25 inches, but to fully cover the needs of modern industry it was considered necessary to extend this up to 200 inches.

Under Criterion 3, all values should be based on logical formulae, so that ranges can be extended or values checked whenever necessary. Formulae are required for the calculation of both tolerances and allowances, and are required to achieve two purposes:

1. To provide a series of values based on size: (a) for each grade of tolerance, and (b) for each class of fit.

2. To provide (a) a series of grades of tolerance, and (b) a series of classes for each type of fit, from very small tolerances and allowances for precision fits, to large values for rough work or heavy fits.

The first of these is the function of the basic part of the formulae, which has to be designed to meet the requirements of criterion 4. The second purpose may be taken care of by modifications to the basic formulae, and by using a series of factors applied to the basic formulae, to give suitable steps between grades and classes. This provides uniform coverage of the whole engineering field. It has been found that steps of 60 per cent between grades of tolerance, and 60 to 100 per cent between classes of fit, provide about the ideal coverage for most purposes.

Under Criterion 4, the formulae should be so designed that any particular class or grade will represent a similar quality, or result in similar performance, throughout the range of sizes. For tolerances, the formula should therefore approximate the rate of increased difficulty of maintaining the required accuracy with increasing size. This will vary due to machine errors and adjustments, tool wear, material variations, measurement errors, deformation or inaccuracies of gages, temperature variations, and different processes.

Obviously, to be accurate, this would require a complicated formula, which would be different for each manufacturing process. However, as we are only trying to produce a series which will represent *similar* quality throughout the range, the practical solution is to find a formula which will represent the approximate average variations in different processes. Such a formula is that provided in the ABC agreements for the range up to 20 inches, which is

$$G(.52\sqrt[3]{D} + .01D)$$

where D = the mean diameter in inches, and G = a factor for each grade.

Likewise formulae for allowances are a compromise for average conditions. Formulae for running fits have to include allowances for measurement errors, lubrication, and temperature variations. Force or shrink fits should increase almost in direct proportion to diameter, like the old rule-of-thumb of .001 in. per inch, in order to maintain constant assembly stress. Locational fits are less critical and the formulae should more nearly approach the tolerance formula.

**Table 3—Preferred Basic Sizes**

| | | | | | |
|---|---|---|---|---|---|
| | 0.0100 | 1⅜ | 1 3750 | 7½ | 7.5000 |
| | 0.0125 | 1½ | 1.5000 | 8 | 8.0000 |
| 1/64 | 0.015625 | 1⅝ | 1 6250 | 8½ | 8.5000 |
| | 0.0200 | 1¾ | 1 7500 | 9 | 9.0000 |
| | 0.0250 | 1⅞ | 1.8750 | 9½ | 9.5000 |
| 1/32 | 0 03125 | 2 | 2.0000 | 10 | 10.0000 |
| | 0.0400 | 2⅛ | 2.1250 | 10½ | 10.5000 |
| | 0.0500 | 2¼ | 2.2500 | 11 | 11.0000 |
| 1/16 | 0.0625 | 2⅜ | 2 3750 | 11½ | 11.5000 |
| | 0.0800 | 2½ | 2.5000 | 12 | 12.0000 |
| 3/32 | 0.09375 | 2⅝ | 2.6250 | 12½ | 12.5000 |
| | 0.1000 | 2¾ | 2.7500 | 13 | 13.0000 |
| ⅛ | 0.1250 | 2⅞ | 2.8750 | 13½ | 13.5000 |
| 5/32 | 0.15625 | 3 | 3.0000 | 14 | 14 0000 |
| 3/16 | 0.1875 | 3¼ | 3 2500 | 14½ | 14.5000 |
| ¼ | 0.2500 | 3½ | 3 5000 | 15 | 15.0000 |
| 5/16 | 0 3125 | 3¾ | 3 7500 | 15½ | 15.5000 |
| ⅜ | 0.3750 | 4 | 4.0000 | 16 | 16.0000 |
| 7/16 | 0.4375 | 4¼ | 4 2500 | 16½ | 16.5000 |
| ½ | 0.5000 | 4½ | 4.5000 | 17 | 17.0000 |
| 9/16 | 0 5625 | 4¾ | 4.7500 | 17½ | 17.5000 |
| ⅝ | 0 6250 | 5 | 5 0000 | 18 | 18.0000 |
| 11/16 | 0 6875 | 5¼ | 5 2500 | 18½ | 18.5000 |
| ¾ | 0 7500 | 5½ | 5.5000 | 19 | 19.0000 |
| ⅞ | 0.8750 | 5¾ | 5 7500 | 19½ | 19.5000 |
| 1 | 1.0000 | 6 | 6.0000 | 20 | 20.0000 |
| 1⅛ | 1 1250 | 6½ | 6.5000 | | |
| 1¼ | 1 2500 | 7 | 7.0000 | | |

*All dimensions are given in inches.

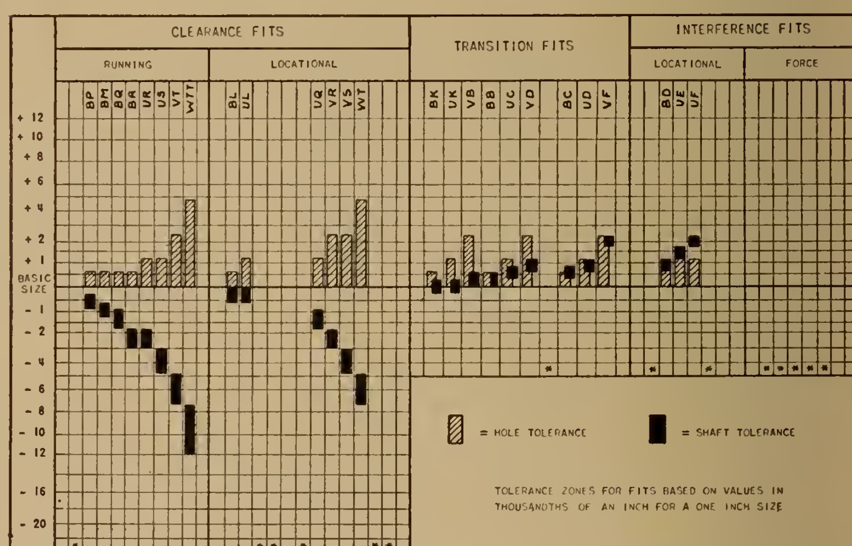


**Fig. 8. Basic hole fits in British standard BS-164.**

This is a selection of fits from the Old British Standard which most nearly correspond to those in figure 6. There are others in this standard, with more or less impractical tolerances, but none, in the basic hole system, which would fill the spaces shown with an asterisk*.

Under Criterion 5, the fits should be equally applicable for interchangeable manufacture or selective assembly, as conditions warrant. The coarser fits are all suitable for interchangeable manufacture. The more precise fits are more difficult to control, and may be more economically produced, especially when quantities are small, by matched fits or selective assembly. The method of adapting these precise fits to selective assembly or matched fits should be explained in the standard.

Under Criterion 6, the least number of tables and classes of fit, consistent with adequate coverage of normal requirements, should be provided, for simplicity of presentation and use.

One of the chief criticisms of the

ISO system was the fact that there were such a large number of possible combinations of holes and shafts, that selection of a suitable fit was difficult, and the benefits of standardization were partly lost. About the maximum number of fits required to give adequate coverage would be those shown in Figs. 5 and 6.

Under Criterion 7, while designers should be free to choose whatever class they desire for any particular application, some assistance should be provided to enable a suitable choice to be made in cases where experience may be lacking.

Freedom of choice appears to be more or less inherent in all of the old standards, but the American Tentative standard B4a specified actual speeds and journal pressures. This was felt to be too restrictive, as the fits could certainly find a much wider application than indicated by the values given. On the other hand, the other standards gave practically no guidance as to the applications for which the various fits were suitable.

### Existing Standards

Let us now examine briefly some of the existing standards, and see wherein they failed to meet the criteria set up by the committee. Prior to the advent of the ABC Agreements and the Unified Standards, the four best known systems used in the English speaking countries were: the British Standard BS164-1924; the American Tentative Standard B4a-1925; the Newall System, used chiefly in Great Britain; and the ISA (now ISO) metric system, used generally throughout Europe. The number of basic hole fits provided by each of these standards is shown in Table 2.

### American Tentative Standard B4a—1925

This standard provided only eight classes of fit, four clearance fits, two transition fits, and two interference fits. These are shown in Fig. 7, and a comparison with Fig. 6 will indicate the serious lack of fits in this respect. These fits were all on a basic-hole system, with no provision for other hole-basis or shaft-basis fits. They covered a range of zero to 8½ inches, except that heavy force and shrink fits were extended up to 136 inches.

The formulae used were simple, but for this reason failed to some extent to maintain the same quality level or operating characteristics throughout the range of sizes for any one class. Thus it failed to meet Criteria Nos. 1, 2 and 4 in particular, and to some extent Nos. 5 and 7 also. It also failed to give preferred sizes and tolerance values, or a series of grades of tolerance for general use.

It seems fair to say that this tentative standard was never accepted by American Industry, it has been little used, and was therefore abandoned in 1947, when it was decided to work on a new standard. It was an attempt at simplification of the problem, but resulted in over-simplification to the extent that there was not sufficient choice of fits to meet the needs of industry. Moreover, it lacked the flexibility necessary to provide special fits for special applications.

### British Standard BS164—1924

This British standard has been widely used in Great Britain since it was published in 1924, but has had to share its position with the Newall system, which is more simple, and more recently with the ISO system, which is somewhat more comprehensive.

It is based on the system of providing a series of holes and shafts, from which numerous fits can be produced. There are 4 holes with unilateral tolerances, 4 holes with bilaterial tolerances, 3 oversize holes, and a series of 14 shafts. Any of these holes and shafts can be combined, but the fits produced with unilateral holes are not the same as those produced with bilateral or oversize holes. No provision is made for shaft-basis fits, and no preferred basic sizes or tolerances are given.

If we consider only the fits in the basic-hole system of which there are 56 possible combinations, as shown in Table 3, we find that only 26 can be used to form a useful series of fits. These are shown in Fig. 8. The other 30 combinations are of no practical value, because they are either too close to the fits shown in Fig. 8, or because the tolerances on one part would be too precise or too coarse for the allowance and tolerance on the mating part. At the same time, a comparison between Figs. 6 and 8 shows that there are several gaps, for which no suitable fits exist in BS164.

Thus this standard fails to meet Criteria Nos. 1 and 6; it also fails to meet No. 2, because it covers the range only up to 25 inches; it fails to meet Nos. 3 and 4 because there is only one formula, which is not completely satisfactory for tolerances, yet it also has to serve for clearances and interferences for all classes of fit. It fails to meet No. 7, because little or no guidance is given for specific applications.

### Newall System

The Newall System is a very simple one, which has been used to a small extent in Great Britain. It is a bilateral hole-basis system, in which the tolerances and allowances can be reversed if desired to produce a bilateral shaft-basis system. There are two standard holes, and six standard shafts. Fits are produced by using either of the holes with any one of the shafts, thus producing a total of only 12 fits.

This standard therefore fails to meet Criterion No. 1, because there are insufficient fits in the system. For this reason it covers only a very

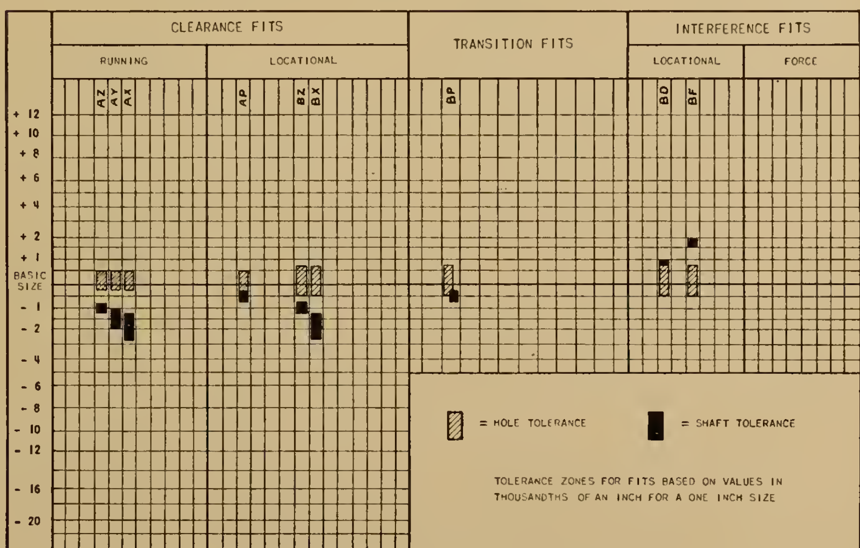


**Fig. 9. Fits in the Newall System**

There are three other fits in the Newall system, but they are very similar to fits shown above, and do not help to fill in the gap between this chart and Figure 6. Note that hole tolerances are all bilateral; there are no basic holes in this system.

limited field, and does not begin to be adequate as a general engineering standard. It also does not meet Criterion No. 2, because it only covers a range up to 12 inches.

It fails to meet Criteria Nos. 3 and 4 because it is not based on logical formulae, and each grade or class does not represent similar quality or operating performance throughout the range of sizes. It even fails to meet Criterion No. 6, because although there are 12 fits in the system, only 9 of these are needed for the limited range covered by the standard, as shown in Fig. 9, the other 3 being too close to one or other of these nine fits to be of any practical value.

### ISO System

The ISA Standard, which was developed between 1926 and 1940, and published as ISA Bulletin No. 25 in January 1941, was taken over by the International Standards Organization following World War II, and is now known as the ISO system. It is the most comprehensive of the older standards, and was intended to cover the needs of all conceivable applications within its size limitations.

It is based on a series of 16 grades of tolerance, of which about half are suitable for fits, the balance being either very precise, and intended for gage work, or very coarse tolerances for purposes other than fits. It includes a series of 21 holes, each with a different allowance, which can be made in any one of the tolerance grades; and a similar series of 21 shafts.

This permits fits to be produced in an almost limitless number of combinations (actually over 100,000), either on a hole or a shaft basis, although the basic hole system is referred to as the preferred method. This multiplicity of possible combinations, or fits, has caused much confusion in attempts to use the system. In most cases the reaction has been to reject the system as being too complex without giving it further study.

However, it should be realized that many of the combinations give identical fits; that many are quite impractical and would never be considered; and that it was intended that each industry or user would select a few fits suitable for their particular needs, and standardize on these fits. Some attempt has been made to give preferred holes and shafts, but the resulting number of fits is still more than necessary.

The ISO system therefore meets Criterion No. 1 fairly well; and also

**Table 4—Tolerance Series.**

| | | | | | |
|---|---|---|---|---|---|
| 0.0001 | 0.0003 | 0.001 | 0.003 | 0.010 | 0.030 |
| — | — | 0.0012 | 0.0035 | 0.012 | 0.035 |
| 0.00015 | 0.0004 | 0.0014 | 0.004 | 0.014 | 0.040 |
| — | — | 0.0016 | 0.0045 | 0.016 | 0.045 |
| — | 0.0005 | 0.0018 | 0.005 | 0.018 | 0.050 |
| 0.0002 | 0.0006 | 0.002 | 0.006 | 0.020 | 0.060 |
| — | 0.0007 | 0.0022 | 0.007 | 0.022 | — |
| 0.00025 | 0.0008 | 0.0025 | 0.008 | 0.025 | — |
| — | 0.0009 | 0.0028 | 0.009 | 0.028 | — |

*All dimensions are given in inches.

**Table 5—Equivalent Fits in Various Standards.**

| Canadian B97—1954 | British BS 1916—1953 | American B4a—1925 | British BS 164—1924 | Newall System |
|---|---|---|---|---|
| **Running and Sliding Fits** | | | | |
| RC1 | H5 g4 | | | |
| RC2 | K6 g5 | | BP | |
| RC3 | H6 f6 | | BM | AZ |
| RC4 | H7 f7 | CL 3 | BQ | AY |
| RC5 | H7 e7 | | BR | AX |
| RC6 | H8 e8 | CL 2 | UR | |
| RC7 | H9 d8 | | US | |
| RC8 | H10 c9 | | VT | |
| RC9 | | | WTT | |
| **Locational Clearance Fits** | | | | |
| LC1 | H6 h5 | CL 4 | BL | |
| LC2 | H7 h6 | | UL | AP |
| LC3 | H8 h7 | | | |
| LC4 | H9 h9 | | | |
| H10 h10* | H10 h10 | | | |
| LC5 | H7 g6 | | | BZ |
| LC6 | H8 f8 | | UQ | BX |
| LC7 | H9 e9 | | VR | |
| LC8 | H10 d9 | CL 1 | VS | |
| LC9 | H11 c11 | | WT | |
| LC10 | | | | |
| LC11 | | | | |

| Canadian B97—1954 | British BS 1916—1953 | American B4a—1925 | British BS 164—1924 | Newall System |
|---|---|---|---|---|
| **Transitional Fits** | | | | |
| LT1 | H7 j6 | | BK | |
| LT2 | H8 j7 | | UK | BP |
| H9 j8* | H9 j8 | | VB | |
| LT3 | H7 k6 | CL 5 | BB | |
| LT4 | H8 k7 | | UC | |
| H9 m8* | H9 m8* | | | |
| LT6 | H8 m7 | | | |
| LT7 | H7 n6 | CL 6 | BC | |
| LT8* | H8 p7 | | UD | |
| LT9* | H9 r8* | | VF | |
| **Locational Interference Fits** | | | | |
| LN1* | | | | |
| LN2 | H7 p6 | | BD | BD |
| LN3 | H7 r6 | | UE | |
| LN4* | | | UF | BF |
| LN5* | | | | |
| **Force or Shrink Fits** | | | | |
| FN1 | | CL 7 | | |
| FN2 | H7 s6 | CL 8 | | |
| FN3 | H7 t6 | | | |
| FN4 | H7 u6 | | | |
| FN5 | H7 x7 | | | |

These fits are illustrated in Figures 6 to 9. Fits shown in the British standard BS 1916 are identical with corresponding fits in Canadian standard B97. Other fits are nearest equivalents.

*Fits shown with an asterisk are not included in the tables of the standard fits, and have to be derived as explained in the appendix to the standard.

**Table 6—Description of Running Fits.**

As described in Canadian Standard B97—1954

Running and Sliding Fits

Running and sliding fits represent a special type of clearance fit. These are intended to provide a similar running performance, with suitable lubrication allowance, throughout the range of sizes. The clearances for the first two classes, used chiefly as slide fits, increase more slowly with diameter than the other classes, so that accurate location is maintained even at the expense of free relative motion.

These fits may be described briefly as follows:

RC 1 Close Sliding Fits are intended for the accurate location of parts which must assemble without perceptible play.

RC 2 Sliding Fits are intended for accurate location, but with greater maximum clearance than class RC 1. Parts made to this fit move and turn easily but are not intended to run freely, and in the larger sizes may seize with small temperature changes.

RC 3 Precision Running Fits are about closest fits which can be expected to run freely, and are intended for precision work at slow speeds and light journal pressures, but are not suitable where appreciable temperature differences are likely to be encountered.

RC 4 Close Running Fits are intended chiefly for running fits on accurate machinery with moderate surface speeds and journal pressures, where accurate location and minimum play is desired.

RC 5, RC 6 Medium Running Fits are intended for higher running speeds and/or for heavy journal pressures.

RC 7 Free Running Fits are intended for use where accuracy is not essential, and/or where large temperature variations are likely to be encountered.

RC 8, RC 9 Loose Running Fits are intended for use where materials made to commercial tolerances are involved such as cold rolled shafting, tubing, etc.

Criterion No. 3, because values are based on logical formulae. It fails to meet Criterion No. 4, because the formulae cannot be used to extend the ranges satisfactorily from zero to say 200 inches, although they have been used to establish some of the values in the Unified Standards.

The system also fails to meet Criterion No. 2, because the range covered is only .04 to 19.69 inches. Yet ISO have already reached some measure of agreement on values below .04 and over 20 inches, and these will no doubt be incorporated in the ISO standard within the next few years. It also fails to meet No. 6, because of the multiplicity of fits as mentioned above; and No. 7 because the system gives very little guidance in the choice of fits for specific applications.

### ABC Agreements

The general acceptance of any one of these systems would have resulted in reaping some of the benefits of standardization, but none of them are entirely satisfactory as a unified standard for the reasons already explained.

These deficiencies were recognized by the standardizing bodies of the ABC countries when discussions were started during World War II. The ground work was laid for a new series of national standards at the Conference for the Unification of Engineering Standards (where the Unified Screw Thread was born), held at Ottawa in 1945.

Subsequent work and study resulted in a draft for a complete new standard by the Canadian committee in 1950, which overcame practically all of the objections of the older systems, and met the ideals set up by the committee. This standard represented an entirely new system.

It was then agreed however, that as the ISO system contained such a wide range of tolerances, holes, and shafts, and was so extensively used in other parts of the world, it should be possible to select suitable values from this range to meet at least some of the requirements of the new standards. While the new standards might be set up in an entirely different manner, the final hole and shaft limits for any particular fit would then agree closely with standard limits in the ISO system.

After further study by the three countries, agreement was finally reached on a series of values and other technical details, and this agreement was adopted at an ABC Conference in New York in February 1953.

It was found that the ISO formulae were more simple than those developed by the Canadian Committee. While they could not be used to cover the complete range desired, they were reasonably satisfactory for a limited range. This limited range is covered by the agreements, and modified formulae are used to extend the ranges beyond these limits.

The ABC Agreement includes the following:

1. A series of preferred basic sizes from 0 to 20 inches.
2. A series of preferred tolerance values from .0001 to .060 inches.
3. A series of definitions applying to limits and fits.
4. A graded series of fundamental tolerances, covering the range from .04 to 19.69 inches.
5. A series of 8 running fits, covering the range .04 to 9.85 inches, and 19 other fits covering the range .04 to 19.69 inches.
6. A series of hole and shaft limits, given in an appendix, from which other special fits can be derived.

It is intended that these technical details will form the basis of each of the three national standards, but each of the countries is free to extend the range of sizes, or to add other fits and further data as desired.

### The New Unified Standards

The American committee B4 have not yet completed their new standard, but when published it will undoubtedly be along similar lines to the Canadian Standard.

The new British Standard BS1916—1953 was published last year. This standard is based on the method of providing a series of standard holes and shafts, which are then combined to produce various fits. It is thus similar to the ISO system and uses the same symbol system. However, all of the fits in the ABC agreements can be pro-

**Table 7—Limits for Running Fits**

Basic Hole System

| Nominal Size Range | | Fit RC 3 | | | Fit RC 4 | | | Fit RC 5 | | | Fit RC 6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Over | To | Min. & Max. Clearance | Hole Limits Grade 6 | Shaft Limits Grade 6 | Min. & Max. Clearance | Hole Limits Grade 7 | Shaft Limits Grade 7 | Min. & Max. Clearance | Hole Limits Grade 7 | Shaft Limits Grade 7 | Min. & Max. Clearance | Hole Limits Grade 8 | Shaft Limits Grade 8 |
| .04 | .12 | .0003<br>.0008 | +.00025<br>−.0000 | −.0003<br>−.00055 | .0003<br>.0011 | +.0004<br>−.0000 | −.0003<br>−.0007 | .0006<br>.0014 | +.0004<br>−.0000 | −.0006<br>−.0010 | .0006<br>.0018 | +.0006<br>−.0000 | −.0006<br>−.0012 |
| .12 | .24 | .0004<br>.0010 | −.0003<br>−.0000 | −.0004<br>−.0007 | .0004<br>.0014 | +.0005<br>−.0000 | −.0004<br>−.0009 | .0008<br>.0018 | +.0005<br>−.0000 | −.0008<br>−.0013 | .0008<br>.0022 | +.0007<br>−.0000 | −.0008<br>−.0015 |
| .24 | .40 | .0005<br>.0013 | +.0004<br>−.0000 | −.0005<br>−.0009 | .0005<br>.0017 | +.0006<br>−.0000 | −.0005<br>−.0011 | .0010<br>.0022 | +.0006<br>−.0000 | −.0010<br>−.0016 | .0010<br>.0028 | +.0009<br>−.0000 | −.0010<br>−.0019 |
| .40 | .71 | .0006<br>.0014 | +.0004<br>−.0000 | −.0006<br>−.0010 | .0006<br>.0020 | +.0007<br>−.0000 | −.0006<br>−.0013 | .0012<br>.0026 | +.0007<br>−.0000 | −.0012<br>−.0019 | .0012<br>.0032 | +.0010<br>−.0000 | −.0012<br>−.0022 |
| .71 | 1.19 | .0008<br>.0018 | +.0005<br>−.0000 | −.0008<br>−.0013 | .0008<br>.0024 | +.0008<br>−.0000 | −.0008<br>−.0016 | .0016<br>.0032 | +.0008<br>−.0000 | −.0016<br>−.0024 | .0016<br>.0040 | +.0012<br>−.0000 | −.0016<br>−.0028 |
| 1.19 | 1.97 | .0010<br>.0022 | +.0006<br>−.0000 | −.0010<br>−.0016 | .0010<br>.0030 | +.0010<br>−.0000 | −.0010<br>−.0020 | .0020<br>.0040 | +.0010<br>−.0000 | −.0020<br>−.0030 | .0020<br>.0052 | +.0016<br>−.0000 | −.0020<br>−.0036 |
| 1.97 | 3.15 | .0012<br>.0026 | +.0007<br>−.0000 | −.0012<br>−.0019 | .0012<br>.0036 | +.0012<br>−.0000 | −.0012<br>−.0024 | .0025<br>.0049 | +.0012<br>−.0000 | −.0025<br>−.0037 | .0025<br>.0061 | +.0018<br>−.0000 | −.0025<br>−.0043 |

Hole and Shaft limits are applied algebraically to the basic size to obtain the limits of size for the parts. All dimensions are in inches.

### Table 8—Limits for Force and Shrink Fits

Basic Hole System

| Nominal Size Range | | Fit FN2 | | | Fit FN3 | | | Fit FN4 | | | Fit FN5 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Over | To | Limits of Interference | Hole Limits Grade 7 | Shaft Limits Grade 6 | Limits of Interference | Hole Limits Grade 7 | Shaft Limits Grade 6 | Limits of Interference | Hole Limits Grade 7 | Shaft Limits Grade 6 | Limits of Interference | Hole Limits Grade 7 | Shaft Limits Grade 6 |
| .04 | .12 | .0002<br>.00085 | +.0004<br>−.0000 | +.00085<br>+.0006 | | | | .0003<br>.00095 | +.0004<br>−.0000 | +.00095<br>+.0007 | .0005<br>.0013 | +.0004<br>−.0000 | +.0013<br>+.0009 |
| .12 | .24 | .0002<br>.0010 | +.0005<br>−.0000 | +.0010<br>+.0007 | | | | .0004<br>.0012 | +.0005<br>−.0000 | +.0012<br>+.0009 | .0007<br>.0017 | +.0005<br>−.0000 | +.0017<br>+.0012 |
| .24 | .40 | .0004<br>.0014 | +.0006<br>−.0000 | +.0014<br>+.0010 | | | | .0006<br>.0016 | +.0006<br>−.0000 | +.0016<br>+.0012 | .0008<br>.0020 | +.0006<br>−.0000 | +.0020<br>+.0014 |
| .40 | .56 | .0005<br>.0016 | +.0007<br>−.0000 | +.0016<br>+.0012 | | | | .0007<br>.0018 | +.0007<br>−.0000 | +.0018<br>+.0014 | .0009<br>.0023 | +.0007<br>−.0000 | +.0023<br>+.0016 |
| .56 | .71 | .0005<br>.0016 | +.0007<br>−.0000 | +.0016<br>+.0012 | | | | .0007<br>.0018 | +.0007<br>−.0000 | +.0018<br>+.0014 | .0011<br>.0025 | +.0007<br>−.0000 | +.0025<br>+.0018 |
| .71 | .95 | .0006<br>.0019 | +.0008<br>−.0000 | +.0019<br>+.0014 | | | | .0008<br>.0021 | +.0008<br>−.0000 | +.0021<br>+.0016 | .0014<br>.0030 | +.0008<br>−.0000 | +.0030<br>+.0022 |
| .95 | 1.19 | .0006<br>.0019 | +.0008<br>−.0000 | +.0019<br>+.0014 | .0008<br>.0021 | +.0008<br>−.0000 | +.0021<br>+.0016 | .0010<br>.0023 | +.0008<br>−.0000 | +.0023<br>+.0018 | .0017<br>.0033 | +.0008<br>−.0000 | +.0033<br>+.0025 |
| 1.19 | 1.58 | .0008<br>.0024 | +.0010<br>−.0000 | +.0024<br>+.0018 | .0008<br>.0024 | +.0010<br>−.0000 | +.0024<br>+.0018 | .0015<br>.0031 | +.0010<br>−.0000 | +.0031<br>+.0025 | .0020<br>.0040 | +.0010<br>−.0000 | +.0040<br>+.0030 |
| 1.58 | 1.97 | .0008<br>.0024 | +.0010<br>−.0000 | +.0024<br>+.0018 | .0012<br>.0028 | +.0010<br>−.0000 | +.0028<br>+.0022 | .0018<br>.0034 | +.0010<br>−.0000 | +.0034<br>+.0028 | .0030<br>.0050 | +.0010<br>−.0000 | +.0050<br>+.0040 |

Hole and Shaft limits are applied algebraically to the basic size to obtain the limits of size for the parts. All dimensions are in inches.

duced in this manner, as well as numerous additional fits.

The new Canadian Standard B97-1954 is essentially the same as the draft of the new standard drawn up in 1950, but with values and other details adjusted in conformity with the ABC agreements. It includes all of the fits in the agreements, plus a few additional ones to more adequately cover the field. The range has been extended up to 200 inches. The basic hole system has been adopted as standard, and the tables are based on this system. Rules and designation symbols are included for identical fits on (1) a bilateral hole basis, (2) a basic shaft system, and (3) matched assembly fits, as well as other special fits.

Let us therefore look in more detail at the main provisions of this standard, which are as follows:

1. A series of definitions, as agreed at the ABC conference in 1945.
2. The ABC series of preferred basic sizes, from which the basic size of mating parts should be chosen. These are given in Table 3.
3. A series of basic tolerances and allowances, as given in Table 4.
4. A series of standard fits, of the five types described in the discussion of Criterion No. 1. The number of classes of fit of each of these types provided in the standard are shown in Table 2A. Equivalent fits in the other standards are shown in Table 5.
5. A description of the standard fits, which aids in the selection of suitable fits for specific applications. The descriptions of running fits from the CSA standard are reproduced in Table 6.
6. Tables of limits for all of the standard fits, showing the limits of clearance or interference, and the tolerance limits for the holes and shafts. A portion of these tables are given in Table 7, Running Fits, and Table 8, Force or Shrink Fits.
7. The standard also gives a table of grades of tolerances, a table showing grades produced by various machining processes, and in the appendixes, (A) a table of standard limits for holes and shafts, (B) corresponding fits in the Canadian and British standards, and (C) Derivation and formulae for allowances and tolerances.

#### Using the Standard

The designer, in selecting a fit for a certain application would proceed as follows. First, he would establish the basic size, giving preference to values in the table of preferred sizes, (Table 3). We will consider that 1 in. is chosen, and that a mechanism is being designed which must run freely, yet must have very small bearing play. The designer looks over the descriptions of running fits, and probably with some experience with other similar mechanisms, he chooses a close running fit, RC4.

On his design sketch, or specification, he merely writes 1 in.-RC4, referring to the assembled bearing and shaft, as shown in Figure 10, or as shown for other examples in Figure 11. Or, if he wishes to use bilateral holes, or a basic shaft fit,

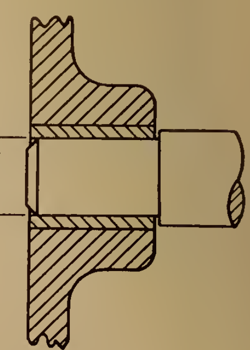


Fig. 10. Design sketch for an RC4 running fit.

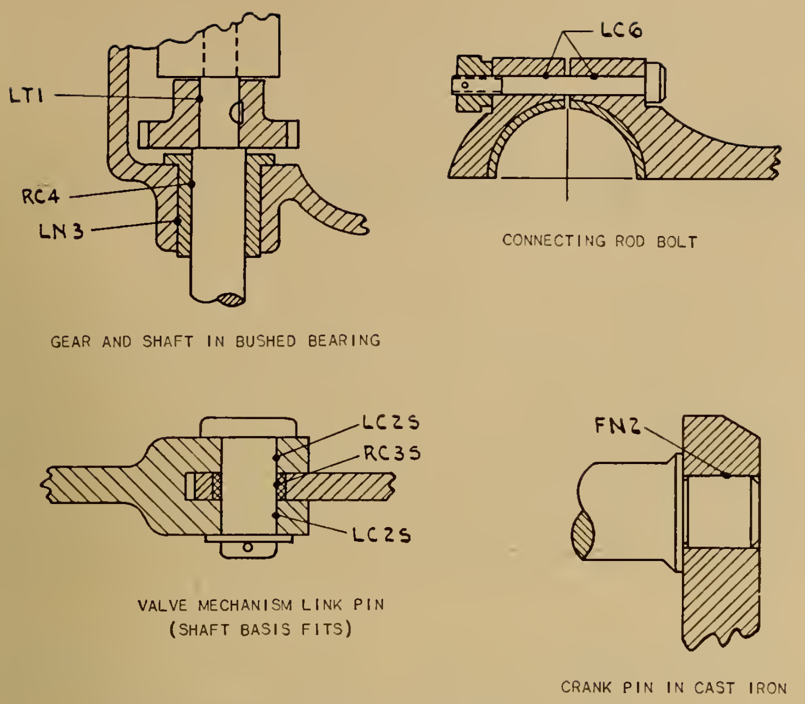


**Fig. 11. Typical design sketches using the new fits.**

he can specify exactly the same fit in either of these systems by writing 1 in.-RC4B or 1 in.-RC4S respectively, as explained in the standard for modified fits.

Next, the draftsman, in making the drawings of the individual parts, looks up the table in the standard (see Table 7) and finds that the hole limits are − 0 + .0008, and the shaft limits − .0008 − .0016. Therefore on the part drawings he specifies: Hole 1.0000 in. + .0008 in. and Shaft .9992 in. − .0008 in.

The toolmaker or producer makes the parts to these limits, knowing that the desired fit will then be automatically produced. Moreover, as the 1 in. + .0008 in. hole, which is a basic hole with a grade 6 tolerance, is also used for 12 other fits in this standard, he most likely has a standard plug gage of this size with which the hole can be checked. That is all there is to it!

This review may have seemed somewhat complicated, but it merely illustrates the complexities that had to be studied by the committees, and which have been built into the standard. Using the standard is an entirely different matter, for it has been designed to meet all of the general requirements of industry, yet has been made as simple to use as standards engineers have been able to contrive. √

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## Rotary Wing Aircraft Development

(*Continued from page 575*)

in progress convertible aircraft design studies by three major firms. The latest reports indicate good possibilities that prototype construction and experimental test flying of all three may follow the studies.

A convertible aircraft may assume a variety of design forms, but of these two essentially different types have received most consideration. In each of these and in keeping with the definition, there would be sufficient fixed wing area to provide most, if not all, of the lifting force at forward cruising speed. Two are (1) those with a rotating-wing system which either becomes an idling or stopped rotor, a fixed wing or a retractable rotor. In any of these the forward thrust is provided by a device other than the lifting rotor, and (2) those with a rotor system adapted for 90° shaft rotation to provide forward thrust in level flight.

The pros and cons of the many possible variants of convertible aircraft design contain subject matter for volumes of discussion and interesting though the subject may be, this particular discussion can only be an introduction to an intriguing possibility that remains to be explored and exploited.

### Rotary Wing Aircraft Future Possibilities

An historical summary such as this can touch only upon the high spots of a subject, and must bypass some of the interesting controversial items. The review indicates that in spite of very early efforts, the rotary wing craft has achieved some measure of success and public interest in only the last 10 to 15 years. It is intriguing, then, to speculate as to what the future may hold for this class of air vehicle.

It may be expected that the military services will expand their respective fields of operation with rotary wing aircraft and will be the means of encouraging development of all the promising variants in design. Civil application will grow rapidly along the line of the experimental postal service pattern already set by operations in the United States and abroad.

Short line commuter service is just now beginning under restricted operational conditions and will grow rapidly as more efficient and multi-engine machines become available. The airport to city center operation must follow. The large multi-engine types considered necessary before civil scheduled passenger operation can become a reality is on the horizon.

The old tried and true reciprocating engines may power early civil models, but turbine type engines are bound to find application to rotary wing craft because of inherent advantages.

The compound helicopter, with some fixed wing in addition to the rotor or rotors, constitutes the most likely configuration for craft requiring higher cruising speeds and greater ranges. It seems likely that the further development of this type will be along the lines of turbo-prop engines for forward propulsion propellers with engine compressor air bleed for pressure-jet rotor tip drive for the take-off, approach and landing portions of the flight. This is the approach to the convertible aircraft which, too, will have its application.

The future of rotary wing aircraft presents an attractive picture, and plenty of interesting, difficult work. The goals are worth attaining. √

# THE ASME BOILER CODE

In the July 1952 issue of *Mechanical Engineering*, the ASME commenced publication in serial form, of a history of events leading up to the present ASME Boiler Code, from the first development of boilers in the 18th Century. This history, continued through some ten issues, was prepared by Arthur M. Green, Jr., of Princeton University.

As a preface to the regular publication in current issues of *The Engineering Journal*, of Boiler Code Regulations, this history has been presented in condensed form. It has appeared in several issues of the *Journal*, of which this is the last.

## VI. Times of National Emergency and War, 1941-43

#### Fusion Welding of Copper

So many difficulties were encountered in arranging revisions to Paras. U-67, U-69(b) and (e) U-70(a) and (e) and U-71(a) on welding of copper and copper alloys, that in May, 1941, it was recommended they be withheld. Interpretations for metals most needed at that time, namely monel metal and deoxidized copper, were recommended, and inquiries and replies were formulated, referring to Paras. U-69 and U-70. Cases 934 and 935 were formally approved in June, 1941.

#### Standard Qualification Procedure —Section IX

The American Welding Society adopted the Standard Qualification Procedure in April, 1941, and at the Boiler Code Committee meeting of May, 1941, differences were brought to its attention. A Special Committee recommended adoption in June. Its progress report was accepted and the final form was then referred to the Executive Committee, with power to act. The final form was adopted in August, 1941, as Section IX of the Code, to replace the rules which had existed. Due to certain changes in tables and diagrams, an interpretation was prepared which would be published, permitting optional use of Section IX in place of the Appendix and certain paragraphs of the Code.

#### Penetrameter Setting

The General Fire Extinguisher Co., which found difficulty in placing a penatrameter inside small pipes in radiographing joints with the capsule inside the pipe, appealed in September, 1941, the refusal of permission to place the instrument on the outside of the pipe beneath the film. With approval of the Special Committee on Radiographic Examination, the Boiler Code Committee permitted the penetrameter to be placed on the film side of the pipe joints, provided certain requirements were satisfied.

Due to a great number of gammagraphs of welded pipes having irregularities which had a definite effect on the image of the hole, it was recommended to enlarge the small holes to 3/32 for gamma rays. The reply (Case 976) permitted this for use with gamma rays, since the 1/16 hole was intended for X-rays.

#### Tube Holes Through Welds

In May, 1942, on recommendation of the Special Committee to report on Tube-Holes through Welds, Case 850, permitting tube holes within ¼ inch of the welds, was annulled. Recommendation was made that permission be granted to place tube-holes in welds. This (Case 971) formed the basis for new wording of Paras. 105-C and U-74 as they appeared in the 1943 editions. The minutes of the Boiler Code Committee for September 11, 1942, stated that the Executive Committee had approved the report of the Special Committee on the Insertion of Tube Holes through Welds of Boiler Drums submitted in June, and they considered Case 971 should be released without further action.

#### Revision of Section VIII

Discussion took place in January, 1942, on the need for revision of Section VIII, on the perplexing problems resulting from the two Codes for Unfired Pressure Vessels, (ASME and API-ASME), war conditions, and the need of time by the Committee and industry to reorganize, clarify and simplify the rules. The Committee voted that, in view of the existing emergency, the proposed revision of Section VIII be received as a progress report, and distribution be limited to the Committee. The Conference Committee reconsidered their former action of January, and changed it to permit distribution to those who requested a copy of the report. In March the Executive Committee annulled former action, and voted that a notice be published in Mechanical Engineering that the draft was ready for distribution, a 60-day limit being set for criticism.

#### Banded Pressure Vessels

A new design of pressure vessel for extremely high working pressures was presented to the Executive Committee in August, 1941, by the Babcock & Wilcox Co. Eleven such vessels were in service and four were being built for use in Pennsylvania. All were approved by State authorities. The Company asked if these vessels met Code requirements and, if so, asked that they might be stamped with the Code symbol. The Executive Committee voted that the vessels might be stamped under provisions of Paras. U-1(b) and U-69.

This action was announced to the Committee in September, 1941, and an interpretation of an inquiry was suggested by the Executive Committee. A Special Committee was appointed to consider this case in relation to other forms of banded vessels, as well as other variations. The Special Committee to formulate the reply covering vessels built by Babcock & Wilcox and the A. O. Smith Corp., pointed out that since pressure limits had not been increased, and as the pressure on the larger vessels exceeded the upper limit of Section VIII, the Special Committee should be discharged. The Executive Session later decided to recommend to the open session the same day that a new Special Committee be approved.

The rules were again considered in October, 1943, and the Special Committee reported no agreement had been reached. They believed the whole question should be considered by the main Committee. After discussion, prestressing was approved, and the question of temperature variation was decided to be the same as in solid vessels. Members were invited to communicate criticisms to the Special Committee. This completed the work reported on Rules for Layer or Banded Vessels for 1943.

#### Welded Locomotive Boilers

It will be recalled that the construction of an experimental welded locomotive, authorized by the ICC for the D. and H. Railroad Co., was reported in April 1937. The granting of permission was accompanied by provisions; (1) approval by the Mechanical Division of the Association of American Railroads (2) welded boiler to be tested under ASME Code for Welded Boilers (3) operation as a stationary boiler for six weeks (4) when in locomotive service, welded joints to be inspected every three months the first year, every 6 months the second year, etc. (5) no other welded boiler to be used in railway operation till experimental boiler was proved satisfactory.

The Committee on Locomotive Construction had been asked in July, 1935, to consult locomotive builders as to inauguration of a preliminary study on the merits of fusion-welded locomotives for general use. A Committee representing the D. and H. Ry., the Boiler Code Committee, and a number of locomotive manufacturers met in January, 1936, and approved the design, later submitting it to the Bureau of Locomotive Inspection of the ICC. The latter agreed to approve construction.

The boiler was built by the American Locomotive Co., and after passing all the prescribed tests was put into service. After seven years of service no defects had developed. At the Committee Meeting of October, 1941, it was announced that such construction met the intent of the Code. The inquiry and reply (Case 951) was approved by letter ballot. In February 1941, rules were proposed for welding of locomotive boilers which had been submitted to the Committee and to the Subcommittee on Boilers for Locomotives. The rules consisted of fifteen paragraphs, L-101 to L-115. Later, Para. L-116 was added.

#### Welded-in Staybolts

Changes were proposed in provisions of the Code for welded-in staybolts, as well as plug and slot-welded stay plates, by the Subcommittee on Unfired Pressure Vessels, in April, 1942. These included Para. U-41(b) and (c). These changes were approved.

#### Miscellaneous Welding Details

In February, 1942, headers of superheaters, water walls and economizers were included in Para. P-112 and structures for fusion-welding of circumferential joints. The Hammer Test required by Paras. P-109 and U-77 on the joints of X-rayed fusion-welded vessels was deleted from Para. P-109, and waived in Para. U-77. Backing ring requirements for circumferentially welded seams of pipes were discussed at the Committee Meeting of June 1941. Revisions of September and December, 1941, were adopted. Suggested revisions for qualifications for operators were dropped by action of the Executive Committee in August, 1943.

The welding of dissimilar metals was considered in February, 1942, and the inquiry and permissive reply were referred to the AWS Conference Committee for review. The report was approved in May, 1942, as Case 972, permitting fusion-welding of two Code metals if procedure and operators were qualified under Section IX and all tests had been applied.

A revised copy of Rules for Repairs by Fusion-Welding was reported at the November, 1940, meeting of the Committee, and further revised in March, 1941. The revised rules were considered liberal, but the Special Committee was prepared to sanction work being done without rules, if they did not conflict with the Code. The Committee voted that the Rules were suitable for the purpose intended.

In January, 1943, Qualifications for Procedure of Machine Welding and Welding Operators was discussed relative to Case 992, as Section IX referred to manual welding. The Committee voted to refer the subject of machine welding qualifications under Section IX to the Subcommittee on Welding and the AWS Conference Committee. Oxyacetylene pressure welding was proposed in March, 1942, in an inquiry from Alco Products, in which the metal plates were pressed together and brought to a plastic condition for welding. In June, 1942, the inquiry and reply were altered and the final revised inquiry and reply to this Case 973 were approved. The use of air for testing certain riveted vessels by Para. U-64(b) was discussed in March, 1942, and the extension to welded vessels to be tested under Para. U-77 was developed. This resulted in Para. U-64(f) for the use of air in testing vessels which could not resist the weight of water for the hydrostatic test.

#### Section IX—Welding Qualifications—1941 Edition

Section IX was issued in December, 1941, as a book of 48 pages without index. It limited its scope to manual applications of arc- and gas-welding processes with those ferrous metals which in their unwelded condition would meet the requirements of the prescribed guided-bend test. It assumed the manufacturer or contractor had an organization familiar with the various welding codes, and was capable of designing, engineering and supervising welded construction.

Part I, Procedure Qualifications, contained Paras. Q-101 to Q-110. Part II, Operator Qualifications, included Paras. Q-201 to Q-212. Table Q-5, Grouping of Materials for Procedure, was rearranged and enlarged from that of the 1940 edition, Table VA-8. The so-called Appendix, Recommended Forms of Procedure Specifications, referred to Carbon Arc Welding, Metal Arc Welding and Oxyacetylene processes. Specification S-63 (later SA-233), Iron and Steel Arc Welding Electrodes, ASTM-A-233-40T, listed ten different classes of electrodes to be used in different welding positions with their tensile strengths and elongations, with and without stress-relief. This S-63 was the first real specification for weld metal used in the ASME Boiler Code.

In this Section IX, figures Q-1(a) to Q-27 were given with no text matter, and were arranged to show forms of the different test specimens and their preparation. In the 1940 Edition these figures had been scattered throughout the Appendix. The "groove" weld of Section IX was the "butt" weld of the 1940 edition.

#### Miscellaneous—Safety Valves

At the meeting of January, 1941, of the Special Committee on Safety Valve Requirements, it was decided to ask water relief valve manufacturers to co-operate for agreement on data which they could supply for determining requirements for valves in the Code. The Revisions of safety valve requirements of the Heating Boiler Code were approved for publication in June, 1941. They were changed and reported together with changes for water relief valves in September 1951. Minor changes were made in February and May, 1942, before issuance of the Section in September 1943.

#### Department of Justice, Para. P-322.

The inquiry into precedures of the Boiler Code Committee by the U.S. Department of Justice, mentioned in a previous instalment, resulted in a number of conferences during the early part of 1941. In February three members of the Committee met at Washington with two Dept. of Justice officials. The investigation had resulted from complaints that the Code restricted inspection to insurance companies, and from reports that some of these had declined to make inspection for certain small manufacturers.

The visitors stated they had never heard of a refusal for such a reason. The Department had been informed that the Code was State law in some cases. The requirement of the Code was then explained, as well as the requirements of the first model laws of Massachusetts in 1909 and 1913. The Department officials made certain suggestions for changes in the Code, and various aspects of the situation were discussed. The Code members gave assurance that the Committee would give careful consideration to the Department's recommendations.

#### Shop Inspection

A special meeting of the Committee for discussing shop inspection was held in March, 1941, with members of the Conference Committee present. Two questions were presented: (a) whether inspection laboratories should be permitted to authorize application of the Code Symbol to a Code pressure vessel, and (b) whether inspectors in the employ of owners or purchasers should be so authorized.

A summing up of predominating opinion of those present was:

(1) Inspection must be provided so the Code Symbol would retain significance.

(2) Prevention of use of the Symbol by others than those authorized to maintain at least present standards of inspection.

(3) Retention by the Committee of authority to delegate or rescind power to other groups to qualify and appoint inspectors.

(4) Establishment of requirements that must be fulfilled before an inspector could be employed to inspect and authorize use of the Symbol.

(5) Action to be taken to delegate to the National Board the power to qualify and appoint inspectors under procedures established under item (4).

A joint special meeting of members of the Boiler Code Committee and the Conference Committee, and 16 guests and non-committee members of Subcommittees, was held in May, 1941, to consider a revision of Para. P-332(b), Inspectors, which would include inspecting corporations under certain provisions, including the paragraph requiring qualification by examination.

Supervisors of inspection for Cities and States indicated their problems, and members from the petroleum industry gave their experiences and opinions regarding inspection. The main trend of opinion seemed to favor retention of the present requirement. After discussion it was announced the subject of revision would be studied by the Committee.

#### Department of Justice

At a summer meeting in August, 1941, of the Executive Committee, a slightly modified formulation of different parts of Para. P-322, Inspection, Data Reports, and Stamping, approved by the Committee, was presented and approved. This was in the form published in the 1943 edition of Section I. In October 1941, a letter was presented by the Secretary of the ASME, Mr. C. E. Davies, stating that on September 22, Fowler Hamilton and Walter Powell of the Department of Justice had met with him and read the letters of the Committee. In response to his request for advice as to the next step, they stated that they would close their file by writing a memorandum of the conference, saying there seemed no need for further action. The Case, Mr. Davies, said, could therefore be considered closed.

#### Special Committee on Rules for Dished Heads

Following discussion of Case 892, a new Special Committee on Dished Heads was appointed in May, 1940. The Committee commenced to set up formulas for heads in December, 1940, and reported some to them in February, 1941, and in October, 1942. Members at the latter meeting expressed the view that actions on revisions should be based on tests and not solely on theory. Others stated they believed the present rules were perfectly safe. No action was taken to change the Code rules, however, Para. U-75 was amended in March, 1943.

A letter from F. A. Page of California in September, 1941, asked permission to use spherically dished heads, attaching a ring to give proper thickness for bolting. After discussion, Mr. Page was advised that the construction was possible under the rules, and that a Special Committee would prepare the rules. In October, 1942, an inquiry and reply for a proposed case was reported, giving shapes and methods of forming three such heads. Although no action was taken at the meeting, members were asked to study the report before the next meeting in December. After deferring action in January and February, the report for spherically dished heads was adopted with several modifications in March, 1943, and became Case 997.

#### Federal Housing Administration

Following many questions asked by the Federal Housing Administration about elements of the Code for Low Pressure Heating Boilers, R. K. Thulman of the Authority expressed the view before the meeting of January, 1941, that, while the FHA wished to keep quality good, any code specified should be very flexible. The Committee replied that it did not approve any manufacturer, but merely formulated rules that the manufacturer must adhere to.

Replying to inquiries of March and June, 1941, from the FHA, the Subcommittee on Heating Boilers replied that: (1) The Code Committee could not undertake to investigate individual designs, (2) The Committee had not the personnel or funds to investigate non-Code steel heating boilers, (3) The Code did make a difference between tube and plate construction, and (4) separate sections were not made on small boilers, as design was largely independent of boiler size. These replies were approved for transmittal to the FHA. In September, 1941, the Committee pointed out that the Code should be amended to cover their questions, or a separate Code covering boilers for residences only would be necessary. This was referred to the Executive Committee.

### Allowance for Static Head

The effect of static head with relief valves near the lower levels of a boiler or vessel containing liquids was considered in February, 1941. This led to the addition of Para. U-2(b), calling for valves to be placed in the vapor space, while additional valves might be placed below the liquid level and set at a higher pressure. Para. U-19(a) was amended to define maximum working pressure as maximum pressure at the top of the vessel in its normal position.

### Boiler Assembly in the Field

An inquiry regarding the application of the Code Symbol Stamp (Case 944) was considered by the Committee in September, 1941. This was referred to a Special Committee, and was discussed in August, September and December of 1941, and again in February and March, 1942. In March, 1942, the form of approved reply authorized the use of a special assembly, stamp or use of the regular Code stamp by one who held such, with certain other provisions.

After further discussions with the Special Committee in January and February, 1943, regarding questions and replies, Instructions to Holders of Assembler Code Symbol Stamps were approved in September, 1943. The important parts were: (1)when erection was supervised by the manufacturer during erection and the erector was only the supplier of labor, the erector need not fill out any paper. (2) When a knocked-down boiler was supplied complete by one manufacturer and assembly was by an independent agency, the manufacturer would furnish complete data reports except regarding hydrostatic tests, which would be filled in by the assembler. (3) The manufacturer of parts would execute the data reports and apply the proper Code Symbol stamp in the shop to the parts. The manufacturer of other parts must supply data sheets to be placed on master data reports (4) after completion of hydrostatic test the Stamp would be applied after authorization of a qualified inspector, and (5) the assembler would obtain the required data reports for distribution to the proper parties.

### Special Laboratories for Testing Safety Valves

Tests for relieving capacities for safety valves were performed at the Ohio State University. In October, 1942, the Manning Maxwell and Moore Laboratory was approved for testing valves up to 25,000 lb. per hour and 600 p.s.i. The approval of the Crane Company laboratory was referred to the Executive Committee and to the Special Committee on Safety Valve Requirements.

### Safety Heads with Relief Valves

A letter relating to the location of a safety head beneath the relief valve was presented to the Committee in October, 1941. The installation proposed was for use on a dipthenyl oxide (Dowtherm) vaporizer. The question related to the ability of such an arrangement to meet Code requirements for Power Boilers and Unfired Pressure Vessels. After discussion, the matter was referred to a Special Committee for further study and conference with the proponents.

The Special Committee reported in March, 1942, that it had endeavored to provide interconnections between valves and safety heads, and revisions of safety valve requirements, to accomplish this. Following an investigation with various chemical companies, the Special Committee pointed out in September, 1942, that the Codes had made no distinction between vessels, contents of which were harmless, and those of a toxic or inflammable nature. Their report suggested that the emergency relief device be considered in one of four stated ways, and proposed changing the number of Para. U-10 to U-9 and adding a new Para. U-10 providing for emergency pressure relief.

Further discussion occurred in October, 1942. The National Board of Boiler and Pressure Vessel Inspectors had expressed the opinion that the head might be used as a supplementary protective device if the vessel had the regular Para. U-2 safety devices. The subject was again referred to the Special Committee and the Special Committee on Safety Valve requirements.

### Vessels Under External Pressure

That some low pressure vessels under internal pressure may become subject to external pressure under condensation of their contents, was brought before the Committee in October, 1941. This question together with the out-of-roundness requirement was referred to the Special Research Committee on Vessels under External Pressure. This special committee reported in March, 1942, that out-of-roundness limits should remain unchanged, and later, that no further work could be done on the chart of Fig. U-19, other than to plan an addition for the so-called Revision of Section VIII. It suggested use of a safety factor of 4. Many vacuum vessels were then being built with a safety factor of 5. Figure U-19 appeared as Fig. U-22 in the 1943 edition for the same metals, except for two which had been removed from Section II.

### Rules for Bolted Flange Connections

Revision of the Rules for Bolted Flange Connections of the 1940 edition, Paras. U-18 to U-24, were reported by the Special Committee in December, 1941, after careful study. It was published in "*Mechanical Engineering*" for February 1942. The Special Committee met in March, 1942, but there was so much disagreement that further reports were held up until agreement could be obtained. In September, 1942, revised and new paragraphs were presented, and Paras. UA-18 to UA-24 were approved. New rules contained enlarged Paras. UA-18 and UA-19. Changes or additions were made in Paras. UA-20, UA-21, UA-28, UA-23 and UA-24.

### Rules for Pressure Piping

The fact that in limiting the application of the Code "to pipe connections up to and including valves required by the Code", which now included practically all the main steam piping, was called to the attention of the Committee in October, 1941, by the Pipe Fabrication Institute. The Institute's Executive Committee formally asked the Boiler Code Committee to amend its rules, and to accept the American Standard Code for Pressure Piping as authority for the whole field of piping. A letter of suitable reply with mention of co-operation was authorized, copy to be sent to the National Board.

A letter from the National Board of Boiler and Pressure Vessel Inspectors was presented in February, 1942, commenting on the letter to the Institute, and suggesting that the situation would be clarified by revising the Code so that valves on each outlet of a boiler would not be necessary. Further conferences were suggested with the ASA Sectional Committee B-31, in an endeavor to eliminate differences of opinion. It was also suggested that the Pipe Fabrication Institute and Sectional Committee B-31 should appoint representatives to confer with the Boiler Code Committee, to consider the whole question of feed piping. The Committee voted to take no further action on the National Board's suggestion, but to consider the suggestion of further conferences and the conference of representatives to consider feed piping.

A Report comparing the provisions of the ASME Code and the ASA Code for pressure piping was presented to the Committee in September, 1942. In February, 1943, the Committee voted to drop the matter of co-ordinating the two Codes. At the Executive Session of March, 1943, the Executive Committee recommended the appointment of certain committee members to a joint ASME-ASA Co-ordinating Committee on the design of pressure parts common to their codes and standards.

A Conference on Rules for Piping, Valves and Fittings was held at the Committee meeting of June, 1943, between it and representatives of the Stone and Webster Engineering Corporation and the Associated Factories Mutual Insurance Co. After hearing from the guests the Committee discussed the matter, and it was mentioned that a Joint Conference Committee on Piping Codes and Standards had been formed. The Committee took no action at this meeting.

### Separately Fired Superheaters

In Case 991 reconsidered in January, 1943, the Committee gave its opinion that separately fired superheaters, not integral with a boiler, were fired pressure vessels and within the scope of code requirements from inlet to outlet flange, including all piping valves and safety devices. No stop valve was required at the outlet of such superheaters.

### Work of the Boiler Code Committee

The Special Committee on the Work of the Boiler Code Committee reported in February, 1942. Its report followed in general that discussed in a previous chapter. It gave the results of its study of the complaint about the great number of addenda and interpretations since issuance of the 1931 edition of the new Welding Rules, and recommended that these be continued as the needs of the industry indicated, but that an effort be made to restrict them to a minimum to meet the need.

It also made suggestions for more efficient conduct of meetings and work of the Committee, and suggested improvements in relation to procedure, committee reports, interpretations, revisions, hearings and meetings. Its report contained standard forms of letters of reply to indefinite questions, semi-commercial questions, and to requests for approval of designs. The Special Committee also reported on the membership of certain committees, and recommended the dropping of certain members who did not attend meetings.

### Shells, Tubes and Pipes

Paras. P-180(a) and U-20, dealing with thickness of shells for internal pressure, were considered for revision in April, 1941, because of Case 899. Para. U-20(c) became para. U-20(e). A new Section was added, Non-Ferrous Tubes and Pipe, External Pressure. The transfer of the Lamé formula equivalent from Para. P-180(b) as item (2) of Para. U-20(a) was suggested at the March meeting. A Special Committee was appointed to study the simplified formula presented by Mr. Boardman.

Three different recommendations were referred to a Special Committee. This Special Committee reported that Paras. P-14 and U-14 should be identical, and that Para. 180(a) should remain unchanged as far as the lamé formula was concerned. In July, 1942, as polling of the main Committee members showed that on none of the revisions of Paras. P-180(a), (b), Paras. U-20(a) and (b) and U-78(g) were a majority in favor of them. This indicated that changes should be made. In April, 1942, a new Para. U-20(b) on Spherical Shells was adopted with a formula for the determination of thickness. This was approved by Committee action in June, 1943.

### Action of War Production Board

In March, 1942, WPB Limitation order L-42 Schedule III (B) (3) required elimination of gage cocks, and in May the Committee advised the Plumbing and Heating Section of the Board that two or more gage cocks were necessary on heating boilers to determine the water level in case the water glass was broken (Paras. H-62 and H-115). The ASME did not feel justified in allowing their symbol on boilers not so equipped. In June, 1942, the Simplification Branch, Bureau of Conservation, W.P.B., contended the Code required piping and valves of feedwater lines to be of American Standard for 25 per cent in excess of maximum allowable pressure. The Chairman of Sectional Committee B-16(c) recommended the elimination of this 80 per cent rating. The reply to the W.P.B. explained why this factor should not be altered.

## 1943 Editions of Sections of The Code

### Section I—Power Boilers

The foreword of the 1943 Edition of Section I followed in general those of past years, but had the following sentence added: "Where an inquiry is not clearly an interpretation of the rules nor a problem of application on administration, it may be considered both by the Boiler Code Committee and the National Board." In the preamble, an added paragraph called attention to the fact that "the Code does not contain rules to cover all details of design and construction. Where complete details are not given it is intended that the manufacturer, subject to the approval of the authorized inspector, shall provide details of design and construction which are as safe as otherwise provided by the Rules of the Code."

Important changes were as follows: Para. P-1(a) Selection of Materials, was enlarged to permit limited use of small parts, cast, forged or rolled, for which it was difficult to obtain identified materials. The number of specifications available for steel plates in Para. P-2 was increased to nine. Designating symbols were changed from S- to SA- followed by the ASTM number. Materials of Para. P-3 contained four new materials for pipes or tubes. Para. P-9 listed one new (c) listed copper and brass pipe. Para. P-11 had four new specifications. Tables of Paras. P-15 and P-16 were altered, and P-17(b) was revised. Para. P-22 had a sentence added. Para. P-23 was greatly enlarged to provide for heavy pipe, and Para. P-23(j) was added. Para. P-24 was rewritten and enlarged.

Paras. P-101 to P-115 contained new sub-paragraphs, and there were many referénces to the new Section IX, Welding Qualifications. A few changes were made to Para. P-102, notably P-102(h), (h) (4) (a) to (b), (h) VIII, (x) (12b) and (h13). The list of available materials in Para. P-103 was increased to 34, and Para. 105(c) was revised. New Paras. P-108(c-4 and 5) were added. Para. P-109 was now entitled Hydrostatic "Test", as the hammer test was eliminated.

Para. P-112(a) now included superheaters, waterwalls and economizers. Para. P-112(d) was added. A new Para. P-115 was added. A new formula for working pressures was added to Para. P-180(a). A new formula was added in Para. P-195 and some of the lettered paragraphs were expanded or altered. Paras. P-198 to P-248 were practically unaltered, except for part of Para. P-200. Para. P-250 permitted seal welding of tube ends, and Para. P-251 permitted sealing after rolling.

Paras. P-253 to P-267 remained the same as in the 1940 edition, but some of the figures were changed. Additions were made in Para. P-268(a). Para. P-271 limited the range of setting of pressure to safety valves for saturated steam, and a note was added in Para. P-274. Other than an addition to Para. P-281(a) no further changes were made in Paras. P-269 to P-290. Changes were made in Paras. P-291 to 298. In Paras. P-299 to P-322 a new Figure P-40 and a new Para. P-299(b) were added. Two new paragraphs were added to Para. P-300 and others altered or reworded.

Paras. P-323 to P-339 were not altered, except for deletion of hammer test and enlargement of Paras. P-331 to P-334 while some changes were also made in Para. P-332, (a) (b) and (c). Para. P-332 (d) was greatly enlarged. Paras. P-332(e) and (f) were added.

The Appendix was reduced in size to 30 pages. Para. A-47 was deleted and Para. A-125 was added. This volume, with its index and Section VI, covered 218 pages in contrast with the 254 pages of the 1940 edition.

### Section II—Material Specifications

The 1943 edition of Section II of 426 pages bore the date March, 1944. In it, the new form of listing of Specifications by the ASTM designating numbers, in place of the former "S" number, was used. The list was followed by an alphabetical index of the important parts of the title. This new arrangement was a great improvement over that used in 1943.

### Section III—Boilers of Locomotives

The great addition to Section III was the inclusion of Rules for the Fusion Process of Welding, Paras. L-101 to L-115, by which boilers not subject to federal inspection could be fabricated by fusion welding under ASME Boiler Code requirements. In Paras. L-1 to L-84 there were few changes, notably in Paras. L-14(b) and L-82(a) (b) and (c) (d) and (f). The contents of the new sections on Paras. L-101 to L-110 have been mentioned previously.

### Section IV—Low Pressure Heating Boilers

The preamble of Section IV was enlarged by three new paragraphs; (1) limitation of capacities of domestic water heaters and range boilers, (2), recommendations for use of safety valves on all vessels for storing water, and (3) provision for details of design and construction as safe as otherwise provided in the Code. Paras. H-69 to H-83 was the same as in the 1940 and 1943 editions, except for the addition of one material, SA-30.

Few changes had occurred in other portions. A new Para. H-38(b) was added. Para. H-43 was enlarged, and reference to the diaphragm type of valve was deleted. Para. H-45 was omitted. Paras. H-46, -47 and -48 were placed under different headings and enlarged. Paras. H-49 and -50 of 1940 were omitted. The marking of valves and the restriction on its application as given in Paras. H-51 and H-53 remained practically unaltered, except for tests approved in Para. H-52. Para. H-52 and Tables H-6 and 7 were omitted.

Para. H-61 permitted a transparent material other than glass for water gages. Para. H-68 was altered. Part 2, Cast Iron Boilers, fixed maximum pressure at 15 p.s.i. from steam and 160 p.s.i. for water not over 250 F., as previously. The portion of Part 2 dealing with safety and water relief valves was a repetition of Paras. H-43 to -64.

The unchanged Para. H-118 differed from its counterpart Para. H-65. Paragraphs on stamping were almost the same as Paras. H-68(a) and H-120(a) and were identical in sub paragraphs (b) (c) and (d). The Form H-1 and the Appendix Paras. HA-1 to HA-11 were unchanged. This edition contained 45 pages and an index of 4 pages.

### Section V—Miniature Boilers

The issuance of Section IX, Welding Qualification, in 1941 removed Paras. MA-1 to -24 and four pages of commended forms of procedure from the Appendix of the Miniature Boiler Code, and made reference to Section IX necessary in Para. M-4(c). One specification was added, SA-30. Para. M-4(d) was added. Para. M-11 was enlarged. An addition to Para. M-19 provided for the omission of the hammer impact test when the vessel had been stress-relieved. Inspection requirements, Para. M-20, were altered for agreement with those of the other sections of the Code. Inspections were required during construction and after completion. Inspectors should be qualified state, municipal or insurance company inspectors. The use and intent of the Data Report, M-20(d), was explained more fully, as was also true of paragraphs (f) and (d). The use of the marking "ASME" or "ASME, Std". was prohibited unless so specified in Para. M-20(b). The Appendix contained only Approval of New Materials under Paras. MA-1 to MA-7 this with index of 1½ pages made a book of 16 pages.

### Section VI—Rules for Inspection

Section IV was published as usual in the same volume as Section I, Power Boilers. There had been no changes during this period. This section comprised 14 pages with three inserted sheets, Forms P-5, -6, and -7 for inspection reports. The index was contained with that for Section I and the Appendix in 12 pages at the end of a 218 page volume.

### Section VII—Care of Power Boilers

After the review of the 1940 edition, it was found that no changes were necessary. Thus the 1943 edition was identical with the previous edition, with exception to some changes in sequence of the several divisions.

### Section VIII—Unfired Pressure Vessels

The greatest change in Section VIII was removal of a large part of the Appendix dealing with fusion-welding to Section IX of the Code, reducing the previous 187 pages to 152 pages. The preamble preceding Para. U-1 was enlarged to exclude vessels under pressures exceeding 2,500 to 3,000 p.s.i., and to provide for action under approval of an authorized inspector when the Code did not contain rules for the design of some part. Para. U-1(a) now excluded vessels with pressures of 15 p.s.i. or less, and deletions were made. Vessels of 5 cubic feet capacity were exempted from the requirement of Para. U-65, Inspection, but provision was made for inspection if desired.

Para. U-1 also required safety devices. Para. U-2(b) was added, and Para. U-2(d) was new. Para. U-12(a) was enlarged. Para. U-13(a) gave two additional plate materials, U-13(e) listed four additional materials and Para. U-13(f) was added. Para. U-13(h) (3) specified maximum stresses. Para. U-17 was changed, and a new paragraph U-17(b) Under-Tolerance, was added additions to Para. U-19 fixed maximum working pressures. New formulae were given in Para. U-20(a), while U-20(e) gave a new formula for internal pressure. Para. U-20(f) was added.

Para. U-36(a) to (z) was altered as reported for the 1943 edition of Section I. Para. U-36(h) was omitted. Paras. U-37(c) and (d) had been introduced into the Unfired Pressure Vessel Code of 1940. Additions were made to Para. U-41(b) (1-8) and (c) (1-7). Para. U-59 was identical with that of 1940, except for slight changes in U-49(a) and (p) and Fig. U-10. Hydrostatic tests were described in Para. U-64, and Para. U-65(f) was added. A new Para. U-66(d) was added. A new Para. U-67(b) required the use of Section IX except as provided elsewhere, while (c) referred to tests.

Figure U-16, previously deleted, was restored. Para. U-68(i) required all vessels built under requirements of Para. U-68 to be stress-relieved, and (j) required stamping. Para. U-69 was considerably changed, and some paragraphs were omitted since they were included in Section IX. Para. U-70 described a third type of vessel for storages of gases or liquids at pressures not exceeding 200 p.s.i. and temperatures not over 250° F., but unavailable for use with lethal gases or liquids.

Para. U-70(d) (1) qualified operators to weld U-70 vessels. Para. U-71 increased materials from 14 to 36. Para. U-72 contained a clarification in U-72(f). Para. U-73 was reworded. Para. U-74 was altered to permit reinforced holes to be machine-cut through the stress-relieved weld seam. Stress relieving in Para. U-76 was greatly enlarged. The hammer test was eliminated under certain conditions in Para. U-77. Para. U-78 was unchanged. Paras. U-91 to U-96 were practically unchanged. but Paras. U-97 to U-109 were deleted. No changes were made in Paras. U-110 to U-114.

Para. U-120 increased available materials from 14 to 17, and the paragraphs to the end of this part of the Code, Para. U-138, were unchanged. In Paras. U-140 to -144 the upper limit of temperature was changed to -20° F. A change was made in Para. U-142(f). The Appendix was altered by additions. Fig. UA-1 was placed after Tables UA-1. A new Table UA-6 and new Tables UA-8(a) were added. Table UA-8(b) was changed, and two new figures, UA-3 and UA-4 replaced old Fig. UA-2. A new formula was added in Para. UA-100. This 1943 edition of Section VIII, with index, made a book of 152 pages.

#### Section IX—Welding Specifications

The Specification for Iron and Steel Welding Rods was omitted from the 1943 edition of Section IX, as it had been placed in Section II of the Code as Specification SA-223. Another Specification SA-251 was added. Except for a few changes in the list of Specifications mentioned in Table Q-5, the principal change in the 1943 edition from that of 1941 was the introduction of Form Q-1, with references to it in Paras. Q-110 and -212 and the omission of the Specifications. This made a book of 40 pages. There was no index.

#### API-ASME Code

A new EW Section, Design and Construction of Fusion Welded Vessels Subject to External Pressure, was added. New charts and other charts from Section VIII appeared, as well as figures from the Power Boiler Code. The arrangement of Section EW made a complete unit by references under EW numbers and titles EW-311 to -319 and EW-226 to -337 to the same numbered paragraphs bearing the letter W, and became requirements of this division without printing them again.

A note was added to the introduction, stating that pending development of provision for use of alloy steel plates, such plates as had been accepted by the Committee for use in Section VIII would be permitted, using 1.25 times the stresses in Table U-2 of Section VIII. The American War Standard for Pressure Temperature Ratings for Steel Pipe Flanges Fittings and Valves were accepted, and ASME Cases 896, 959, 978 and 985 were approved for use.

The major changes from the third printing were the addition of Section EW, the increase in the number of acceptable materials, a new table of stresses to replace a former chart, revision of a paragraph on bolted flange connections, and sectioning of welds. Appendixes on peening, sectioning formulas for vessels under external pressure, with bibliography, were added.

As eight of the ten members of the Joint Committee were also members of the Boiler Code Committee, it is readily understood that alterations to one Code would affect the other Code in a similar manner. √

## Roads

Roads are the keys that will unlock the strongbox of Canada's vast natural resources, C. W. Gilchrist, managing director of the Canadian Good Roads Association, Ottawa, told the Mississippi Valley Conference of State Highway Departments at the 45th Annual meeting in Chicago in March.

The speaker sketched the history of highway development in Canada from the early military and colonization roads down to the "number one" highway project in the country today. There were tremendous difficulties to overcome in building the Trans-Canada Highway, the speaker said, because much of it had to be hewn out of virgin wilderness. It would not be completed for some years, but he found it paradoxical that "a country that can maintain its own atomic reactor and build jet engines does not yet have a trans-continental highway".

The provinces of Canada were building roads as fast as money and manpower would permit but were still falling far behind the demands, the speaker said. Under such conditions there was not a very coherent and comprehensive policy on developmental roads.

He cited the building of the 384-mile Mackenzie Highway from Grimshaw, Alberta into the Northwest Territories as one example of Dominion-Provincial co-operation on a developmental project. The road cost $4 million, 48 per cent of which was paid by the federal government, the rest by the province of Alberta. This road opened the country for development.

Mr. Gilchrist emphasized the importance of roads in defence.

# FROM MONTH TO MONTH

**Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers**

## Guidance in the High School

A new publication on guidance for high school students, written by Canadians for Canadians has appeared recently. It is titled "After High School — What ?"

The publication is unique in several ways. First of course it is wholly Canadian. Then it is probably the shortest treatise on the subject ever published in booklet form. It is the first publication ever turned out jointly by several institutes and associations. It is distributed without charge (35,000 copies first printing), the whole cost including mailing being borne by the organizations represented on the committee. It is printed in French as well as English. It covers both engineering and science.

Guidance is a subject on which the Institute and many other societies as well, have shown an interest for many years. The first effort organized on a Dominion-wide basis, was carried out by the Institute's committee on the Training and Welfare of the Young Engineer starting in 1939 under the chairmanship of the late Harry F. Bennett. Subsequently through the offices of the Wartime Bureau of Technical Personnel, the committee was expanded and changed in name to include representatives of the Canadian Institute of Mining and Metallurgy and the Chemical Institute of Canada. Over 400 counsellors were appointed across Canada.

In its present form the committee is known as the Canadian Committee on Counselling in Engineering and Science, and now includes in its membership representatives of the provincial professional associations. Under this title the committee has undertaken a greater activity and a more intensive effort in order to help the high school student reach a decision as to what he should do on graduation.

It is this committee which has published "After High School — What ?" Distribution has been made to high schools and to counsellors. From all reports the booklet fills an urgent need. As the cost of this whole endeavour has been borne by the members of the participating organizations, every member of the Institute may feel a personal interest in it. It is his money that has made it possible. Through the committee he is participating in the essential work of counselling.

Recognition of the merits of the booklet has come from the Engineers Council for Professional Development. The chairman of their Guidance Committee has asked (and received) permission to adapt the material to United States conditions, and to republish it. ECPD is the principal publisher of material of this kind in the United States. The Canadian Committee is pleased with this tribute and is glad to cooperate through ECPD with the great engineering organizations of our neighbours over the border.

Perhaps it is only fair to the pioneers in the counselling field, to observe that this new publication which is different and better in every way, is not the first to be published for Canadian high school and university students. Back about 1940 the Engineering Institute through its Committee on the Training and Welfare of the Young Engineer, published the booklet, "The Profession of Engineering in Canada". This too was distributed without charge. It too was printed in French and English. Over 50,000 copies were placed in 10 years time with schools and universities.

This acknowledgement of the work of an earlier committee is made, not to discount in any way the greater work of the joint committee, but rather to give credit to those who pioneered the field in Canada and laid the foundations for the broader, more comprehensive effort of the combined organization. It is so easy to forget the past.

Although the new publication has been well received, and will do a great work, perhaps its greatest value will be that it is the product of a combined effort — an effort that indicates the steadily increasing determination of all engineering organizations in this country to work together for the common good. There lies the real value.

## Cover Picture

The cover picture dramatically shows a 7,000-ton forging press in operation at Trenton, Nova Scotia.

The press is described in the paper "7,000 Ton Forging Press" by Hans Ulmann, M.E.I.C., beginning on page 557 of this issue.

*Photo courtesy Dominion Engineering Works*

# A Presidential Message

My first words to the membership of The Engineering Institute of Canada in my new capacity must be words of humble but grateful appreciation for the high honour that has been conferred upon me. Humility and gratitude are the more keen when I reflect upon the calibre of men who have been elected to the Presidency of the Institute in the past.

While the Institute has many functions to fulfil, perhaps the most important of these is to provide the "forum" where minds can meet for the interchange and discussion of views and experience in matters pertaining to the profession and practice of engineering. It is through the operation of this "forum" principle of interchange and discussion that professional people build up a body of tested technique and practice; it is through this method that engineers retain their links with the past while keeping abreast with that which is new; it is through this "forum" principle, through the process of interchange and discussion, that we achieve the homogeneous out of what would otherwise be heterogeneous.

Through Branch and Section meetings, through regional and national professional conferences, through the pages of the *Journal* and by maintaining for its membership the closest contact with professional engineering organizations in other parts of the world, The Engineering Institute of Canada seeks to encourage the widest application of this "forum" principle and to provide many meeting places where the "stuff" of our profession may be freely exchanged.

With the present almost startlingly rapid rate of discovery in the fundamental sciences, and with ever greater efforts being directed toward research into the application of these sciences, engineers are being constantly called upon to examine and to test radically new methods and materials. This they do, and always with the prayer that they may not too hastily abandon the "old" nor be too tardy in applying the "new".

In such dynamic times as these this particular function of our Institute — to provide the "forum", to arrange the meeting places and to facilitate the interchange of views and experience in matters pertaining to the profession and practice of engineering in Canada — is perhaps more important than it has ever been. With more Members, more Branches, more Sections, with larger *Journal* coverage, and with closer international affiliations, the Institute is in a better position to contribute to the performance of this function than at any time in its long and distinguished history.

H. W. Stephens

*President*

# Colonel By and Ottawa

Few national capital cities owe their foundation so definitely to one man as does Ottawa to Lt. Col. John By of the Royal Engineers. In the early years of the city's history, this was clearly recognized, since the small settlement on the Ottawa used to be known as Bytown. Today, however, there is little in Ottawa to remind the citizen or to inform the visitor of the debt owed to its founder. This is an omission which is as unfortunate as it is surprising.

The change in name, from Bytown to Ottawa, was made almost a century ago. The new name was proclaimed on January 1st, 1855, following the enactment of the necessary legislation by the government of Upper and Lower Canada at Quebec City on 18th December 1854. These are dates the centenary of which will be suitably celebrated by the Corporation of the City of Ottawa and by citizens generally. What occasion could be more fitting than this to make public recognition of the service rendered by Colonel By not only to Ottawa but to Canada as a whole, in the founding of what is now the national capital?

Many cities have to dig deep into their historical records in order to find one or more individuals who may be claimed as founders. There are few important cities of the New World which have not honoured such founders either by public monument or by the use of their names. But all that Ottawa has today in honour of Colonel By is a cube of granite bearing a faint inscription, the pedestal of a monument planned but never erected. Probably not one citizen in a thousand knows even of this strange relic, hidden as it is near a flowerbed beneath the Confederation Bridge. And yet it is all that can be found in honour of Colonel By in the city the site of which he selected, and the first buildings of which he erected.

It was to supervise the building of the Rideau Canal, as part of a new military route between Montreal and Kingston that By was sent to Canada. The Duke of Wellington had interested himself in the project; he may even have selected the Colonel for his onerous task since he had served in the Peninsular War as well as having spent some time in Canada, during which he had assisted with the construction of the Citadel in Quebec City.

It was in May 1826 that he arrived to take up his duties as superintendent of the building of the Rideau Canal. At that time, Hull was a small village at the foot of the Chaudiere Falls, a few settlers only having established clearings in the bush that still surrounded the southern shore of the Ottawa River. Soon after selecting the site of the flight of locks which were to form the entrance to the Canal, Colonel By arranged for the first clearing of land on what are now Parliament Hill and Major Hill Park.

On this wonderful site, now the head of the nation's capital, buildings soon appeared, a workshop (still, happily, in existence), a barracks (where the Parliament Buildings now stand), a residence for Colonel By (where the Chateau Laurier may now be seen), a stable and even a bake-house. These stone buildings formed the nucleus around which the little settlement gradually grew, soon dividing into "Upper Town" and "Lower Town", eventually to become the Ottawa of today.

The full story of the Canal is a long one; suffice it to observe here that it was a masterpiece of civil engineering even though carried out for strictly military reasons. It was intended to provide a safer route between Montreal and Kingston for military personnel and supplies than that afforded by the St. Lawrence River. Although fortunately never needed for such wartime purposes, it proved to be a potent factor in the opening up of Eastern Ontario, and had an unexpected national significance.

In little more than five years, the Canal was finished, the first steamer passing through in May 1832. The achievement of constructing this waterway through almost 140 miles of virgin bush, with its many dams, locks and rock channels, almost on schedule and at a cost which today appears fantastic (less than £800,000), shows clearly what a great engineer and how able an administrator Colonel By was. And yet, four days before the triumphal first passage from Ottawa to Kingston, he was recalled to England not to receive the honours which he had so justly earned but to face a Parliamentary Committee of Inquiry.

The conclusion today is inescapable that By was the victim of what can only be called "political buck-passing" for he was completely exonerated by the Committee just as all other inquiries into the progress of the work had vindicated and endorsed his work and his administration. All available local records show also that he was a man of sterling character and of an unusually kindly disposition.

Worn out, however, by the strain of the inquiry, in poor health due to all the rigours he underwent in the building of the Canal, and beyond doubt disappointed at the ignominy and neglect from which he suffered in England, he died at the relatively early age of 54 at Shernfield Park in the lovely village of Frant in Sussex, England, where he lies buried.

Ottawa has perpetuated the neglect these many years but now has a singularly appropriate opportunity for making amends. The engineers of Canada, and of Ottawa in particular, have a special interest in being associated with the official recognition that it is hoped may now be given to Colonel By. They have indicated this interest by the setting up of a special Colonel By Memorial Committee (under the auspices of the Ottawa Branch of the Engineering Institute of Canada). After much study, the Committee is of the opinion that a fitting memorial would be a fountain located in the triangular garden plot between the Chateau Laurier and the Union Station.

Such a memorial, bearing a suitable inscription, and located (as it would be) close to the site of Colonel By's own house and in the centre of the area where his workyard was once the scene of such great activity, would seem to be a modest enough memorial to one who was not only a fine soldier, a great engineer and a Christian gentleman, but also the founder and planner of Ottawa, the national capital of Canada.

R. F. Legget, M.E.I.C.

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# Correspondence

***Anniversary at University of New Brunswick***

Mr. R. L. Dobbin, President:

The University of New Brunswick on Tuesday last held its annual Founder's Day ceremony which this year commemorated the one hundredth anniversary of the founding of engineering instruction at this institution. I believe you are aware of this event and that Dr. John B. Stirling, your immediate past president, was the guest speaker. Mr. Charles Weyman, the president of your local branch, was on the platform and at the conclusion of the ceremonies presented to the University a very fine clock which the Engineering Institute of Canada has given to mark the occasion of the University's Centenary of Engineering.

The Senate of the University of New Brunswick has asked me to express the thanks of the University for this very fine gift and to say how much we appreciate your recognition of this event which we feel is something of a milestone in the history of engineering instruction in Canada. We have just begun construction of a Memorial Student Centre and when this building is completed, I know we shall have a spot in which to place the clock.

With kindest regards, I am,

Yours most sincerely,

Colin B. Mackay,
President,
University of New Brunswick.

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## ACI's Jubilee

Among the most useful, though not most high-hat, technical societies on this continent is the American Concrete Institute — ACI to its friends. About the only qualification for membership, aside from the ability to pay its modest annual fees, is that one should not hate concrete. This generous membership policy has brought together in its ranks some 6,200 engineers, architects, contractors, cement manufacturers, steel suppliers, concrete machinery makers and others whose interest in concrete varies from the highly theoretical to the severely practical. Perhaps this catholic range has made it easier for ACI to compile, and win acceptance for, the many standards it has developed in its fifty years of life, standards which certainly have been a major factor in promoting the use of concrete.

It was in October, 1904, that a small group met at the Louisiana Purchase Exhibition — the St. Louis World's Fair — to organize the National Association of Cement Users, with the original intention of trying to improve the quality of concrete blocks. However, before organization was completed the objectives of the group had been extended to cover all phases of the concrete industry. Because its name did not truly represent this wider purpose, it was changed in 1913 to The American Concrete Institute.

ACI's annual meeting of February 22-26, 1954, in Denver was its fiftieth, so naturally a good part of its program was given over to papers with historical backgrounds, but there were numerous timely technical papers and committee reports, too. A contribution from Canada was "One Hundred Thirty Foot Precast Concrete Hangars", by Otto Safir, of Safir Engineering Consultants, Ltd., Vancouver. This hangar was built for the RCAF and no member weighed more than a ton. Canada also contributed a film, "Namao", based on precast concrete practice here.

We have not room to list all the papers and reports; they dealt with most aspects of concrete, with much emphasis on prestressing, which one observer remarked "has become something of a fad with many" in the United States. All the papers and reports will, we suppose, appear in ACI's *Journal*, published at 18263 West McNichols Road, Detroit 19, Mich.

One of the most interesting and useful features of ACI's annual meetings is the research session. This consists of a series of short talks — eight or ten minutes each — on new work going on in concrete research. No record of the talks is kept, so speakers are willing to discuss what they are doing long before they are ready to write formal papers on their work. This year, T. C. Clendenning, of the Hydro-Electric Power Commission of Ontario, spoke on work which the Commission is doing on the early strength of concrete.

Canadian engineers have always taken a good deal of interest in ACI: R. B. Young, M.E.I.C., is one of its past presidents and this year Hugh C. Ross, M.E.I.C., was elected a director for a three-year term. There were 29 Canadians registered at the Denver meeting, including the following members of the Institute: N. A. Lawrence, Edmonton; Guy R. Rinfret, Montreal; Raymond P. Gauthier, Ottawa: M. B. Pierce, Regina; H. I. King, Prof. M. W. Huggins, R. B. Young, Alex. E. Chernick, Morgan H. Price and Hugh C. Ross, Toronto; John H. Swerdfeger, West Vancouver; and J. B. Striowsky, Winnipeg.

H. C. Ross, M.E.I.C.

## *Thirty-five Years Ago*

Comment on the *JOURNAL* of May 1919

May, 1919, should go down in Institute history as a red-letter month, for the *Journal* of that date carried the draft of the long awaited, much discussed model "Act Respecting the Engineering Profession", submitted by the committee appointed following the resolution of the just previous Ottawa annual meeting. The committee had its photograph taken in session; in the *Journal*'s cut we note E. E. Brydone-Jack, Winnipeg, and H. R. McKenzie, Regina, whose names were not on the original committee roster.

Although Council was ordered by the Ottawa resolution to submit this draft to letter ballot of the members of the Institute, at its meeting of April 22, 1919, it pondered the question of whether or not it should "send a letter of transmittal giving advice to the members" along with the ballot. It finally put off any decision until the opinions of absent members of Council could be obtained.

Editorial comment on the draft was brief, but naturally in strong support of it. It emphasized the point that "members of the Institute are given no preference whatsoever in the proposal, while the expense of the meeting is being borne entirely by the Institute; that is, the Institute is unselfishly working in the interests of the whole profession. Other organizations in Canada, comprising professional engineers, will no doubt appreciate the work of the Institute in this connection." Let us hope they did.

The Calgary Branch took up the cudgels on behalf of engineers in the Civil Service, by publishing copies of letters it had addressed to three M.P.'s from the west. It cited several cases of obvious injustices, e.g., men with ten or twelve years of experience were drawing only $1,200 a year and being given assistants who were rated at $1,500 to train. Its letters state that "engineers and technical men are woefully underpaid at the present time, not only by the Government, but by all employers . . . In the Government service worse unfairness seems to exist, which should first be corrected, and then the salaries of engineers should be considerably raised."

Notwithstanding the generally low salary level of the times, there seem to be glimmers of improvement. The Kipawa Fibre Co. advertised for a "first-class draftsman and office engineer" and offered $2,100 a year, plus transportation to Temiskaming. Among openings in the Civil Service were the positions of agricultural engineer (irrigation) at $1,600; designing mechanical draftsman, not necessarily a graduate, at $2,400-$2,700; and an office engineer, a graduate with three years' experience, at the same salary as that offered for the draftsman. Apparently it didn't pay to go to college.

One might contrast with these the average salaries just reported as received by mid-year graduates of Cooper Union, New York, $4,400 for day students and $5,180 for evening students. The difference is probably due to the fact that evening students are older and more mature than day students and, as they work during the day, have more experience as well.

The *Journal* published occasional outstanding papers then as it tries to do now. To the writer's notion, R. M. Wilson's "Design of Hydro-electric Plants for Combatting Ice Troubles" was such a paper. Although it was mostly confined to a discussion of methods found successful for dealing with ice at the Cedars Rapids plant on the St. Lawrence above Montreal, it contained a good deal of general information applicable to any plant.

As is often the case, the discussions were as valuable as the paper itself. Perhaps the most interesting was contributed by John Murphy, who spoke from his long experience in fighting ice at hydro-electric plants on the Ottawa at Ottawa. We have no means of knowing whether he discovered the fact that ice, frazil particularly, will not stick to a surface if the temperature of that surface is a fraction of a degree, even a thousandth, above 32°F. If not, he certainly was the first engineer to make use of it. As long ago as 1904, he was advocating the heating of critical equipment to avoid ice troubles.

If memory serves correctly, it was about 1912 that Mr. Murphy showed the writer a steam-heated trash rack at one of the Ottawa plants, and only a year or two later that he had worked out a successful and economical scheme for heating trash racks electrically. Rejected as unorthodox and impracticable at first, his ideas gradually found acceptance, though in 1919 they were still regarded askance by some. We have learned a good deal about ice and its behaviour since Mr. Murphy's time, but he had much to do with putting our thinking on the right track.

The May, 1919, *Journal* not only gave Mr. Murphy a forum in which to sound off on ice, but it also published a paper by him on "Railway Electrification". Those whose memories go back that far will recall that there was a serious coal shortage during the last years of the first world war; disastrous results were averted only by government control and even then conditions were bad enough. The certain effects of a real coal famine gave Mr. Murphy a hook upon which to hang strong arguments for the electrification of railways.

In 1919 it took six pounds of coal to produce one locomotive horsepower hour; at the same time, a good steam station could produce a horsepower hour on no more than about three and a half pounds. Canada's railways then used 9 million tons of coal a year, 30 per cent of the country's production. To haul it, they had to use rolling stock and motive power that otherwise could have been producing revenue. The overall efficiency of a good locomotive was only three or four per cent.

Fuel economy, plus the many other advantages of electric traction — low repair costs and standby charges, regenerative braking, little track punishment, etc. — were sure, in Mr. Murphy's opinion, to compel railway electrification in the not distant future. His views were supported by W. G. Gordon (Canadian General Electric Co., Ltd.) and F. H. Shepard (Westinghouse Electric & Mfg. Co.) in shorter papers also published in this *Journal*.

Everybody knows what has actually happened. Except under special conditions — tunnel operation, for example — railway electrification has not made the progress in America that Mr. Murphy anticipated. The reason? — the diesel locomotive, of course, made possible economically by the decreased cost of oil as compared to that of coal and by some other factors. The diesel locomotive has many of the advantages of its electrical brother plus some of its own, not the least of which is that it can operate over railways as they are, requiring no expensive electrical distribution systems.

For engineers needing to take a "cure", the *Journal* obligingly abstracted a bulletin of the Mines Branch giving the properties of most of the mineral springs of Canada from Abenakis Springs in Quebec to Harrison Hot Springs in British Columbia, saying that "it is probable that Canadian waters will be found equal in every respect to any of the famous European waters". However, the *Journal* dared not trespass on medical territory by venturing to suggest which springs should be patronized, according to one's malady.

Another news note said that the Newfoundland Government had been advised to relay the track of its railway, operated by the Reid Newfoundland Co., with heavier steel for its entire length from St. John's to Port aux Basques, remarking that its gauge would also no doubt be changed to standard at the same time. However, in 1952, when the writer spent four months in the newest province, narrow gauge was still in use and the Canadian National Railways were struggling to operate the line with some efficiency.

Politics in the best sense showed up in the report of the Saint John Branch, which put itself on record as "favouring the League of Nations . . . a constructive idea . . . (All) must personally uphold . . . co-operative ideals . . . for world government . . . (Or) the League of Nations cannot be a lasting success." Has the Institute or any of its branches ever endorsed the United Nations in a similar way?

Wireless telephony was demonstrated for the first time in Canada at a meeting of the Ottawa Branch, with Lt. Cmdr. Edwards as demonstrator. "Gramophone records . . . (broadcast) the characteristic sounds of a submarine running on the surface and submerged, as compared with the sounds of other vessels."

"Water from Shoal Lake was turned into the Winnipeg mains on Saturday morning, April 15th (1919). This completes the Greater Winnipeg Water District project, which was one of the largest on the continent."

Among the personals we note that "C. J. Mackenzie, who recently returned from overseas, has resumed his duties as professor of civil engineering at the University of Saskatchewan" and that "Maj. C. C. Lindsay . . . has been appointed assistant engineer of the Reclamation Branch in the Department of the Interior." All members of the Institute will recognize Dr. Mackenzie as the recently retired head of Canada's atomic energy project. Maj. Lindsay is now a consulting engineer in Montreal and has been active in Institute affairs.

It was also noted that Ivan E. Vallée had been appointed chief engineer and director of railways in the Department of Public Works and Labour of Quebec and also engineer of the Public Services Commission; he is still with the province. As a coincidence, the *Journal* also carried the obituary of Mr. Vallée's father, Louis André Vallée, who entered the Quebec provincial service in 1862 and at his death occupied the positions to which his son had just been appointed.

The May, 1919, *Journal* carried 107 pages of text and 12 pages of advertising, a ratio that would make our present advertising department feel that it was a failure.

# The ASME Boiler Code

## Proposed Revisions and Addenda to Boiler and Pressure Vessel Code

As need arises, the Boiler Code Committee entertains suggestions for revising its Codes. Revisions approved by the Committee are published here as proposed addenda to the Code to invite criticism.

In the following the paragraph numbers indicate where the proposed revisions would apply in the various sections of the Code.

Comments should be addressed to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.

***Par. P-268.*** Openings and Reinforcements.(1) Revise to read as follows:

P-268(a) Scope:

(1) The rules in this paragraph apply to all openings in shells, headers or heads except as otherwise provided in (2) and (3).

(2) Openings in a definite pattern, such as for tube holes, may be designed in accordance with the rules for ligaments in Par. P-192 and P-193, provided the diameter of the largest hole in the group does not exceed that permitted by the chart in Fig. P-34.

The notations given in Fig. P-34 are defined as follows:

P = maximum allowable working pressure, pounds per square inch.

d = maximum allowable diameter of opening, inches.

D = outer diameter of the shell, inches.

t = actual thickness of the shell, inches.

S = maximum allowable stress value, pounds per square inch, taken from Table P-7.

$$K = \frac{PD}{1.6St} \quad (A)$$

$$K = \frac{PD}{1.82St} \quad (B)$$

Formula (A) shall be used with shells and headers designed to the rules in Par. P-180(b). Formula (B) shall be used with shells and headers designed to the rules in Par. P-180(c).

(3) (a) No calculations need be made to determine the availability of reinforcement. Single openings in shells or headers, whose I.D. is not less than four times the diameter of the opening and which satisfy the following conditions:

(1) Welded attachments not larger than 2-in. pipe size.

(2) Threaded, studded, or expanded connections in which the diameter of the hole in the vessel wall is not greater than 2-in. pipe size.

(3) (b) Calculations demonstrating compliance with P-268(c) shall be made for single openings not covered in (3) (a).

P-268(b) Shape, Size and Location of Openings:

(1) Shape of Openings(2): (a) Openings in the cylindrical sections of a vessel should be circular, elliptical, or obround.(3) All openings in formed heads shall preferably be circular, but if not circular shall be elliptical. When the long dimension of an elliptical or obround opening exceeds twice the short dimension, the reinforcement across the short dimension shall be increased as necessary to provide against excessive distortion due to twisting moment.

Footnote 1. The rules governing openings as given in this Code are based on the stress intensification created by the existence of a hole in an otherwise symmetrical section. They are based on experience with vessels designed with safety factors of 4 and 5 applied to the ultimate strength of the shell material. External loadings such as those due to the thermal expansion or unsupported weight of connection piping have not been evaluated. These factors should be given attention in unusual designs or under conditions of cyclic loading.

Footnote 2. The opening made by a pipe or a circular nozzle, the axis of which is not perpendicular to the vessel wall or head, may be considered an elliptical opening for design purposes.

Footnote 3. An obround opening is one which is formed by two parallel sides and semicircular ends.

(b) In special cases, openings may be of any other shape than those given in (a), but when they are of such proportions that their strength cannot be computed with assurance of accuracy, or when doubt exists as to the safety of a vessel with such openings, the part of the vessel affected shall be subjected to a proof hydrostatic test as prescribed in Par. P-247.

(2) Size of Openings: (a) Properly reinforced openings in cylindrical and spherical shells are not limited as to size and shall comply with the provisions which follow, and with the additional provisions given under (2) (b).

(b) The rules for reinforcement of openings apply to openings not exceeding the following dimensions: (See Footnote 4).

For vessels 60 in. diameter and less:— ½ the vessel diameter but not over 20 in.

For vessels over 60 in. diameter:— 1/3 the vessel diameter, but not over 40 in.

Footnote 4. Larger openings should be given special attention and may be reinforced in any suitable manner at least complying with the intent of the Code rules. It is recommended that the reinforcement provided be distributed close to the opening. (A provision of about two-thirds of the required reinforcement within a distance of ¼ d on each side of the finished opening is suggested.) Special consideration should be given to the fabrication details used and inspection employed on critical openings: reinforcement often may be advantageously obtained by use of heavier shell plate for a vessel course or inserted locally around the opening; welds may be ground to concave contour and the inside corners of the opening rounded to a generous radius to reduce stress concentrations; magnetic particle or fluorescent penetrating oil weld inspection may be used when radiographic examination is not practical. The degree to which such measures should be used depends on the particular application and the severity of the intended service. Appropriate proof testing may be advisable in extreme cases of large openings approaching full vessel diameter, openings of unusual shape, etc.

(3) Openings in or Adjacent to Welds: Any type of opening permitted in these rules may be located in a welded joint. Such opening shall meet the requirements of Par. P-105(c).

P-268(c) Reinforcement Required for Openings in Shells and Formed Heads:

(1) General — The rules in this subparagraph apply to all openings other than flanged-in openings in formed heads covered by Par. P-195, openings in flat heads covered by Par. P-268(d), and openings covered in Par. P-268(a) (2) and (a) (3) (a).

Reinforcement shall be provided in amount and distribution such that the area requirements for reinforcement are satisfied for all planes through the center of the opening and normal to the vessel surface. For a circular opening in a cylindrical shell, the plane containing the axis of the shell is the plane of greatest loading due to pressure.

(2) Area Required—The total cross-sectional area of reinforcement, A, required in any given plane for a vessel under internal pressure shall be not less than

$$A = d \times t_r \times F$$

where d = the diameter in the given

plane of the finished opening inches;

$t_r$ = the required thickness of a seamless shell, header or blank head computed under the rules of the Code for the designated pressure, inches, except that

(a) When the opening and its reinforcement are in a torispherical head and are entirely within the spherical portion, $t_r$ is the thickness required for a seamless hemispherical head of the same radius as that of the spherical portion.

(b) When the opening and its reinforcement are in an ellipsoidal head, in which one half of the minor axis is equal to one-quarter of the inside diameter, and are located entirely within a circle the center of which coincides with the center of the head and diameter of which is equal to 80% of the shell inside diameter, $t_r$ is the thickness required for a seamless hemispherical head of radius equal to 90% of the inside diameter of the shell.

F = 1.00 when the plane under consideration is on the longitudinal axis of a shell and for heads. For other planes in a shell or header the value of F shall be determined from Figure P-34(a).

(P-268(d) Reinforcement Required for Openings in Flat Heads:

(1) Flat heads that have an opening with a diameter that does not exceed one-half of the head diameter or shortest span, as defined in Par. P-198, shall have a total cross-sectional area of reinforcement not less than that given by the formula:

$$A = 0.5d \times t$$

where d is defined in Par. P-268(c) and t in Par. P-198.

(2) Flat heads that have an opening with a diameter that exceeds one-half of the head diameter or shortest span, as defined in Par. P-198, shall be designed as a flange in accordance with accepted Rules for Bolted Flange Connections.

(3) As an alternative to (1), the thickness of flat heads may be increased to provide the necessary reinforcement by using 2C in place of C in formulas for calculating head thickness in Par. P-198. Except for the types of construction shown in (g) and (h) of Fig. P-21, the value of 2C to be used in the formulas need not exceed 0.75.

P-268(e) Limits of Reinforcement.

(1) The boundaries of the cross-sectional area in any plane normal to the vessel wall and passing through the center of the opening within which metal must be located in order to have value as reinforcement are designated as the limits of reinforcement for that plane.

(2) The limits of reinforcement, along the vessel wall, shall be at a distance, on each side of the axis of the opening, equal to the greater of the following:

(a) The diameter of the finished opening.

(b) The radius of the finished opening plus the thickness of the vessel wall, plus the thickness of the nozzle wall.

(3) The limits of reinforcement, measured normal to the vessel wall, shall conform to the contour of the surface at a distance from each surface equal to the smaller of the following:

(a) 2½ times the shell thickness

(b) 2½ times the nozzle-wall thickness, plus the thickness of any added reinforcement exclusive of weld metal on the side of the shell under consideration.

(4) Metal within the limits of reinforcement that may be considered to have reinforcing value shall include the following:

(a) Metal in the shell and the nozzle wall over and above the thickness required to resist pressure. The area in the shell available as reinforcement is the larger of the values of $A_1$ given by the formulas,

$$A_1 = (Et - Ft_r)\, d$$

or

$$A_1 = 2(Et - Ft_r)\,(t + t_n)$$

where $A_1$ = area in the excess thickness in shell or head available for reinforcement, square inches,

E = 1 when an opening is in the solid plate or when the opening passes through a circumferential joint in a shell (exclusive of head-to-shell joints); or

E = the longitudinal joint efficiency when any part of the opening passes through any other welded joint,

t = thickness of shell or head, inches,

$t_r$ = required thickness of the shell or head to resist pressure as defined in Par. P-268(c), inches,

$t_n$ = thickness of nozzle wall, inches,

d = diameter in the plane under consideration of the finished opening, inches,

F = factor from Figure P-34(a) (See P-268(c) (2) ),

$t_{r_n}$ = required thickness of nozzle wall to resist pressure, inches, found by the formula used for $t_r$ in Par. P-180, omitting the 0.1″ additive thickness or "C" factor.

(b) Metal added as reinforcement, and metal in attachment welds.

P-268(f) Strength of Reinforcement:

(1) Material used for reinforcement shall have an allowable stress value equal to or greater than that of the material in the vessel wall, except that material of lower strength may be used, provided the area of reinforcement is increased in inverse proportion to the ratio of the allowable stress values of the two materials to compensate for the lower allowable stress value of the reinforcement. No credit may be taken for the additional strength of any reinforcement having a higher allowable stress value than that of the vessel wall. Where vessels are designed to Par. 180(b) and similar paragraphs, the allowable stress value is to be taken as equivalent to 0.8 times the values shown in Table P-7.

(2) On each side of the defined in Par. P-268(e) (3), the strength of the attachment joining the vessel wall and reinforcement or any two parts of the attached reinforcement shall be at least equal to the smaller of:

(a) The strength in tension of the cross-section of the element of reinforcement being considered, or

(b) The strength in tension of the area of the unfinished opening, including any rivet or stud holes, in the shell or head based on $t_r$ less the strength in tension of the reinforcing area which is integral in the vessel wall as permitted by Par. P-268(e) (4).

(3) The strength of the attachment shall be considered for its entire length on each side of the plane defined in Par. P-268(e).

(4) For detailed requirements for welded, and riveted construction see Par. P-268(h).

P-268(g) Reinforcement of Multiple Openings:

(1) When any two adjacent openings which require reinforcement are spaced at less than two times the distance defined in Par. P-268(e) (2) so that their limits of reinforcement overlap, the two openings (or similarly for any larger group of openings) shall be reinforced in accordance with Par. P-268(c), with a reinforcement that has an area equal to the combined area of the reinforcement required for the separate openings. No portion of the cross-section shall be considered as applying to more than one opening, or be evaluated more than once in a combined area.

(2) Two adjacent openings shall have a distance between centers not less than 1-1/3 times their average diameter.

(3) When a group of openings is reinforced by a thicker section butt-welded into the shell or head, the edges of the inserted section shall be tapered as prescribed in Par. P-104(d).

(4) When a shell or drum has a series of holes in a definite pattern, the net cross-sectional area between any two finished openings within the limits of the actual shell wall excluding the portion of reinforcing part not fused to the shell wall, shall equal at least 0.7F of the cross-sectional area obtained by multiplying the center to center distance of the openings, by the required thickness of a seamless shell, where the factor F is taken from Fig. P-34(a) for the plane under consideration, see Fig. P-37(a). The Journal regrets that space requirements did not permit reproduction of these illustrations.

P-268(h) Methods of Attachment of Pipe and Nozzle Necks to Vessel Walls:

(1) General—Nozzles may be attached to the shell or head of a vessel by any of the methods of attachment given in this paragraph, except as limited in Par. P-268(a) (3) (b).

(2) Welded Connections—Attachment by welding shall be in accordance with the following requirements:

(a) Sufficient welding shall be provided on either side of the plane through the center of the opening parallel to the longitudinal axis of the shell to develop the strength of the reinforcing parts through shear or tension in the weld, whichever is applicable. The strength of the groove welds shall be based on the area subjected to shear or to tension. The strength of fillet welds shall be based on the area subjected to shear (computed on the minimum leg dimension). The inside diameter of a fillet weld shall be used in figuring its length.

(b) The allowable stress values for groove and fillet welds and for shear in nozzle necks, in percentages of stress value for the vessel material are as follows:

| Nozzle Wall Shear | Groove-Weld Tension | Groove-Weld Shear | Fillet Weld Shear |
|---|---|---|---|
| 70% | 74% | 60% | 49% |

NOTE:—These values are obtained by combining the following factors: 87½% for combined end and side loading, 80% for shear strength of weld metal, and following efficiency factors:

| | |
|---|---|
| Nozzle Wall in shear | 80% |
| Groove Weld in tension | 85% |
| Groove Weld in shear | 68% |
| Fillet Weld in shear | 55% |

(c) Reinforcing plates and saddles of nozzles attached to the outside of a vessel shall be provided with at least one telltale hole (Maximum size ¼ in. pipe tap) that may be tapped for a preliminary compressed air and soapsuds test for tightness of welds that seal off the inside of the vessel. These telltale holes shall be left open when the vessel is in service.

(d) the location and minimum size of attachment welds shall conform to the requirements shown for typical examples in Figure P-36. The symbols used in Figure P-36 are defined as follows:

$t$ = thickness of vessel shell or head, inches,

$t_n$ = thickness of nozzle wall, inches,

$t_e$ = thickness of reinforcing element, inches,

$t_w$ = dimension of partial-penetration attachment welds (fillet, single-bevel, or single-J), measured as shown in Fig. P-36, inches,

$t_c$ the smaller of ¼ inch or 0.7 $t_n$. (Inside corner welds may be further limited by a lesser length of projection of the nozzle wall beyond the inside face of the vessel wall).

$t_{min}$ = the smaller of ¾ inch or the thickness of either of the parts joined by a fillet, single-bevel, or single-J weld, inches.

$t_1 \times t_2 = 1\frac{1}{4}\ t_{min}$, measured as shown in Figure P-36, inches. $t_1$ or $t_2$ not less than 1/3 $t_{min}$ or ¼ inch.

(e) All welding shall be equivalent to that required under the rules in Pars. P-101 to P-111, inclusive or in Par. P-112. Radiographic examination of attachment welds may be omitted except as specifically required in other paragraphs of this Code, and except for Inserted-Type Nozzles.

(3) Riveted Connections—Attachment by riveting shall be in accordance with the following requirements:

(a) Openings for nozzles and other connections shall be far enough away from any main riveted joint so that the joint and the opening reinforcement plates do not interfere with one another.

(b) Welded connections which require stress-relieving and which are attached to vessels having seams of riveted construction shall be fabricated and stress-relieved prior to the making up or attachment of the courses by riveting. If they do not require stress-relieving and are attached after riveting, the welds shall be located at a distance from the riveted seam at least equal to the outside diameter of the attachment weld plus four times the thickness of the shell plate.

(c) Openings for pipe connections to vessels having riveted joints may be made by inserting pipe couplings or similar devices, not exceeding 3 in. pipe size, in the shell or heads and securing them by welding, provided the welding is performed by welders or welding operators who have been qualified under the provisions of Section IX of the Code for the welding position and type of joint used.

(d) For nozzle fittings having a bolting flange and an integral flange for riveting, the thickness of the flange attached to the pressure vessel shall not be less than the thickness of the neck of the fitting.

(e) The strength of rivets in tension in a flanged frame or ring riveted to the outside of a vessel shall be at least equal to that required to resist the load due to the maximum allowable working pressure with a factor of safety of 5 computed as follows:

(1) For outside calking the load shall be equal to the area bounded by the outside calking multiplied by the maximum allowable working pressure;

(2) For inside calking (and with no outside calking) the load shall be equal to the area bounded by the inside calking multiplied by the maximum allowable working pressure.

(f) The rivets attaching nozzles shall be so spaced as to avoid the possibility of the shell plate or the nozzle flange failing by tearing around through the rivet holes. An example illustrating the method of calculations is given in Par. A-70.

(4) Studded Connections—Connections may be made by means of bolt studs. The vessel shall have a flat surface machined on the shell, or on a built-up pad, or on a properly attached plate or fitting. Drilled holes to be tapped for straight threads shall not penetrate within ¼ of the wall thickness from the inside surface of the vessel unless at least the minimum thickness required as above is maintained by adding metal to the inside surface of the vessel. The threads shall be full and clean and shall engage the stud for a length of at least 1½ stud-diameters. Studded connections shall meet the requirements for reinforcement. No credit for reinforcement shall be allowed for any areas attached by studs only.

(5) Threaded Connections—Pipes, tubes, and other threaded connections that conform to the ASA Standard for Pipe Threads (ASA B2.1-1945) may be screwed into a threaded hole in a vessel wall provided the pipe engages the minimum number of threads specified in Table P-12 after allowance has been made for curvature of the vessel wall. A built-up pad or a properly attached plate or fitting may be used to provide the metal thickness and number of threads required in Table P-12 or to furnish reinforcement when required:

**Table P-12. Minimum Number of Pipe Threads for Connections**

| Size of pipe connection. in. | ½ & ¾ | 1, 1¼ & 1½ | 2 | 2½ & 3 | 4–6 | 8 | 10 | 12 |
|---|---|---|---|---|---|---|---|---|
| Threads engaged | 6 | 7 | 8 | 8 | 10 | 12 | 13 | 14 |
| Min. plate thickness required, in inches | 0.43 | 0.61 | 0.70 | 1.0 | 1.25 | 1.5 | 1.62 | 1.75 |

Threaded connections larger than 3-inch pipe size shall not be used when the maximum allowable working pressure exceeds 100 p.s.i. This 3-inch pipe-size restriction does not apply to plug closures used for inspection openings, end closures, and similar purposes.

(6) Expanded Connections—A pipe tube, or forging not exceeding 6 in. in outside diameter may be attached to the wall of a vessel by inserting through openings complying with Par. P-268(a) and expanding into the shell, in accordance with the requirements of Paragraphs P-251 and P-252.

P-268(i) Nozzle Neck Thickness—The thickness of a nozzle neck used in a reinforced opening shall not be less than the thickness required for the applicable loadings, but in no case less than the smaller of the following:

(1) The thickness of the shell or head;

(2) The thickness of standard-wall pipe (ASA B36.10-1950) for pipe nozzles or the required minimum thickness of a tube nipple based on 600 p.s.i. internal pressure.

P-268(j): Unless specifically allowed otherwise, all connections after being attached by fusion welding shall be stress-relieved.

Fusion-welded connections may be added to a vessel after it has been stress-relieved, without requiring stress-relief provided:

(1) The diameter of the attachment opening in the vessel wall does not exceed that allowed for an unreinforced opening, or does not exceed 2 in., whichever is smaller;

(2) The inside and outside attachment welds do not exceed 3/8-in. throat dimension.

This provision does not apply to those connections so placed as to form ligaments in the shell, the efficiency of which will affect the shell thickness. Such added connections shall be stress-relieved.

P-268(k) Fig. P-36 illustrates some types of fusion-welded connections which are acceptable.

When end faces of nozzle or manhole necks are to remain unwelded in the completed vessel, these end faces shall not be cut by shearing unless at least 1/8-in. of additional metal is removed by any method that will produce a smooth finish.

P-268 (1) Typical examples of the application of the above rules are presented in Pars. A-65 to A-70.

### Other Code Revisions due to Revised Par. P-268

Remove lettered paragraph reference but leave "P-268" reference in the following locations:

(1) Par. P-108(b).
(2) End of Par. P-112(c).
(3) Par. P-194(b).
(4) Par. P-194(f).
(5) Par. P-195(d).
(6) Par. P-195(k).
(7) Par. P-259.
(8) Par. P-260.

Other Rivisions:

(1) Par. P-195(d)—Delete "In the application . . . (all the way to) . . . referred to in Fig. P-37 and Par. P-268(g)."

(2) Par. P-195(k)—Add words in parenthesis "(Opening with inherent reinforcement)" after "Unreinforced openings" in the first line. Revise reference to Fig. P-35 to Fig. P-34.

(3) Par. P-198(b)—Replace entirely by "OPENINGS: Openings shall be designed in accordance with the rules in Par. P-268."

(4) Paragraphs A-65 to A-70, examples to be revised to indicate construction in accordance with revised Par. P-268.

(5) Par. P-105(c)—Add words in parenthesis "(Opening with inherent reinforcement)" after unreinforced holes" in first line.

More About

# President R. L. Dobbin's Western Trip

Edmonton. President Dobbin presents Institute prize to third year engineering student K. Dudman of the University of Alberta. From left to right: President Dobbin, Mr. Dudman, Dean R. M. Hardy, and N. J. Allison, Branch chairman.

Moose Jaw. Left to right: E. C. B. Macnabb, P. L. Graham, E. K. Dokken, L. Cockerel, L. Austin Wright and Mr. Blacksten.

Lethbridge (at left). Left to right at head table: A. L. H. Somerville, Deputy Mayor Black, P. M. Sauder, Mrs. Kirkpatrick, R. L. Dobbin, Branch Chairman David Cramer, and L. Austin Wright.

Lethbridge (at right). Left to right around the table: A. J. Branch, Mrs. Branch, N. H. Bradley, Mrs. Bradley, P. H. Walker, Mrs. Walker, K. M. Lissel, Mrs. Lissel, Mrs. Wilson, L. M. Wilson.

Yukon. The general dinner meeting. Seated at the head table are Mrs. H. W. Love, John L. Phelps, Mrs. M. C. Sutherland-Brown, President R. L. Dobbin, Lt.-Col. M. C. Sutherland-Brown, Mrs. J. L. Phelps, Brigadier H. W. Love, Mrs. A. C. L. Adams, and Lt. K. J. Baker.

# 1953 E.I.C. Membership Directory

## Errata

*(Continued from April issue)*

With the completion and distribution of our 1953 Membership Directory, a small number of errors have come to light. Naturally, these are very much regretted, but since the work had to be done under pressure against time, a certain number of mistakes were almost inevitable.

For the convenience of all members we are printing below a further list of names as they should have appeared in the Alphabetical Section. For errors in the Geographical Section the necessary correction is simply noted.—Editor.

**KIELLAND, Axel,** McGill '45. Prodn. Offr. Dept. of Defence Production, Ottawa. J'52. M'52.

**LEGGET, R. F.,** Liverpool '25 and '27. Dir., Divn. of Bldg. Resch., N.R.C., Ottawa. Mail: 531 Echo Dr. J'29. AM'31. M'40.

**LITSTER J. C.,** Alta. '30. Appln. Engr., C.G.E., 1350 Castlefield, Toronto. Mail: 47 Norton Ave., Willowdale, Ont. M'52.

**McKIBBIN, Col. K. H.,** R.M.C. '36, Queen's '38. D.N.D. (Army), Ottawa. Mail: 512 Driveway. S'35. J'41. M'43.

**SCOTT, Lt. Col. C. A.,** Toronto '09. Comm., Cdn. Red Cross Society, B.C. Div., 1235 West Pender St., Vancouver. AM'20. M'40.

**STIDWILL, G. B.,** Queen's '32. Asst to Mgr., Howard Smith Paper Mills, Cornwall, Ont. M'48.

**STIDWILL, L. P.,** Queen's '43. Consltg. Civil Engr., 168 Pitt St., Cornwall. Mail: P.O. Box 1001, Cornwall, Ont. M'48.

**TAYLOR, Ord. Cmdr., George,** Manchester '24. Dir. Engrg. Standards and Naval Specifications, McCoy Bldg., Ottawa. Mail: 288 Carling Ave. M'48.

**TEMPLEMAN, G. E.,** Retd., 147 Strathearn Ave., Montreal West, AM'19, M'27.

# Elections and Transfers

At the meeting of Council held at Kingston, Ontario, on Friday, April 30, 1954, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

*Members:*

W. W. Ashworth, *Brockville*
V. S. Buckler, *Winnipeg*
L. H. Carreau, *Ottawa*
T. A. Crosier, *Winnipeg*
J. L. Darimont, *Whitehorse*
D. D. Dunbar, *Kamloops*
R. D. Jamieson, *Brockville*
G. J. Jouven, *Montreal*
O. O. Junker, *Calgary*
G. F. P. Layne, *Montreal*
R. B. Leeming, *Montreal*
V. A. Mirkovich, *Arvida*
H. B. Mooers, *La Tuque*
E. Quayle, *Montreal*
L. G. Throssell, *Australia*
N. D. Woollings, *London*

*Juniors:*

D. G. Cowan, *Shawinigan Falls*
G. W. King, *Montreal*
M. Masse, *Montreal*
E. W. Mercer, *Summerside*
A. A. Roesch, *Cold Lake*
W. G. Speirs, *Edmonton*

*Transferred from the class of Junior to that of Member:*

W. A. Armstrong, *Berlin, N.H.*
D. E. Beek, *Mindemoya*
R. M. Campbell, *Montreal*
R. S. Cornell, *Montreal*
W. H. George, *Jasper*
J. Gregory, *Edmonton*
R. H. Hales, *London, Eng.*
H. P. Hershman, *Montreal*
J. B. Hicks, *Victoria*
J. S. Hubley, *Shediac, N.B.*
E. J. Klohn, *Vancouver*
G. R. LaBoissiers, *Beauharnois*
D. A. Lamont, *Peterborough*
A. G. Lane, *Montreal*
C. E. Leonoff, *Vancouver*
A. Olynyk, *Montreal*
E. C. Orford, *Hays, Alta.*
S. Rabin, *Montreal*
D. L. Ryan, *Trenton*
E. E. Sutton, *Peace River*

The following Students were admitted:

*University of Toronto*

H. N. Atkins — C.P.J. Korzeniowski
J. A. Becker — D. F. Pearson
T. J. Clerke — F. Schaeffer
D. J. Cox — J. G. Smale
H. H. F. Eisler — B. S. Szabo
J. L. Forster — B. P. Wallace
P. Geiger

*Nova Scotia Technical College*

E. C. Barrett — M. Gonzalez
M. Brake — D. M. MacInnes
W. A. Clarke — A. R. MacKenzie
E. A. De Coste — G. R. Pond

*University of New Brunswick*

R. O. Costar — M. J. Hassell
J. R. Dean — K. G. Wilson

*University of Alberta*

D. Albrecht — D. B. Smith
N. F. Budgen — J. F. Tod
D. J. Marsden — K. R. Walker

*Royal Military College*

W. H. Jopling — M. C. Schofield
W. C. Moffatt — D. P. Sexsmith

*McGill University*

R. Kingstone — G. A. R. Prentice
L. Kolisnyk

*Mount Allison University*

F. L. Henderson — P. W. Ross

*Memorial University*

J. E. Kean — R. T. Parsons

*Queen's University*

D. I. Gallagher

*University of Ottawa*

J. Griffon — J. Muldenna

*Carleton College*

J. Belanger

*St. Mary's University*

R. J. M. Mansour

**Applications through Associations:**

By virtue of the co-operative agreement between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

Alberta

*Members:*

K. M. Millar — G. Olson

*Junior to Member:*

J. A. Barnes — T. D. Lusted
J. I. Lessard

Saskatchewan

*Members:*

R. C. Cheyne — E. B. Moysey
N. P. Elphinstone — J. Runcie
R. E. Lawrence — R. L. Slavin
O. R. Mann — J. L. Townley

*Student:*

L. Lee — O. Rapp

*Junior to Member:*

M. E. Stadnyk — O. L. Symes

Nova Scotia

*Member:*

D. T. Bayer

*Junior to Member:*

W. J. P. Chaffey — G. E. Mason
C. H. Hood

*Student to Member:*

F. J. MacDonald

Quebec

*Members:*

P. R. Browning — A. U. Wastvind
J. Stoddart

*Juniors:*

E. J. Arnold — G. S. Conger
T. C. Arnold — L. W. Frech

# News of Other Societies

Over 1,500 engineering educators will attend the annual meeting of the **American Society of Engineering Education** on June 14-18 at the University of Illinois, Urbana, Ill.

The meetings will include conferences sponsored by the Engineering College Administrative Council and the Engineering College Research Council, which are two component organizations of the ASEE.

There will be over 100 individual conference programs arranged by divisions, committees and councils of the Society. Members of the Engineering Institute who wish to attend the Conference should write to Professor Robert K. Newton, ASEE Housing Chairman, University of Illinois, Urbana, Illinois, for information and reservations.

**The American Society of Civil Engineers** (33 West 39th St., New York 18) will hold the 1954 spring meeting on June 14 – 19, at the hotel Chalfonte-Haddon Hall, Atlantic City, N.J.

# NEWS OF THE ASSOCIATIONS & CORPORATION

**Information received through co-operation with the provincial organizations**

## Nova Scotia

The following report presented by Dr. F. H. Sexton, as chairman of the Professional Relations Committee for the Nova Scotia Association of Professional Engineers gives a good idea of the effort being made by the Nova Scotia Association in the interests of Professional Engineers.

Associated with Doctor Sexton on the committee were the following: G. D. Anderson, G. T. Clarke, W. A. Devereau, D. F. Kirk, C. N. Murray, F. C. Morrison, and J. P. Vaughan.

### Report of the Professional Relations Committee

During the year no special cases were referred to the committee for investigation, nor was any definite action requested by the Council of the Association.

#### *Better Public Relations Needed*

The committee has long been aware of the need of better public relations for the profession. This is not suggesting that there is any antagonism on the part of the public toward the engineer, either singly or in groups. Nothing could be further from the fact. The public marvels at the ingenious machines and the great works constructed by the engineer, and vicariously glows with satisfaction at the great material progress that is being achieved by modern science and technology. However, it does not know, nor does it seem interested in either the man who plans and carries out the advances nor in his status in society. Part of this indifference and ignorance is due to the fact that engineering has achieved the professional level so recently, and partly to the engineer himself.

The word engineer was commonly used in the last century to describe the man at the throttle of the thundering locomotive, the whirring steam engine of the power plant, or the thudding engines of the steamboat. Even today the same word is generally used in Great Britain to designate all the skilled mechanics who operate machine tools, build ships, or follow many other so-called engineering trades. In the popular mind it is still associated with a vocation or trade. It does not carry the implication that it is a profession on the same level as the ministry, law, or medicine. The engineer is generally regarded as a super mechanic, but is not accorded the social prestige of a person with university training with a high code of ethics, who is basically devoted to human service. The works of the engineer overshadow the man.

#### *"Silent Service Is Not Enough"*

The engineer has not put forth any great amount of effort to dispel the popular misconceptions of his profession. It is sad to state that often he himself does not hold a sufficiently high opinion of his own calling. If this is the case, he certainly cannot win from those outside it the regard it deserves. His general attitude is one of humility. This is a worthy one when we consider that he must feel this way in face of the great forces of nature which he tries to control and direct for the good of mankind. It is not right, however, for him to be similarly humble when in contact with other men. He seems to have a distinct inferiority complex when mixing socially or in a business way with other people. This may be due to the fact that he seems to regard their knowledge as superior to his own. He has a bad reputation for talking shop endlessly with his own kind and shutting up like a clam with others. In the face of rapidly changing science and technology, it is natural that the engineer should devote a great deal of effort to keeping abreast of the advance. It is not justifiable, however, that he should fill all the compartments of his mind with details of his work. He ought to widen his interests, knowledge, and sympathies if he is to lead a significant and wholesome life. A materialistic philosophy of life is a weak and narrow foundation upon which to erect a satisfactory structure of enjoyment and service in a beautiful and entrancing world.

The wisdom of the bulletins which you have received under the title of *"Silent Service is not Enough"* must have been approved by most of you, if not by all. These have been in the hands of the members for a whole year, but there is not much evidence that the advice has been generally followed. In looking over the advertisements of the engineering firms in the leading provincial newspapers, I have observed only one who has used the significant title of P.Eng. after his name. Where members have been mentioned in the news, this abbrevation has been absent in almost every case. When will we drop this attitude of false modesty and regard the title of P.Eng., not as a means of emphasizing a personal distinction, but as a duty to secure a public recognition of a noble profession?

#### *Professional Titles*

There is a growing general custom for people with professional titles to use them freely. I feel sure we do not criticize persons who habitually proclaim their callings by adding the abbreviations of M.D.C.M., R.N., C.A., and Q.C., after their names. Through constant repetitions we all know what they mean, and we respect their implications. Engineering today has the largest membership of any of the professions, but it has not yet received the public recognition that it deserves. I doubt if our members would be able to recognize the full titles that are expressed by the following abbreviations: A.R.S.M., D.I.C., L.S.P., D.C.E., K.S.A., B.L.S., L.R.S.M. Yet most of these have been earned by a course of training at least as rigorous and advanced as that for a Bachelor of Science of Engineering. They also imply as great a degree of ability and intellect. If our members would be as careful to use our proud title, our recognition and prestige would soon be established because of our great numbers.

There are several outstanding engineering projects being carried out in Nova Scotia at present. A few articles about them have appeared in the press, but these have been mere statements of progress based mainly on interviews with the contractors. There is not the least doubt that the greatest interest lies in the engineering features of these costly construction enterprises. Why haven't the engineers taken the opportunity to give the public some stories about how the works were planned; in what manner they are different from other bridges and causeways; why the causeway across the Strait of Causo was chosen instead of a bridge or a tunnel; the gigantic machinery that is being employed; how the work is being carried out? The public has an insatiable curiosity to know how things are made and how they are done. It would not be of any interest to give all the boring technical details which an engineer imposes on the attention of his fellows in an address at a professional meeting. There are, however, thrills and romance in a story of how a mountain is being moved, and stone blocks the size of a motor truck being dumped into thirty-fathom depths of the sea. All an engineer has to do is to sift out the aspects of the work that are of significance to other people, and tell them to a reporter. The latter will write the story and be glad to tell it. It seems that the fault lies in the neglect of the engineer to discover what is newsworthy in his efforts and to share it with the public. Until he does this, the recognition of the profession will remain under the traditional bushel.

The committee endorses wholeheartedly the recommendations set forth in the series of leaflets that have come to you under the caption *"Silent Service is not Enough"*. The matters are presented in a far better way than the committee could have done it, because the authors are experts in this complex area of public relations. We recommend that the leaflets be read again, and that our members make serious and continuous efforts to carry out the instructions set forth therein.

*Engineers and Architects*

During the year the secretary circulated a copy of a code of practice that had been jointly agreed upon by the architects and engineers of the State of Massachusetts. This is a highly desirable move, because the dividing line of competence and responsibility between the two in many types of construction is so uncertainly marked. There have been some unethical practices on the part of both professions in the past. Engineers have planned structures on a purely functional basis when beauty should also have been incorporated into the design. Architects have specified technological equipment and services that should have been selected by engineers. Both have availed themselves of the free services and advice of manufacturers for equipment and material whose applications fell outside their practical experience. Each has at times employed technicians instead of registered professional engineers in the preparation of portions of specifications dealing with matters outside of their full knowledge and experience. Happily, both professions are recognizing the undesirability of these practices, and are cooperating to wipe out unethical lapses and put all their planning and supervision on a high professional plane. In this province there has been appointed a joint committee of the two associations which is engaged in securing higher standards. It is very helpful to have the definite code of the architects and engineers in Massachusetts as a guide.

*Lectures Commended*

The committee wishes to express its commendation of the effort of the Halifax Branch of the Engineering Institute in providing a series of lectures on subjects of importance to the practising engineer. They are planned to broaden his field of knowledge and interest and to awaken his desires for a fuller culture. Such efforts are praiseworthy under the present pressures of duty and the tendency toward specialization among all professional persons. It is to be hoped that the program of subjects will be widened and deepened in each succeeding winter, until it covers the full range of the humanities, science, current affairs, and the principal divisions of knowledge necesary for significant living.

The committee is concerned with any effort it can make to maintain and improve the status of every individual member and the prestige of the profession as a whole. It believes that the engineer has lifted his calling to a remarkably high level by the works of members alone. Business and industry are competing for the men with the highest training in applied science from the moment they appear from the universities with their diplomas freshly signed. Every year sees a largely increased number moving into the most responsible executive positions in our corporations. This state of affairs should be seized upon by all and every one of us to strive for adequate recognition and the deserved prestige of the profession as a whole. Let us each give our best efforts toward this goal.

F. H. SEXTON,
*Chairman*

## New Brunswick

### Transfer Fee Abolished

Letters were read from Alberta, British Columbia, Ontario, and Quebec Asociations regarding their policy of not collecting transfer fees. The following motion was adopted:

"That the New Brunswick Association, as of this date, March 12, 1954, abolish the policy of collecting the transfer fees from members of other provincial Associations or Corporation who transfer their membership to this Association. This being done to further in every way possible the free interchange of registered engineers from province to province in Canada."

### Licenses Issued

The secretary's action in issuing licenses to the following was approved: C. O. Whitman, Montreal; H. A. Anderson, Cleveland; K. R. Rybka, Toronto; K. E. Whitman, Halifax; W. P. London, Niagara Falls; R. A. H. Hayes, Niagara Falls; C. A. E. Fowler, Halifax; T. M Keogh, Toronto; J. Price, Windsor.

### Joint Finance Committee

Prof. E. E. Wheatley and R. C. Eddy were appointed as the Association's representatives on the Joint Finance Committee.

The Council met with Dr. L. A. Wright, Dr. E. O. Turner, R. M. Richardson, and I. M. Beattie for a discussion of the changes in the Joint Agreement. All agreed that the proposed changes in the agreement were the proper thing.

## Quebec

### The Retiring President's Message

This first opportunity to write a message to Professional Engineers through the *Engineering Journal* is particularly appreciated as it coincides with the change in officers of the Corporation of Professional Engineers of Quebec.

At the end of his term, when he can no longer be brought to task for his sins, a retiring president likes to make some personal observations. I propose to make the most of my opportunity by doing a little preaching.

When nations band together in a common cause—somewhere a harsh voice will chant "Imperialism!!"

When provinces are called upon for a united effort, the voice cries "Dictatorship!!"

When organizations pool their efforts, the howl is "Regimentation!!"

If men put their shoulders to a single wheel—"Skullduggery!!"

These harsh words are effective. Without further evidence or argument, they make us back away from a possible threat to our freedom. But before we discard suggestions for united action, let us mentally substitute the word "Co-operation!!" for the harsh slogans of the thoughtless critics.

This simple substitution sheds an entirely different light on our contemplation of the efforts of men to work together.

We hear so much these days of evil designs on our freedom that we are inclined to forget the part that co-operation has played in the good things we possess.

But how can we tell which is "co-operation" and which is "skullduggery!!"?

Why is that fellow pushing his plausible plan?

What are his (ulterior no doubt) motives?

It seems to me that we can consider proposals more objectively and analytically if we spend less time looking for motives and more time considering merits.

What does all this have to do with engineering?

We have today some most important problems of co-operation to solve in our profession. We must be sure, therefore, that we are in the mood to consider them on a proper engineering basis and that the harsh words are reduced to their proper importance.

We are a giant young profession and we are free and independent in our thinking.

True we must be independent thinkers if we are to build better buildings and machines, but we sometimes carry our independence too strongly into our thinking about our purely professional problems.

For example:

We are inclined to be pro this engineering organization and anti that.

We tend to be interested only in the technical and not in the professional.

We will worry about the problems of one branch of engineering (our branch) and show no interest in the problems of others.

We will gaily make rules and regulations in one province without considering the effect on others.

But we are growing up. We can no longer fulfil our duty as a profession unless we increase our strength and usefulness through closer inter-organization co-operation and unity.

There is a need for co-ordinated laws, rules and procedures on matters affecting the movement of engineers from province to province.

There is a need for uniform high standards of admission to practise.

There is a need for greater freedom for the professional engineer to practise his profession.

There is a need to strengthen those fine institutes that work for the advancement of our engineering knowledge.

There is a need for united action and policy on efforts to improve the calibre and position of the engineer in his community.

These needs are recognized.

Already, there have been a large number of fine acts of co-operation for our greater strength. There is a growing movement for greater unity of action in the profession.

It becomes important, therefore, that every engineer take an increasing interest in co-operation. He should study each new proposal objectively and on its merits, but with a will to achieve results through co-operation. He must be most careful not to be led astray by harsh or careless slogans.

This new industrial age in Canada demands a bigger and a better engineering contribution. We may rejoice that engineers are responding by a movement for greater unity and co-operation. It is a sign of maturity. It shows that our profession is ready to strengthen its organization so that we may increase our contribution to the welfare of the public.

R. F. SHAW,
*President*

### Félicitations les plus sincères

Je suis heureux de pouvoir me joindre au Président de la Corporation en offrant mes félicitations les plus sincères à l'Engineering Institute of Canada pour l'excellente initiative qu'elle a prise d'accorder des colonnes de son journal aux associations provinciales.

Ce geste aura pour résultat de resserrer les liens qui unissent les sociétés techniques et les associations professionnelles d'ingénieurs et contribuera sûrement à la réalisation de notre idéal à tous: une profession forte et unie capable de remplir pleinement ses devoirs et obligations envers son pays et ses membres.

La Corporation des Ingénieurs est heureuse par conséquent d'offrir son concours aux éditeurs de l'Engineering Journal pour faire connaître aux membres des associations et sociétés soeurs le point de vue et les opinions des ingénieurs du Québec sur les problèmes fondamentaux qui concernent la profession et de publier dans ces colonnes des nouvelles susceptibles d'intéresser nos confrères des autres provinces.

LEOPOLD NADEAU.
*Secrétaire général*

### Engineers' Right To Design Industrial Buildings Challenged

Can an engineer legally design an industrial building in Quebec? For years this question has been debated and fought over by engineers and architects around the conference table, before the courts and in the legislature.

The courts have stated that there is no clear answer to this question on the basis of existing Acts and that although a certain field of activity is clearly reserved to members of one or the other of the two professions, there exists between these fields a no-man's land where both groups can only practice at their own risk, and where each case would have to be decided by the courts on its own merits.

This is a most unsatisfactory situation and the Corporation is of the opinion that the lack of confirmation of the obvious right of the engineer to design industrial buildings is one of the most serious single deterrents to the proper and full development of engineering in Quebec, leaving the Quebec engineer in a position inferior to other engineers the world over.

For the third time within eight years, the Corporation recently submitted to the Quebec Legislature a proposed amendment to the Professional Engineers' Act which would have clearly confirmed the right of the engineer to control and direct the design of industrial buildings without denying this same right to architects.

The proposed amendment was submitted to all the professional and trade organizations except the P.Q.A.A.) which were directly or indirectly interested. Not one of these groups voiced any opposition; on the contrary, a large majority were openly favorable and many actively supported our request. It should be noted particularly that the Canadian Manufacturers' Association representing the people for whom industrial buildings are designed and erected and the Canadian Construction Association representing the contractors who build these buildings both actively supported the proposed amendment. This indicates that the public whom we serve considers the engineer well qualified to design industrial buildings. As expected, the only opposition came from the Province of Quebec Association of Architects.

Unfortunately, the legislature decided to reject the proposed amendment for reasons which are not quite clear as yet.

### Practice of Engineering by Corporations

One of the major problems presently being considered by the Corporation is the complex question of the practice of engineering by corporate firms, partnerships, registered firms, etc. and the use made by these organizations of the words "Engineer" or "engineering" in their names or as a title or designation in their advertisements.

In the past the Corporation had tolerated the use of the title "Engineer" by corporate firms owned or managed by professional engineers or employing professional engineers, although under the Professional Engineers' Act, this title is reserved exclusively to individuals who are members of the Corporation.

However, this practice having led to serious abuse in recent years, our Council has reached the conclusion that the Corporation would not be properly fulfilling its main duty to the public if the practice was allowed to continue. In addition, there is evidence that the prestige of the profession may be adversely affected.

Consequently it has been decided to request all corporate firms presently using the title "Engineer", as applied to the firm, in their advertisements, to discontinue this practice in the best interest of the profession and of the public which it serves.

Many firms have already undertaken to comply with this request on a voluntary basis and in a remarkable spirit of cooperation.

In addition, a committee has been appointed to carry out a thorough study of the other parts of the problem as well as to make a complete survey of the policies adopted by other engineering organizations throughout Canada and the United States on this subject.

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## Manitoba

### Officers Elected

Gerald B. Williams, chief engineer, Highways Branch, for the Province of Manitoba and a member since 1939 of the Association of Professional Engineers of Manitoba, is the newly elected president of that body.

He succeeds Major J. L. Charles, chief engineer, western region, for the Canadian National Railways. Major Charles, who gained considerable military engineering experience in two wars, is largely responsible for the construction of the Hudson's Bay Railway and the newly built Lynn Lake Railway.

Mr. Williams, past president of the Engineering Alumni Association, member of the Motor Carrier Board, and chairman of the Canadian Good Roads Association Observer Committee for A.A.S.H.O. on test roads, now undertakes the new responsibility for guiding the affairs of the Association in 1954.

The officers elected to the executive council of the association at the General Annual Meeting, January 21, 1954, and those remaining from 1953 are: vice-president, J. Hoogstraten, professor of Civil Engineering, University of Manitoba; councillors, J. L. Charles, past president; C. L. Fisher, chief engineer,

**Gerald B. Williams**

Armco Drainage and Metal Products of Canada Ltd.; G. W. Moule, contract engineer, Winnipeg City Hydro-Electric System; D. M. Stephens, chairman and general manager, Manitoba Hydro-Electric Board and president-elect of the Engineering Institute of Canada.

C. S. Landon, a member of council for the past 21 years was re-elected as secretary-treasurer and registrar of the Association. Mr. Landon is well known in engineering circles, and has an excellent record of service to the Association and its members.

### Engineer's Grading

In a recent poll of the members of the Association, by the executive council, a grading for engineers and a recommended minimum salary for each grade was determined. Further to this, at the last annual meeting, a petition signed by 46 members and submitted at an earlier meeting was introduced. This petition asked that a schedule of minimum salaries be edited in booklet form and distributed to the members. After a short discussion this matter was referred to a special meeting of council to be held not later than March 31, 1954.

### P. O'Donnell Burke-Gaffney Honored

A bronze miniature bison, symbol of the Province of Manitoba and mounted on a marble base with a silver plate suitably engraved, was presented to P. O'Donnell Burke-Gaffney as a token of esteem and affection from the council and members. Mr. Burke-Gaffney, formerly sales engineer, Johns Manville Co. Ltd., was one of the original founders and a past president of the Dominion Council, and had been member, registrar, and president, of the Association of Professional Engineers of Manitoba.

The Association's representative to the Dominion Council meeting to be held in Toronto, May 28, 1954, Professor J. Hoogstraten, was asked to agree to a proposed amendment to the Dominion Council Constitution by the B. C. Association which if adopted, would remove the upper limit of the assessment which can be made on any member association and thus provide sufficient funds to establish a permanent secretary for that body.

The Association was happy to participate again in "The Kipling Ritual" and Professor Hoogstraten, vice-president of the Association, made a speech of welcome to the graduating class.

The newly appointed publicity chairman of the Association is A. W. Greenberg, structural designer, Green Blankstein Russell and Associates, Architects and Engineers.

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## Saskatchewan

### New Officers Elected

New officers elected at the Annual Meeting of the Association held in Regina on February 18, 1954, were:

President: G. N. Munro, associate chief engineer, PFRA, Regina.

Vice-President: W. R. Staples, assoc. prof. in Mechanical Eng., University of Saskatchewan, Saskatoon.

Councillors: W. M. Berry, chief, hydrology division, PFRA, Regina; W. G. McKay, consulting engineer, Underwood, McLellan & Associates, Saskatoon; E. C. B. Macnabb, division engineer, CPR, Moose Jaw.

The newly elected officers will also sit as executive members on the Saskatchewan Branch of The Engineering Institute of Canada.

F. E. Estlin, manager of the Canadian General Electric Co., Regina, was appointed to represent the Association on the Saskatchewan Branch of The Engineering Institute of Canada.

Allan Tubby, past-president, was appointed to represent the Saskatchewan Association on The Dominion Council of Professional Engineers.

### Transfer Fee Abolished

The Saskatchewan Association has now abolished the transfer fee of members in good standing in other provincial Associations, to become effective in 1955. This action could not be made effective immediately as it required an amendment to the By-Laws which has to be ratified by the Legislature.

Other provincial associations which have abolished their transfer fees now include Alberta, British Columbia, Ontario, Quebec, and New Brunswick.

### Institute President Visits Saskatchewan

Ross L. Dobbin, president of The Engineering Institute of Canada, visited members in Regina on February 5, Prince Albert on March 11, and Saskatoon on March 12. Successful dinner meetings were held in all cities. Mr. Dobbin presented addresses on his trip to the Coronation as an official representative of the Institute.

### Uniform Examination Syllabus Accepted

For those wishing to qualify as professional engineers by examination, the Saskatchewan Association has now accepted the Syllabus of Examinations which is presently being used by the Corporation of Quebec and the Associations in Ontario and British Columbia. This is another step towards uniform requirements by all registration bodies in Canada.

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## Alberta

### Annual Meeting and Convention

There was a total attendance of approximately 230 members at the noon luncheon which was addressed by Prof. Robert A. Sutermeister from the School of Business Administration, University of Washington, Seattle. The banquet in the evening was addressed by J. R. White, president of Imperial Oil Limited.

During the afternoon forum discussions, the proposal of J. Herbert Smith, past president of the Ontario Association, was given much consideration. After considerable discussion of the topic the meeting unanimously passed the following resolution:

"It is the opinion of this meeting that the plan for unity proposed by J. Herbert Smith, past president of the Association of Professional Engineers of Ontario, should receive consideration by the incoming Council of the Association and that this Council should do all it can to bring about a union of the Dominion Council and the Engineering Institute of Canada."

### Officers Elected

The ballot for the election of officers and councillors resulted in the following being elected:

President: L. A. Thorssen.

Vice-President: T. D. Stanley.

Councillors elected for a two year term were: L. H. McManus, H. H. Beach, R. C. MacPherson and E. W. Christian.

The continuing councillors are: Prof. J. A. Harle, A. W. Howard, J. I. Strong, and R. D. Livingstone.

J. J. Hanna will continue on Council as past president.

At the Council meeting immediately following the Annual Meeting, Dean R. M. Hardy was again appointed Dominion Council representative and P. M. Sauder was again appointed E.I.C. Council representative. J. Graham Dale was reappointed Faculty Council representative and deputy registrar. J. F. McDougal was reappointed registrar.

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## British Columbia

### Engineers and Unions

The new Labour Relations Act was greeted by the Association with mixed feelings when it was found that it contained part of the recommendations contained in the brief submitted to the Minister of Labour in December by the Association. That part exempts all professional engineers from provisions of the act. We were not successful, however, in obtaining exemption for engineers-in-training.

The definition of an employee in the new Labour Relations Act is as follows, "Employee" means, a person employed by an employer to do skilled or unskilled manual, clerical, or technical work, but does not include: (a) a manager or superintendent, or any other person who, in the opinion of the board: (i.) exercises management functions; or (ii.) is employed in a confidential capacity in matters relating to labour relations; (b) a member of the medical, dental, architectural, engineering or legal profession, qualified to practise under the laws of the Province of British Columbia, and employed in his professional capacity; (c) a person serving an indenture of apprenticeship under the "apprenticeship act"; (d) a person employed in domestic service, agriculture, horticulture, hunting, or trapping."

The first recommendation made by the Association in its brief to the Minister of Labour was that part (b), as above, be included in the Act. The second recommendation was that (c) should read "a person serving an indenture of apprenticeship under the "apprenticeship act" or is training for the medical, dental, architectural, engineering or legal profession, and is enrolled as such with the British Columbia registering body for that profession."

Representations were made to the Minister of Labour again after the bill was first brought forward in the House so that engineers-in-training might also be exempted under the Act, but in this we were not successful.

### Agricultural Engineers

For some time Council has been concerned about the question of graduates in agricultural engineering. A number of these men have been accepted as engineers-in-training in the past four years, but in the past when they applied for registration they have been advised they would have to write certain examinations in order to qualify depending upon the branch of engineering in which they applied, and whether or not they had any post-graduate courses. This was occasioned by the fact that there was no agricultural engineering branch provided for, and that these graduates were required to register in either mechanical or civil engineering.

Recently, Council asked Professor T. L. Coulthard, who is in charge of the Department of Agricultural Engineering at the university, to attend a Council meeting and discuss this matter with them. As a result of this meeting, Council finally decided that registration should be granted to graduates in agricultural engineering provided that an engineering report or thesis is submitted which is approved by Council upon the recommendation of either the Mechanical or Civil Board of Examiners.

This means that those agricultural engineering graduates, who previously applied for registration and were required to write examinations in either civil or mechanical engineering, now qualify simply by the submission of a report satisfactory to the Board of Examiners in either of these two branches, and the attainment of the four years of satisfactory engineering experience.

### Minimum Salaries

On the recommendation of the Ontario Association and Quebec Corporation and after a review by our salaries committee and council. the following changes have been made in our recommended schedule of minimum salaries:

| | |
|---|---|
| Grade I | $3,600 |
| Grade II | 4,440 |
| Grade III | 5,340 |
| Grade IV | 6,300 |
| Grade V | 7,560 |
| Grade VI | 10,080 |
| Grade VII | 13,800 |
| Grade VIII | 21,000 |

A new booklet is being prepared and will be available around May 15.

### Toastmasters' Club

This year we have had many requests for speakers for various P.T.A. Groups on the subject of engineering. In order to provide sufficient speakers, we have called upon the recently formed Toastmasters' Club on two occasions to provide speakers for us. In this connection C. P. Jones spoke to the Lynn Valley P.T.A. on Wednesday, March 17 and E. S. Hare spoke to the King George P.T.A. in Vancouver on April 14. Although not a member of the Toastmasters' Club A. H. Ashworth also assisted us by speaking to the North Star P.T.A. in North Vancouver, on March 17 on Municipal Engineering.

In addition to these the writer has spoken to the Prince of Wales P.T.A., to engineering students, and to students of Lord Byng High School and North Burnaby High School.

### New Members

The following have recently complied with all requirements for registration as Professional Engineers in British Columbia, and are duly registered as members of the Association of Professional Engineers of B.C.:

**Abrahamson, Carl W.,** mining, assistant resident engineer, Aluminum Company of Canada Limited, Kemano, B.C.

**Bowman, Ronald F. P.,** civil, general manager, Pacific Great Eastern Railway Vancouver, B.C.

**Campbell, John G.,** metallurgical, production superintendent, Kitimat works, Aluminum Company of Canada Limited, Kitimat, B.C.

**Confortin, John C.,** civil, transitman, Canadian Pacific Railway Company, Nelson, B.C.

**Gall, Allan,** mechanical, B.C. International Engineering Co. Ltd., Kemano, B.C.

**Klohn, Earle J.,** civil, soils engineer, Ripley & Associates, Vancouver, B.C.

**Killam, Cecil G.,** chemical, chief chemist, B.C. Electric Company, Vancouver, B.C.

**Lea, Edgar R.,** geological, resident geologist, Cia Minera Aguilar S.A., El Aguilar, Prov. de Jujuy, Argentina, S.A.

**Linderholm, Bo. Anders O.,** mechanical, designer, Sandwell & Company Limited, Vancouver, B.C.

**Logie, John S.,** mechanical, chief engineer, Burrard Dry Dock Company, North Vancouver, B.C.

**MacKay, Thomas W.,** mechanical, president, Thos. W. MacKay & Son Ltd., Vancouver, B.C.

**Newmarch, Thomas F. R.,** chemical, engineer, Department of Technical Services, Powell River Company Limited.

**Nixon, George M.,** electrical, 1351 Oakwood Crescent, Norgate Park, North Vancouver, B.C.

**Scott, Wm. B.,** civil, construction engineer, Halse-Martin Construction Co Limited, Vancouver, B.C.

**Thompson, Mavor S.,** civil, estimator, Dominion Construction Co. Ltd., Vancouver, B.C.

**Vakomies, Pete J.,** chemical, project engineer, Sandwell & Company Limited, Vancouver, B.C.

**Wate, George K.,** chemical, Technical Services Department, Powell River Company Limited.

### Temporary Licence Renewals

The following were granted renewals of their Temporary Licences to the dates indicated:

**Bausch, Karl McK.,** electrical, chief electrical engineer, Power Division, Bechtel Corporation, San Francisco, California. Expires: September, 1954.

**Burns, Russell W.,** geological (petroleum), chief geologist, Union Oil Co. of California, Calgary, Alberta. Expires: September 28, 1954.

**Evans, John M.,** civil, chief engineer, Standard Oil Company of British Columbia Limited, San Francisco, California. Expires: September 30, 1954.

**Falconer, Wilbert L.,** geological, managing director, Ponder Oils Limited, Calgary, Alberta. Expires: April 26, 1955.

**Folger, Anthony,** geological (petroleum), senior geologist, DeGolyer & MacNaughton, Dallas, Texas. Expires: September 30, 1954.

**Fontaine, Edward A.,** electrical, Stone & Webster Service Corporation, New York 4, New York. Expires: September 26, 1954.

**Galbraith, Frederic McI.,** geological mine geologist, Columbia Iron Mining Company, Cedar City, Utah. Expires: September 26, 1954.

**Landes, Robert Wm.,** geological (petroleum) exploration manager, Imperial Oil Limited, Calgary, Alberta. Expires: March 2, 1955.

**Liesemer, George E. G.,** chemical, Central Leduc Oils Limited, Calgary, Alberta. Expires: March 19, 1955.

**Miller, Victor C.,** geological, consulting geologist and photogeologist, Calgary, Alberta. Expires: September 30, 1954.

**Rambo, Wm. H.,** structural, consulting engineer, Portland, Oregon. Expires: September 22, 1954.

**Richelsen, Walter A.,** mining, consulting engineer, Seattle, Washington. Expires: September 5, 1954.

**Spivak, Joseph,** geological, chief geologist, Socony-Vacuum Exploration Co., Calgary, Alberta. Expires: March 22, 1955.

**Stephens, Edward C.,** geological, mining geologist, Spokane, Washington. Expires: September 19, 1954.

**Troxell, Richart L.,** structural, chief engineer, American Marietta Company, Chicago, Illinois. Expires: October 18, 1954.

**Wardle, James M.,** civil, consulting engineer, Ottawa, Ontario. Expires: March 18, 1955.

**Wright, Paul C.,** Jr., geologist (petroleum) chief engineer, Western Natural Gas Company, Houston, Texas. Expires: September 30, 1954.

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## News of the Personal Activities of Members of the Institute

**Dr. Lillian Gilbreth,** Hon.M.E.I.C., of Montclair, New Jersey, received on April 7 in Chicago the George Washington Award for her "outstanding contribution to engineering and management, and for unselfish devotion to problems of the handicapped."

The award, a top engineering honour, which for the first time has been presented to a woman, was made by the Western Society of Engineers and the American Societies of Electrical, Mining, Civil and Mechanical Engineers. Less than 20 men have so far been presented the award. Four of these have been Herbert Hoover, Henry Ford, Orville Wright and Charels F. Kettering.

**Dean Kenneth F. Tupper,** M.E.I.C., has resigned the deanship of the Faculty of Applied Science and Engineering at the University of Toronto. His resignation will become effective June 30, 1954.

This announcement was made recently by President Sydney Smith who paid tribute to the outstanding leadership which Dean Tupper has given to the faculty, saying that he has won the high regard of his staff, students and graduates. At the same time he has always been more than a "faculty" man, having participated in the general affairs of the University, especially through his active membership on the Hart House Board of Stewards.

Dean Tupper succeeded Dr. C. R. Young as head of the science and engineering staff of the University in 1949, after serving previously as director of the engineering division of the atomic energy project at Chalk River.

He received his early education in Saskatoon and Calgary, and graduated with a B.Sc. degree in mechanical engineering from the University of Toronto in 1929. In addition, he was granted a M.Sc. degree in aeronautical engineering by the University of Michigan in 1938.

During the war he was one of a mission of three of the National Research Council to go to England to study jet propulsion, and when the Canadian Crown company, Turbo Research Limited, was formed to work in the field of jet propulsion, he became its chief engineer.

Then after this company was absorbed by Avro (Canada) Limited, Dean Tupper went to Chalk River where he was appointed director of the engineering division in 1947.

**Dr. R. R. McLaughlin,** M.E.I.C., head of the department of chemical engineering of the University of Toronto, has been appointed to the deanship of the Faculty of Applied Science and Engineering, succeeding Dean K. F. Tupper.

Dr. McLaughlin attended St. Andrew's College and the University of Toronto where he received his B.A.Sc., M.A.Sc., M.A. and Ph.D. degrees. He also held a fellowship in England at the Lister Institute in 1929-30

He joined the staff of the University of Toronto in 1926 as a research assistant in the department of chemical engineering. He then held successive appointments as lecturer, assistant professor, associate professor, professor, and then head of the department. In addition, he served as chairman of the physical and biological sciences division in the School of Graduate Studies.

A diligent and productive scientist, Dr. McLaughlin has been continually active in research. He has been the author of a large number of articles in scientific periodicals, and in 1945-46, served as president of the Chemical Institute of Canada.

Dr. McLaughlin will be the sixth dean of the engineering faculty at the University of Toronto. Professor John Galbraith was principal of the old school of Practical Science from its foundation in 1878 until 1906, when it became a faculty of the university. He was dean of this faculty from 1906 until his death in 1914. W. H. Ellis served as dean during the first World War, and Brigadier-General C. H. Mitchell succeeded him from 1919 until 1941, when Dr. C. R. Young was appointed to this post.

**Harold A. Cooch,** M.E.I.C., chairman of the board of Canadian Westinghouse Company Limited of Hamilton, and **J. Alexander Walker,** M.E.I.C., of the consulting firm of Walker and Graham of Vancouver, have been appointed members of the Federal District Commission. This announcement was made recently by Prime Minister St. Laurent who explained that the Commission is responsible for carrying out the national plan to beautify Ottawa.

Messrs. Cooch and Walker, whose term on the Commission will continue until December 31, 1958, are replacing B. K. Sandwell of Toronto, and William H. Warren of Victoria.

Mr. Cooch has been closely identified for more than 40 years with movements to promote the growth of the electrical industry, while Mr. Walker has been working with the Vancouver Town Planning Commission since 1944.

**William R. Way,** M.E.I.C., vice-president in charge of generation and transmission of the Shawinigan Water and Power Company, has been awarded a fellowship in the American Institute of Electrical Engineers.

Mr. Way's citation noted his contributions to the electrical industry "in the administration of utility engineering and operating practices and intersystem collaboration."

He is a former vice-president of the American Institute of Electrical Engineers.

**C. G. Kingsmill,** M.E.I.C., formerly chief engineer of Defence Construction Limited, has returned to his civilian post

### Councillor for Halifax

**J. Winston MacDonald,** M.E.I.C., assistant chief engineer with Nova Scotia Light and Power, Company, Limited, has been elected councillor of the Institute representing the Halifax Branch. This information was not available for the April issue section on new officers of the Institute.

J. Winston MacDonald, M.E.I.C.

Mr. MacDonald was born at Balmoral Mills, Colchester County, Nova Scotia. He received his general schooling at Pictou Academy after which he entered Dalhousie University where he obtained his B.Sc. degree in physics in 1929. Two years later he received his B.Sc. degree in electrical engineering from the Nova Scotia Technical College.

Previous to graduation, Mr. MacDonald was engaged during the summer months of 1929 and 1930 on construction work with Canadian Westinghouse Company, Limited at Paugan Falls, Quebec, and on installation of substation equipment with Nova Scotia Light and Power Company, Limited.

Since graduation he has worked with Nova Scotia Light and Power Company, Limited. He has been associated mainly with public utility engineering and particularly thermal power development in Nova Scotia and New Brunswick. He was appointed to his present position in 1949.

Mr. MacDonald has been active in the work of the Institute in Halifax, becoming chairman of the Branch in 1952. He presented a paper at the annual meeting of the Institute, at Halifax, in 1953, on the subject of Steam Generation of Power in Nova Scotia. He is at present an E.I.C. representative on the International Electrotechnical Commission's Steam Turbine Committee. In addition, he is a member of the council of the Association of Professional Engineers of Nova Scotia.

with Angus Robertson Limited in Montreal.

Mr. Kingsmill, a mechanical engineering graduate of the University of Toronto, class of 1924, was chief engineer of the power development division of the Quebec Hydro-Electric Commission before joining Angus Robertson Limited in 1952.

**H. W. Tate,** M.E.I.C., assistant general manager of the Toronto Transit Commission, has retired to engage in private engineering practice, but for a limited period will continue as consulting engineer to the Commission to complete outstanding subway settlements and to assist in consolidation of the metropolitan transit system.

Mr. Tate has been associated with the Commission since 1920, and has been prominently identified with track rehabilitation, reconstruction and extension work which has been carried out since the Commission undertook the responsibilities of the Toronto Railway Company.

In 1952 he served as president of the Canadian Transit Association.

**D. C. R. Miller,** M.E.I.C., has recently been appointed to the position of general manager of Dow Corning Silicones Limited in Toronto.

A native of London, England, Mr. Miller received his early schooling in that country and in Scotland. He came to Canada in 1931 and that year entered the University of Toronto where he obtained his degree in mechanical engineering in 1935.

Upon graduation he joined the Duplate Canada Limited in Oshawa, Ont., and has been associated with this firm or one of its related companies ever since.

After serving as production superintendent and plant engineer at the branch factory in Windsor, Ont., for two years, he was sent to England in 1938 to study three new developments: an Italian method for making glass fibres, British manufacturing methods of all types of safety glass, and the newly-developed acrylic transparent sheets. On his return to Canada he designed and operated the equipment for making glass fibres by the Modigliani method. This was the first fibre glass to be produced commercially in Canada. He also installed and operated a department for forming transparent plastic sheets, and his company was again the first in Canada in this field, due mainly to the requirements of military aircraft.

In 1939, upon an arrangement with Owens-Corning Fiberglas Corporation for Canadian manufacturing rights on their process, the Fiberglas Canada Limited was formed, and Mr. Miller became the new company's first employee. After many weeks at the Newark, Ohio plant, studying manufacturing processes, he subsequently installed and operated in Oshawa the first equipment in Canada for making fine glass textile fibres.

Early in 1941 Mr. Miller was transferred on loan to the newly-formed Canadian government company, Research Enterprises Limited, which was established to manufacture optical glass and optical instruments mainly used for fire control instrument purposes, and later for the manufacture of radar equipment. Mr. Miller's position was that of production superintendent of optical shops, and as such he was responsible for the quantity and quality of production of the optical grinding and polishing department and for the assembly of all

D. C. R. Miller, M.E.I.C.

optical instruments. In March 1944 he was promoted to the position of department head in the range finder and binocular departments.

At the war's end, Mr. Miller returned to Fiberglas Canada Limited in Toronto. He presented a thesis in 1947 to the University of Toronto which covered one phase of his wartime work. It was entitled "The Wartime Production of Precision Optics in Canada", and for it he was granted the professional degree of Mech.E.

In 1949 he was appointed manager of the silicone sales division of the company. Then early in 1954, the rapidly growing business necessitated the setting up of a separate company, Dow Corning Silicones Limited, and Mr. Miller was appointed to his present position.

**J. A. de Bondy,** M.E.I.C., has been appointed vice-president of Welland Electric Steel Foundry Limited of Welland, Ont. He will be located at the firm's Montreal office.

A Toronto consulting metallurgist, Mr. de Bondy was formerly Toronto manager of Wilkinson Linatex Co. Ltd. of Montreal.

He is a member and a past councillor of the Canadian Institute of Mining and Metallurgy, a past president of the Electric Metal Makers' Guild, and a past chairman of the Manitoba chapter of the American Society of Metals.

R. G. Barbour, M.E.I.C.

**R. G. Barbour,** M.E.I.C., has been appointed vice-president and managing director of T. Pringle & Son Limited of Montreal.

Mr. Barbour received his electrical engineering degree from the University of New Brunswick in 1924 and his master's degree from the same university in 1927. Before joining T. Pringle & Son Limited as chief electrical and mechanical engineer, he was employed with the Canadian General Electric Company and with the Aluminum Company of Canada on construction and operation.

He has been general manager of T. Pringle & Son Limited since 1952.

**M. L. Zirul,** M.E.I.C., district engineer of the water rights branch of the British Columbia Department of Lands and Forests in Kamloops, B.C., has been elected chairman of the Central British Columbia Branch of the Engineering Institute.

Mr. Zirul was born in North Vancouver, B.C., where he received his elementary education. He then attended the University of British Columbia, graduating in civil engineering in 1941.

Upon graduation he joined the Dominion Water and Power Bureau (now the Water Resources Division) of the Department of Resources and Development of Canada. Until 1944 he was responsible for obtaining stream flow

M. L. Zirul, M.E.I.C.

measurements for streams in the Kootenay district of British Columbia.

He then joined the Powell River Company at Powell River, B.C., as field engineer on construction work, and was later appointed design draughtsman on building design in connection with the installation of the hydraulic barker mill.

From 1946 until 1949 he was assistant district engineer with the water rights branch of the Department of Lands and Forests in Nelson, B.C., and later he was transferred to Kamloops, B.C., in the same capacity. He was appointed to his present position in 1950.

Mr. Zirul served as secretary-treasurer of the Central British Columbia Branch in 1950-51, and was a member of the executive in 1952-53.

**L. M. Hunter,** M.E.I.C., has been appointed to the board of directors of Coca-Cola Limited as a vice-president with direct responsibility for all the physical plant properties of the company and of the home office engineering and production activities.


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A 1936 civil engineering graduate of Queen's University, Mr. Hunter joined the engineering staff of Coca-Cola Limited at the head office in Toronto. He then served in various capacities in the engineering department until 1942 when he was named manager of the engineering and production departments of the company.

**S. V. Antenbring,** M.E.I.C., senior mechanical design engineer in the engineering division of Imperial Oil Limited in Sarnia, Ont., has been named chairman of the Sarnia Branch of the Engineering Institute.

Mr. Antenbring was born in Winnipeg, Man., and after attending the St. Johns Technical High School there, he undertook civil engineering study at the University of Manitoba, graduating with a B.Sc. degree in 1937. Afterwards he was employed for a short time with Sherritt Gordon Mines Limited.

He then joined Imperial Oil Limited in November, 1937 and has since been associated with this company apart from

S. V. Antenbring, M.E.I.C.

the period of May 1941 to October 1945 during which he served with the Royal Canadian Air Force in the aeronautical engineering branch.

At the close of the war Mr. Antenbring returned to Imperial Oil Limited where he was employed on maintenance and construction work at the Sarnia refinery until July 1952 when he was appointed to the position of senior mechanical design engineer in the engineering division.

Mr. Antenbring is a member of the Association of Professional Engineers of Ontario.

**I. Emery Szasz,** M.E.I.C., is now president of Hayes-Durham Forgings Ltd. of Montreal, Que. He was formerly the company's chief engineer and production manager.

Mr. Szasz is a 1923 mechanical engineering graduate of Berne University, Switzerland.

**W. A. Wheten,** M.E.I.C., superintendent of industrial engineering in the power products division of Canadian Westinghouse Company Limited in Hamilton, has been elected chairman of the Hamilton Branch of the Engineering Institute.

Mr. Wheten was born in Saskatoon, Sask., and received his elementary education there. In 1938 he obtained his B.Sc. degree in civil engineering from the University of Saskatchewan.

He then joined the Prairie Farm Rehabilitation Administration as a field engineer on water development, and two years later became assistant engi-

W. A. Wheten, M.E.I.C.

neer with the Department of National Defence (R.C.A.F.) on airport construction. During the period 1941-1946 he served as technical armament officer in the Royal Canadian Air Force, becoming attached to the aeronautical inspection directorate as inspector of explosives in 1942.

Upon his discharge he became irrigation engineer for the Government of Ceylon, and as such, was placed in charge of a large land development scheme employing a staff of 1,500.

Mr. Wheten joined Canadian Westinghouse Company Limited in 1950 as manufacturing engineer. A year later he was promoted to the position of superintendent of industrial engineering in the apparatus division, and in 1953 he was named to his present position as superintendent of industrial engineering in the power products division.

**William Arthur Bowman,** M.E.I.C., designing and structural engineer with the British Columbia Department of Public Works in Victoria, has been elected chairman of the Vancouver Island Branch of the Institute for the term 1954-55.

Mr. Bowman was born at Port Arthur,

W. A. Bowman, M.E.I.C.

Ont. He received his general schooling at the Hudson Public and the Port Arthur Collegiate Institute after which he continued his studies at the University of Manitoba, graduating with a B.Sc. degree in 1942.

During the summer months of his university course Mr. Bowman served as rodman and chainman with the Ontario Department of Highways and with the Canadian National Railways, and as construction inspector with C. D. Howe Co. Ltd. in Port Arthur.

After service with the Royal Canadian Engineers during the war, he joined the C. D. Howe Company in Port Arthur in 1946 as a structural designer. The following year he was transferred by the company to Vancouver, B.C., as a resident engineer.

In 1949 he joined the British Columbia Department of Public Works in Victoria as an engineer in training, and the next year was appointed to his present position.

Mr. Bowman is a member of the Association of Professional Engineers of British Columbia.

He served as secretary-treasurer of the Vancouver Island Branch of the Institute in 1951.

**B. Kelimbet,** M.E.I.C., has joined the mechanical and engineering division of the Public Works Department of the City of Montreal. He was formerly employed by the Johns Manville Company in Asbestos, Que.

Mr. Kelimbet is a 1932 graduate in electrical engineering of the Institute of Technology of Warsaw.

**Joseph A. D'Angelo,** M.E.I.C., has been named supervisor of the manufacturing budget department in the new engine plant of the Ford Motor Company of Canada in Windsor, Ont.

He was formerly employed in the company's time standards and methods section of the industrial engineering department.

Before joining this company, he was associated with National Heating Products Sales Ltd. in Montreal.

Mr. D'Angelo graduated in electrical engineering from the University of Manitoba in 1946.

**Major F. J. Sergi,** C.A.O.R.E., M.E.I.C., who has just completed a course in the Russian language at the Army Language School in California, has been posted to the Royal Military College at Kingston, Ont.

Mr. Sergi graduated in mechanical engineering from McGill University in 1941.

**H. W. Klassen,** M.E.I.C., has been transferred by Angus, Butler & Associates Ltd., from Edmonton to Calgary where he will serve as manager of the Calgary branch of the firm.

Mr. Klassen joined the company in 1952 after having been associated as office manager with Phillips, Stewart and Phillips in Saskatoon, Sask.

Upon graduation from the University of Saskatchewan in mechanical engineering in 1944, Mr. Klassen served with the R.C.E.M.E.; and after the war, he was attached to the University of Saskatchewan as instructor and demonstrator.

**E. R. Welsh,** M.E.I.C., has been appointed general manager of Rice Machine Services Ltd. in Calgary, Alta.

Mr. Welsh graduated in mechanical engineering from the University of Saskatchewan in 1948. After graduation he was employed for five years by Alchem Limited, water treatment engineers, during which time he served in Toronto, Calgary and Montreal.

Mr. Welsh joined Rice Machine Services Ltd. as office manager in 1953.

**Heino Loo,** M.E.I.C., has recently joined the firm of C. B. K. Van Norman and Associates of Vancouver as structural engineer.

He was formerly associated with B.C. International Engineering Co. Ltd. in Vancouver.

Mr. Loo received his B.Eng. degree in structural engineering from Tallin Engineering College in Estonia in 1942.

**R. H. Persson,** M.E.I.C., previously resident engineer with the Prince Albert National Park for the Saskatchewan Department of Resources and Development, is now with Jasper National Park for the Department of Northern Affairs and National Resources.

He is a graduate in civil engineering of the University of Saskatchewan, class of 1948.

**P. G. Campbell,** M.E.I.C., has recently been named resident engineer on the Manitou Falls development of the Ontario Hydro-Electric Power Commission on the English River.

Until his present appointment he was division engineer at Niagara Falls, Ont.

Mr. Campbell received his B.Eng. degree in civil engineering from the Nova Scotia Technical College in 1943.

**Alex G. A. Piercey,** M.E.I.C., has joined the Kamloops refinery of Royalite Products Limited in British Columbia.

He was previously chief chemical

Ralph F. Harrison, Jr.E.I.C.

engineer with the Madison Natural Gas Company in Turner Valley, Alta.

Mr. Piercey received his B.Sc. and M.Sc. degrees in chemical engineering from the University of Alberta in 1936 and 1938, respectively.

**D. G. Ross,** M.E.I.C., is a contract manager of Pentagon Construction Co. Ltd. in Montreal.

He was formerly in private engineering practice in Halifax, N.S.

Mr. Ross received his B.Sc. degree from Dalhousie University in 1922.

**Ralph F. Harrison,** Jr.E.I.C., has been appointed sales manager of the molded plastics section of the Canadian General Electric Company's chemical department. He is located in Cobourg where the company's molded plastics manufacturing facilites are situated.

A graduate in mechanical engineering of Queen's University class of 1947, Mr. Harrison joined the Canadian General Electric Company on its test course at Peterborough that same year. On completion of the test he was assigned to the Cobourg works where he gained experience in plastics manufacturing. He was later transferred to the company's chemical department at head office. Previous to his present appointment he was the company's molded plastics sales representative in the Quebec district.

He is a member of the Association of Professional Engineers of Ontario and of the Society of Plastic Engineers.

**Jean Dumas,** Jr.E.I.C., is now a research officer with the Canadian Armament Research and Development Establishment of the Defence Research Board at Valcartier, Que.

He was previously engaged in post graduate study at the Massachusetts Institute of Technology.

Mr. Dumas received his degree in electrical engineering from McGill University in 1948.

**S/L I. G. Duncan, R.C.A.F.,** Jr.E.I.C., is now chief technical officer at the 22 AC and W R.C.A.F. Squadron in Halifax, N.S. He was previously located with No. 1 GP Headquarters in Montreal.

S/L Duncan received his B.Sc. degree in electrical engineering from the University of Manitoba in 1948.

**W. A. Armstrong,** Jr.E.I.C., is now associated with Brown Company in Berlin, N.H.

He was previously an industrial engineer with Aluminum Company of Canada Ltd. in Arvida, Que.

Mr. Armstrong is a 1948 graduate in mechanical engineering of Queen's University.

**Phil Stamatopoulos,** Jr.E.I.C., has returned to Greece where he will be employed for at least two years.

Mr. Stamatopoulos, a graduate of McGill University in metallurgical engineering in 1949, was formerly associated with the Atlas Asbestos Company in Montreal.

**R. W. Lye,** Jr.E.I.C., is attached to the switchgear and industry control division of Canadian General Electric Co. Ltd. in Peterborough, Ont.

Mr. Lye graduated in electrical engineering from the University of Manitoba in 1949.

## Errata

**Jack C. Morris,** Jr.E.I.C., was mentioned in the January and March issues as having been associated with Canadian Copco Limited and with Carter Construction Co. Ltd. in Toronto. He has never been in the employ of these two companies.

Mr. Morris, a graduate of the University of Toronto in 1951, is a partner in the firm Speckert-Morris Engineering, with headquarters in Markham, Ont. He was associated previously with Sandvik Canadian Limited and Bailey Meter Co. Ltd.

**Merle George Brown,** Jr.E.I.C., who was recently appointed patent examiner with the Dominion Patent Office in Ottawa, was confused in the April *Journal* with **Mervyn Grant Brown,** JR.E.I.C., design engineer with the Mathews Conveyor Company in Port Hope, Ont.

Merle George Brown is a 1952 graduate in mechanical engineering of the University of Manitoba, while Mr. Mervyn Grant Brown is a 1950 mechanical engineering graduate of the University of British Columbia, and has been associated since graduation with the International Nickel Company in Copper Cliff, Ont., and with the Mathews Conveyor Company in Port Hope, Ont.

**Julius A. Krantzberg,** JR.E.I.C., is employed by Truscon Steel Company of Canada Ltd. in Montreal and is engaged in the designing and detailing of reinforcing steel for concrete.

He was previously associated with the Welland Ship Canal staff of the Department of Transport in Ottawa.

Mr. Krantzberg is a graduate of McGill University in civil engineering, class of 1949.

**O. J. Gratton,** JR.E.I.C., is now company engineer with J. D. Campbell & Company in Montreal.

He was formerly associated with Cimentationes Franki de Mexico.

Mr. Gratton received his B.A.Sc. degree in civil engineering from Ecole Polytechnique in 1949.

**Howard R. Lumsden,** JR.E.I.C., has joined the engineering division of Imperial Oil Limited in Montreal.

He was previously associated with Fraser-Brace Terminal Constructors and with the Aluminum Company of Canada.

Mr. Lumsden is a 1949 graduate in civil engineering of McGill University.

**R. J. Trafford,** JR.E.I.C., has been transferred by Dominion Tar & Chemical Co. Ltd. from Montreal to Toronto.

Mr. Trafford is a graduate in chemical engineering of the Nova Scotia Technical College, class of 1950.

**H. W. Grant,** JR.E.I.C., is plant engineer with Standard Aero Engines Limited of Winnipeg, Man.

He was previously associated with the Royal Canadian Air Force in Clinton, Ont., and in Winnipeg, Man.

Mr. Grant is a 1950 electrical engineering graduate of the University of Manitoba.

**Norman Batt,** JR.E.I.C., is now employed on the supervisory staff of the Winnipeg Electric's hydro-electric power plant at Seven Sisters Falls, Man.

He was formerly in the plant maintenance engineering department of the Ford Motor Company in Windsor, Ont.

Mr. Batt graduated in electrical engineering from the University of Manitoba in 1950.

**Donald Smith,** JR.E.I.C., has been transferred by Otis Elevator Company Ltd. from Hamilton to Ottawa.

He has been associated with this company since graduation in electrical engineering from the University of Toronto in 1950.

**P. M. Morency,** JR.E.I.C., is acting supervising engineer with the Rimouski cable project of Canada Wire and Cable Co. Ltd.

He was previously in the company's Toronto and Montreal offices.

Mr. Morency is an electrical engineering graduate of Laval University, class of 1950.

**Jas. C. Browning,** JR.E.I.C., is now refinery manager for Royalite Products Ltd. in Coleville, Sask.

Before joining this company he was employed as refinery superintendent with Refinery Operations Ltd. in Coleville, Sask.

Mr. Browning graduated in 1950 with a B.A.Sc. degree in chemical engineering from the University of British Columbia.

**Robert B. Hill,** JR.E.I.C., has been appointed industrial engineer of the Canada Iron Group of Canada Iron Foundries Limited.

He was formerly planning engineer with Taylor Forbes Limited in Guelph, Ont.

Mr. Hill received his B.A.Sc. degree in engineering and business from the University of Toronto in 1950.

**Wm. E. Blakely,** JR.E.I.C., is now party chief with the National Geophysical Company in Calgary, Alta.

Mr. Blakely is a 1950 graduate in engineering physics of the University of Alberta.

**S. G. Frost,** JR.E.I.C., has recently joined the national building code section of the building research division of the National Research Council.

He was formerly associated with Canadian Celanese Limited in Drummondville, Que.

Mr. Frost received his B.Eng. degree in civil engineering from McGill University in 1950.

**B. G. Bartlett,** JR.E.I.C., is at present an engineer with the Provincial Construction Company on the Woodward's Stores in the New Westmount Shopping Centre in Edmonton, Alta.

He was previously associated with Poole Engineering Co. Ltd. in Edmonton.

Mr. Bartlett is a civil engineering graduate of the University of Alberta, class of 1950.

**Walter S. Zaruby,** JR.E.I.C., is a mechanical engineer in the production department of the Shell Oil Company in Edmonton, Alta.

He received his degree in engineering and business from the University of Toronto in 1952.

**Clive D. McCord,** JR.E.I.C., is a well-site geologist with the Socony Vacuum Exploration Company in Edmonton, Alta.

A 1951 graduate in geology of the University of British Columbia, Mr. McCord has been associated with Link & Nauss Limited, Calgary, and with Crown Silver Mines, New Hazelton, B.C.

**R. L. White,** JR.E.I.C., until recently a graduate industrial trainee with the Allis-Chalmers Manufacturing Company in Milwaukee, Wis., is now with Canadian Allis-Chalmers Ltd. in Montreal.

He is a graduate in mechanical engineering of Queen's University, class of 1951.

**Bernard G. King,** JR.E.I.C., is employed as project engineer with B. Perini & Sons, Canada Ltd. in Ottawa.

He was formerly with the C. D. Howe Company as field engineer in the radio and electrical engineering laboratories in Ottawa.

Mr. King is a civil engineering graduate of McGill University, class of 1952.

**N. D. Ross,** JR.E.I.C., is now industrial sales engineer for Imperial Oil Limited, and is located in Lennoxville, Que.

A graduate of Queen's University in mechanical engineering in 1952, Mr. Ross was previously lubrication sales engineer with the company in Toronto.

**Lt. B. F. Simons,** S.E.I.C., is now located in Kingston, Ont., at the Royal Canadian School of Signals at Vimy Barracks.

Lt. Simons attended the Royal Military College in Kingston, Ont.

**R. L. M. Lord,** S.E.I.C., has joined Dominion Tar and Chemical Company as a process engineer.

Before graduating from Michigan

**Richard L. M. Lord, S.E.I.C.**

State College in chemical engineering in 1953. Mr. Lord was employed during the summers with Canadair Limited, Michigan State Landscaping Department, Michigan State Highway Department, and with the Canadian Pacific Railway at the Cote St. Luc yards in St. Laurent, Que.

**Wm. Bermingham,** S.E.I.C., is now superintendent of Bermingham Construction Ltd. in Hamilton. Ont.

He was previously associated with Pigott Construction Ltd. in Hamilton.

Mr. Bermingham is a 1952 graduate of the Royal Military College in Kingston.

**J. D. Henderson,** S.E.I.C., is with H. H. Angus & Associates, Toronto consulting mechanical and electrical engineers. He is presently engaged on design of ventilating and air conditioning systems for public and industrial buildings.

He graduated from the University of Saskatchewan in mechanical engineering in 1953.

**D. A. Panabaker,** S.E.I.C., is presently employed as a junior geophysicist with Western Geophysical Company of Canada at Edson, Alta. He was previously located in Virden, Man.

Mr. Panabaker graduated in civil engineering from Queen's University in 1953.

**G. Lexier,** S.E.I.C., has joined the toll switching department of the equipment engineering division of Alberta Government Telephones in Edmonton.

He was formerly associated with the Manitoba Telephone Company in Winnipeg.

Mr. Lexier graduated in electrical engineering from the University of Manitoba in 1953.

**John I. Adams,** S.E.I.C., formerly with the Preload Company of Canada in Regina, Sask., is now with Canada Gunite Co. Ltd. in Calgary, Alta.

**Ansley V. Bagnell,** S.E.I.C., is now sales engineer with the industrial division of Lounsbury Co. Ltd. in Moncton, N.B.

He was formerly associated with Modern Construction Ltd. in Moncton, N.B.

**Arthur L. Hooker,** S.E.I.C., formerly project engineer with Northern Construction Company & J. W. Stewart Limited in Goldbridge, B.C., has joined the staff of D. H. Burnett, civil engineer and British Columbia land surveyor in Burnaby, B.C.

# Obituaries

*The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.*

**Adam Cunningham,** M.E.I.C., chief engineer of Price Brothers & Company, Limited in Kenogami, Quebec, died suddenly on April 21, 1953.

Mr. Cunningham was born in Edinburgh, Scotland, on August 23, 1897. Upon completion of his general education at the George Watson College, he served a five-year apprenticeship with West End Engine Works Co. Ltd., mechanical engineers and millwrights specializing in papermaking machinery in Edinburgh. During this period he was employed in the patternshop, machineshop and the fitting and erecting shops. At the same time he received technical training at the Heriot Watt College.

From 1917 until 1920 he served with the Imperial Army, first with the R.A.S.C. mobile workshops in Palestine, and then with the Egyptian Expeditionary Force in base heavy repair workshops in Alexandria, Egypt. He was discharged with the rank of mechanical staff sergeant.

He then entered the University of Edinburgh where he received his B.Sc. degree in mechanical engineering with honours in 1923.

Upon graduation he served one year as lecturer in engineering mathematics and mechanical engineering drawing at Ramsey Technical College during the evening, and at the same time, during the day, he was employed as draughtsman with MacTaggart, Scott & Co. Ltd., hydraulic and electrical engineers at Loanhead, Scotland. In the latter position he was engaged on the design of hydraulic operating gear for dock gates and hydraulic aircraft cranes supplied to the British Admiralty.

Mr. Cunningham came to Canada and in August, 1924, joined the staff of the record department of Price Brothers & Company, Limited, Kenogami Paper Mills. Eight months later he became assistant to the mechanical superintendent of the company's Riverbend mill. Following a slow-down in Riverbend operations, due to the depression, he was transferred to Kenogami in 1933 to

Adam Cunningham, M.E.I.C.

resume his activities in the mechanical department.

He resigned this position in 1936 to accept an appointment with the Ontario Paper Company in Thorold, Ontario, but returned to Kenogami as plant engineer in 1937. He was promoted to the position of chief engineer of the paper division in January, 1944, and to that of chief engineer of the company in July, 1952.

Mr. Cunningham was very active in the civic affairs of the Lake St. John District. He was on the instructional staff of the Wartime Machine Shop Training Program, and also worked untiringly for the Hobby Shop Amateur Theatricals as well as on various committees of the Canadian Legion. He was chairman of the Kenogami Protestant School Board for many years.

Mr. Cunningham served as councillor of the Institute representing the Saguenay Branch for the term 1945-46. He joined the Institute as a Junior in 1925, transferring to Associate Member in 1927, and to Member in 1940.

**Flying Officer Kristjan Marteinn Eyolfson, D.F.C., R.C.A.F.,** JR.E.I.C., was killed in an aircraft crash about ten miles west of Shawville, Quebec on November 10, 1953.

Flying Officer Eyolfson was born in Leslie, Saskatchewan, on May 18, 1917. After receiving his general education at Rose Vale and Leslie, he enlisted with the Royal Canadian Air Force. In recognition of his outstanding service overseas, he was awarded the Distinguished Flying Cross.

Upon his discharge at the close of the war, he entered the University of Saskatchewan and obtained his B.Eng. degree in electrical engineering there in 1950.

Upon graduation he joined the Geological Survey at the Victoria Museum in Ottawa, but in April, 1951, he returned to the Royal Canadian Air Force with which he completed courses of instruction in Prince Edward Island, Texas and Florida. He was then posted to North Bay, Ontario, as an instructor in the officers' training unit, and in September, 1953, he was appointed navigator radar leader in the No. 445 All Weather Fighter Squadron, the first of its kind in Canada.

Flying Officer Eyolfson joined the Engineering Institute as a Student in 1949, transferring to Junior Member in 1952.

**Ronald Emeric Nugent,** JR.E.I.C., outside plant engineer with the Bell Telephone Company of Canada in Sherbrooke, Quebec, died on February 20, 1954.

Mr. Nugent was born at Salisbury, New Brunswick on December 14, 1929. After receiving his general education at Salisbury High School, he entered St. Francis Xavier University in 1947 where he studied for three years before undertaking civil engineering study at the Nova Scotia Technical College. He obtained his B.Eng. degree in 1952.

During the summer months of his university course he served as assistant engineer with T. C. Gorman (N.S.) Limited and as instrumentman with the construction department of St. Francis Xavier University.

Upon graduation Mr. Nugent joined the Bell Telephone Company of Canada as outside plant engineer in Sherbrooke, Quebec, which position he held at the time of his death.

Mr. Nugent joined the Engineering Institute of Canada as a Student in 1951, and was transferred to Junior Member in 1954.

# Employment Service

**THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.**

**NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.**

**REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.**

**INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.**

## SITUATIONS VACANT

### CHEMICAL

CHEMICAL GRADUATE with experience, preferably sales, in metal cleaning, electroplating and/or painting. This is a salaried position plus expenses, commission and annual bonus. Firm also provides a liberal retirement insurance an hospitalization programme. Location working out of Toronto. File No. 4783-V.

A CHEMIST WITH a B.Sc. degree in chemistry or better with good background in organic chemistry, preferably with one or two years' experience in the pulp and paper industry, but not an absolute requisite. Duties include special analytical work, experimentation on cooking and bleaching of kraft base pulp, also on development of by products. File No. 4835-V.

GRADUATE CHEMIST REQUIRED TO BE trained as assistant to chief chemist. Plant located at Cardinal in Ontario in one of Canada's oldest food industries. Forward all details of experience, education, with pictures, and anticipated salary to File No. 4837-V.

CHEMICAL ENGINEERS required for research and development department of large world wide organization with plant located in Montreal. Duties to do development work on various products made from fibres or adhesives. This work will consist of improving our present operations and finding new methods of processing. A certain amount of research work on developing new products will be undertaken. File No. 4844-V.

LECTURER OR ASSISTANT professor of chemical engineering required to give unit operations course with laboratory and design calculations course to junior and senior year classes. Time available for graduate study and research. Industrial experience desirable but not requisite Salary dependent upon qualifications. Apply Nova Scotia Technical College, P.O. Box 1000, Halifax, Nova Scotia. File No. 4851-V.

### CIVIL

CHIEF ENGINEER and director required by structural engineers Toronto. Applicants must be structural engineers specialized in design and full control of drawing office for many years in position of entire responsibility for the design of work of great magnitude in both reinforced concrete and structural steel. Suitable age between 35 and 45. File No. 4785-V.

CIVIL ENGINEER required by private consultant located in Ontario. Requirements are at least five years experience engineering. Preference will be given to applicant having commission as land surveyor. Salary $4,500.00. Please state age, education and experience to fullest extent and ability. File No. 4786-V

RECENT GRADUATES IN civil engineering for employment in Southern Ontario as sales representatives of national manufacturer and erector of steel construction products. Preparatory training course provided. File No. 4793-V.

REQUIRED GRADUATE civil engineers for specialized work in soil mechanics and foundation engineering. Graduate soils work desirable. Locations: Montreal and Toronto with some travelling. File No. 4794-V.

THE COMMUNITY PLANNING ASSOCIATION OF CANADA invites applications for the principal staff position in its national office. Applicants should have a general knowledge of community planning and municipal affairs, and must have an ability to prepare information and publications on planning subjects in non-technical language. Applicats need not possess professional qualifications as planners. The salary will be commensurate with the qualifications and experience of the person appointed File No. 4800-V.

GRADUATE CIVIL ENGINEER wanted for municipal work in Alberta and Saskatchewan. Please submit details of experience and when available. Experience in water and sewer utility construction preferred. File No. 4811-V.

CIVIL ENGINEER required for Ontario Government to take charge under direction, of the administration of The Provincial Aid to Drainage Act throughout the Province. Should have experience with land assessments and understand the municipal drainage act. Position requires mostly office administration work, but some contact work with municipal officials throughout the Province is required. Full employee privileges available, including three weeks vacation, a day and one-half per month illness credit, and superannuation. Interested parties should apply in own handwriting giving full particulars of age, education and especially experience in the type of work to be performed. Salary can be set to suit qualifications of successful applicant. File No. 4812-V.

CIVIL ENGINEER. Registered professional engineer with experience in municipal engineering required by firm of consulting engineers. Applicants must be capable of making detailed designs and supervising field crews. Work will be in Alberta from Edmonton office. Address all applications giving full details of qualifications, experience, references and salary required to File No. 4814-V.

STRUCTURAL ENGINEER with a few years experience for consulting office in Montreal. Inside and outside work, design, calculation, drawing and supervision. File No. 4825-V.

CIVIL ENGINEER, University graduate in civil engineering of at least three years experience after graduation, capable of performing under general supervision the following work: Preparation of reports, hydraulic investigations, structural analyses, design of dams, pipelines, tunnels, surge tanks, power houses and similar structures, supervise draughting and undertake same where required. Previous experience in hydro-electric field desirable. Location British Columbia, salary range $325-$475.00 per month. File No. 4828-V.

APPLICATIONS FOR THE POSITION OF TOWN ENGINEER, for the Town of Dauphin in Manitoba, population 6500. Engineer to have charge of construction and maintenance of streets and sidewalks, gravity water system and sewage disposal plant. Applicants will require to state qualifications and experience, furnish references and state the earliest possible date on which duties will be assured. File No. 4829-V.

CIVIL ENGINEER required for bridge design in a large transportation company with headquarters in Montreal. File No. 4850-V.

### ELECTRICAL

SALES ENGINEER required by well established and highly respected company in the field of scientific illumination. Duties, after a specific training period of approximately two years duration, will involve the sale of prismatic lighting units and the discussion of lighting applications with architects, consulting engineers and electrical contractors, officials of industrial and commercial firms, municipal and hydro offices. Qualities of personality, diligence, and dependability along with a sincere desire for a permanent career in the lighting industry are of prime importance. File No. 4807-V.

ELECTRICAL ENGINEER, university graduate in electrical engineering with at least two years experience after graduation, capable of performing under general supervision the following work: Planning, and design of high voltage switching and transformer stations and electrical portion of generating stations, both hydro and diesel, specification of electrical apparatus and preparation of bills of material; supervise draughting and undertake same where required. Previous experience in electrical power apparatus, relays etc., and their application with utility or at manufacturer's factory desirable. Location British Columbia. Salary range $300-$475.00 per month. File No. 4828-V.

ELECTRICAL ENGINEER, university graduate in electrical engineering for investigation and design under supervision of electrical transmission and distribution systems. Work consists of:

field surveys and reports on distribution projects, engineering planning, preparation of cost estimates and bills of material, and general routine having to do with transmission and distribution projects. This is a junior position offering good opportunity for experience in transmission and distribution engineering. Location British Columbia. Salary range $250-$325.00 per month. File No. 4828-V.

ELECTRICAL ENGINEER required, preferably with aviation experience. The work will consist of designing modifications to aircraft power supply and control systems, dictated by airline service and maintenance requirements. It will further include the supervision of drawing preparation and the writing of modification instructions for the maintenance department. The job will include periodic report writing, equipment surveys, the writing of test schedules and general, service and liaison for the various departments within the company. Job is of a permanent nature with the salary range depending entirely upon the qualifications of the applicant. File No. 4833-V.

ELECTRICAL ENGINEER bilingual, required for system planning studies of rapidly expanding utility located in P.Q. Duties will involve problems of distribution, transmission and hydraulic generation. Educational requirements: graduation in electrical engineering, from a recognized university and from 3 to 7 years experience preferably in a utility or allied field. Employee benefits include: pension, group insurance, and hospitalization plan. In reply please give age, marital status, summary of experience and salary required. File No. 4781-V.

GRADUATE ELECTRICAL ENGINEER required for new plant in Ontario. Applicants should have experience in the telephonic communications field. Company is engaged in the manufacture of telephone dial switching equipment and associated apparatus such as telephone relays etc. The work involves the following detailed engineerings. The preparation of specifications detailing each item of equipment to be supplied for a particular installation. The preparation of exchange drawings to be used by installers in the installation of equipment. File No. 4784-V.

ELECTRICAL ENGINEER required by paper company located in Eastern Canada. Young graduate with some experience not necessarily in paper mill. File No. 4799-V.

ELECTRICAL APPLICATION ENGINEER to specify and aid electric utilities in selection of a wide range of distribution power and other electrical apparatus. Work will include high voltage system studies, relay studies, distribution studies, preparation of proposals and specifications, and conference work on application problems with generating and distribution electric utilities. A sound engineering background and some years of experience required. Experience in selling would be a definite advantage. Location would be Southern Ontario but should be willing to travel. File No. 4847-V.

### MECHANICAL

PROFESSOR OF MECHANICAL and head of mechanical engineering department required by the University of Roorkee founded in 1949 as the first technical university in India. Roorkee is about 100 miles north of Delhi. Applicant should be a mechanical engineer with a sound background of modern mechanical science. He should have a high academic qualification preferably Ph.d. or D.Sc. The direction of specialization is not important. Age preferably not under 38-40 years. Duration of appointment minimum two years preferably three. Living accommodation provided and free medical attention. File No. 4780-V.

INSTRUCTOR OF MECHANICAL engineering to teach mechanical drawing and assist in mechanical engineering laboratory courses. Preference will be given to an applicant with experience in the field of machine shop practice and industrial engineering, who would have an opportunity to develop courses in this field. Location University of B.C. Vancouver. File No. 4791-V.

MECHANICAL ENGINEER required by plant engineering branch of large research organization at Ottawa. Applicants should be B.Sc. graduates in mechanical engineering with at least three years' experience in the design of heating and ventilating of offices and industrial buildings. Duties include the preparation of drawings and specifications for heating and ventilating, and the assistance in the design, layout, and adjustment of refrigeration and air conditioning equipment. Initial salary up to $5750 depending on qualifications. Apply by letter giving full details of education and experience. File No. 4798-V.

MECHANICAL ENGINEER as assistant superintendent required in a modern yarn spinning mill in the City of Granby, Que. The position calls for the services of a mechanical engineer between 24 to 32 years of age who is primarily interseted in production and plant engineering. Previous textile experience is not necessary but manufacturing experience including staff supervision would be of advantage. Complete details of the position will be provided during a personal interview. Applicants are requested to outline their qualifications in detail, incorporating in their reply their home address and a telephone number through which they can be contacted during the day. File No. 4802-V.

MECHANICAL ENGINEER $6,420 to $7,200 Department of Public Works, Ottawa. Details and application forms at your Civil Service Comm. Office, National Employment Office, Post Office and University Placement Office. Quote competition No. 54-1202. File No. 4805-V.

SALES ENGINEER for field work to represent manufacturers agency selling original and maintenance equipment used in mines, paper mills and heavy industry. Company operating in Northern and Northwestern Ontario, also Northwestern Quebec. Progressive training for suitable applicant. Technical, mechanical maintenance or mill experience desirable. Submit record of education, experience, references and photograph, to File No. 4803-V.

PROFESSIONAL ENGINEER preferably mechanical but not necessarily required by real estate organization. Age 40 to 50 years with experience where work would result in the greatest general knowledge of different types of industry, or allied work. Ability to meet and sell senior industrial executives Group commission plan. Applicant will be trained to become assistant manager of the department. Location Toronto, a knowledge of the Toronto area would be helpful. File No. 4821-V.

MECHANICAL ENGINEER REQUIRED by architectural firm in Winnipeg. Must be able to handle design for heating, ventilating and plumbing equipment for a wide range of building types Excellent opportunity with a young progressive firm for the right man. Write giving full details of training and experience. File No. 4826-V.

ENGINEER REQUIRED BY large beverage company located in Montreal with experience in all types of material handling. Top salary to right man with all benefits. Mechanical preferred, age 35-45 years, bilingual if possible. File No. 4834-V.

MECHANICAL SALES ENGINEER wanted by substantial American company manufacturing wrought iron pipe, flat rolled products, electric alloy steel. Applicant should be bilingual, between 25 and 35 years of age in a liaison capacity to discuss specification creations with architects and consulting engineers. Applicant should have a mechanical engineering degree or engineering background and must own a car. Excellent opportunity for qualified man. Salary commensurate with qualifications. File No 4841-V.

DESIGN ENGINEER WITH minimum eight years' experience in gear design and automotive transmissions. Age 45 or under. Must be creative and willing to do actual design work on board. File No. 4842-V.

DESIGN ENGINEER WITH minimum eight years experience in the design of farm tractors or other farm equipment. Age 45 or under. File No. 4842-V.

DESIGN ENGINEER WITH minimum eight years' experience in the design of internal combustion engines, preferably as applied to tractors. Age 45 or under. File No. 4842-V.

DESIGN ENGINEER with minimum eight years' experience in hydraulics preferably as applied to tractors. Age 45 or under. File No 4842-V.

PLANT FACILITIES ENGINEER required for a major appliance manufacturer. Graduate mechanical engineer with a minimum of 3 years machine design and a sound knowledge of electrical welding and substations. A challenging position is offered to a person capable of initiating and carrying through cost reduction, machine and process improvement including working with maintenance supervisors on installation and maintenance. Age to 45. Salary commensurate with ability. File No. 4845-V.

POWER PLANT EQUIPMENT sales engineer, mechanical graduate of Canadian university, wanted to form own company to sell and later to assemble in Eastern Canada, power plant controls and instruments. Prominent American manufacturers launching extensive expansion program of sales and service in Canada. Several years experience in sales to power plants or in operating steam plants essential. Any personal capital advantageous. File No. 4849-V.

### MISCELLANEOUS

MACHINERY MANUFACTURERS' agents require sales engineer preferably bilingual to cover Quebec and S. Ontario. In applying indicate knowledge of previous sales experience and territory covered. File No. 4776-V.

THREE ENGINEERS REQUIRED by manufacturer of multiwall kraft bags and related paper products, 1954 graduates to 6 years experience. Training period in Montreal. Subsequent work in variety of locations. File No. 4777-V.

CHEMICAL OR MECHANICAL engineer required for coal preparation research. Experience in coal cleaning, especially with driesson cyclones and dense media desirable but not essential Starting salary will depend on training and experience and will be in a bracket of $4,000 to $5,000 per annum plus cost of living bonus based on the consumer's index. The present bonus approximates $300 annually. Apply with all particulars recent photo and addresses for reference. File No. 4778-V.

ENGINEER REQUIRED BY manufacturer located in Maritime Provinces planning to enlarge research facilities. Applicant should have been connected with the chip board companies in Europe and have sufficient technical knowledge and related experience to proceed along certain lines of development. File No. 4782-V.

POWER PLANT ENGINEER required by large industrial concern near Montreal to take care of high pressure steam plant turbo-generators and refrigeration. Only those having both practical experience and technical knowledge need apply. State age, experience, and salary expected. File No. 4795-V.

SALES ENGINEER required to join a small progressive company located in Montreal. Experienced in the field of aircraft, radio, instruments, electrical accessories or oxygen equipment. Permanent positions. Apply outlining qualifications and salary expected. File No. 4796-V.

DESIGN ENGINEERS, experienced in the engineering design of aircraft instruments and accessories or equivalent industrial products, required to join a small progressive company located in Montreal. Excellent working conditions and benefit plans. Apply outlining qualifications and salary expected. File No. 4796-V.

GRADUATE ENGINEER to fill the position of Plant Engineer, and should have some product design and cost estimating experience. Plant maintains press, foundry, plating, wire forming, etc. facilities. Location Province of Quebec. File No. 4797-V.

CHEMICAL OR MECHANICAL ENGINEER with from two to five years experience on industrial maintenance work. The position is in the maintenance department working as a project engineer on projects on the maintenance of the buildings and equipment of the plant, including some design work in the nature of alterations and improvements. Location P.Q. File No. 4803-V.

SENIOR DESIGNER required for work on steam boilers and associated equipment. Applicants should have 3 to 5 years recent experience in this field. The work will include the detailed handling of contracts, and the design work necessary for the preparation of proposals and specifications. The applicant should be conversant with heat transfer as it relates to steam power equipment. A knowledge of work on pressure vessels and heat exchangers will be desirable. Location Toronto. File No. 4810-V.

QUALITY CONTROL SUPERVISOR required in Montreal. A Canadian manufacturer of fibres, adhesives and plastics is seeking a graduate engineer with industrial experience in quality control and knowledge of statistical methods. This key position with a future requires a man with ability to plan, organize and supervise all of our quality control activities and to carry out liaison work with our American parent companies. Bilingual required. Salary will be negotiated. All inquiries and applications will be treated in confidence.. Please send a complete resume of your educational background, work experience, personal data and references etc. to File No. 4813-V.

FEDERAL CIVIL SERVICE requires a number of engineers for employment as patent examiners at Ottawa to undergo training in patent law and patent regulations in force in Canada, and then to assume the responsibility for the examination of applications for patents in the field of engineering with a view to making recommendations for the award or denial of patents. The desirable qualifications include a bachelor's degree in applied science with specialization in mechanical, chemical or electrical engineering from a university of recognized standing. File No. 4815-V.

ENGINEERS ARE REQUIRED by the International Economic and Technical co-operation Division, Ottawa Canada for the government of India. Mechanical and Civil graduate engineers with particular experience in connection with hydroelectric design, preferably for high dams, having had responsible charge of the work of design groups involving supervision of planning and scheduling work of subordinates and of the execution and adequacy of designs. The Bhakra-Nangal project is a multi-purpose river valley development scheme for harnessing Sutlej River waters to extend irrigation. File No. 4817-V.

SALES ENGINEER required by a growing organization in the compressor and compressed air equipment field. Area would be South Central Ontario. Straight salary basis. File No. 4818-V.

U.N.E.S.C.O. HAS BEEN requested for assistance in recruiting suitable candidates for vacant university professorships abroad. Burma: agronomic chemistry and soil chemistry. India: economics, civil, mechanical and electrical engineer. Indonesia: technological subjects. Israel: Hydraulics and/or sanitary engineering, electrical (Electronics and telecommunication), mechanical, mathematics, general mechanics, and oscillations, metallurgy, aircraft structures, aircraft propulsions (applied aerodynamics). Turkey: electro-technics hydraulics (power), roads and communications, construction and building materials. Uruguay: construction of buildings. Venezuela: roads and communications, hydraulics (construction). building material and soils. File No. 4819-V.

MANUFACTURER of complete line of industrial, electrical motor control equipment has just completed a new plant in Galt, Ontario. Competent sales engineers are required for Ontario and Quebec territories. Applicants should have electrical, mechanical or engineering business training. File No. 4820-V.

SALES ENGINEER is required by a prominent Canadian electronics manufacturer. This man must be a recent graduate in physics, engineering physics or chemistry and have sales experience or aptitude. The product is a wide range of high quality electronic research and control equipment and the sales territory includes all Quebec industrial centres with headquarters in Montreal. Reply should include details of age, experience and education. A recent photograph should be included if possible. File No. 4822-V.

ENGINEER REQUIRED WITH experience in methods and standards. Applicant should have a good technical and work shop training with a knowledge of time study. Location Ontario. Manufacturer of machine tools. File No. 4823-V.



THE PAKISTAN INDUSTRIAL DEVELOPMENT Corporation invites applications for position of works manager for their paper mills at Chandraghona. File No. 4827-V.

INTERMEDIATE DRAUGHTSMAN; STATION ELECTRICAL. Draughtsman capable under moderate supervision of working up final electrical station arrangements from engineering sketches, preparing bills of material, switchboard and similar wiring diagrams, and selection of cable and conduit to code requirements. Work includes general arrangement and electrical drawings for hydro and diesel generating stations, substations. Requires draughting ability and basic familiarity in arrangement and wiring of electrical apparatus. Location British Columbia. Salary range $200-$275. per month. File No. 4828-V.

JUNIOR DRAUGHTSMAN; Station Electrical. Draughtsman capable under supervision of carrying out work or parts thereof described above for intermediate draughtsman. Requires some experience in electrical wiring diagrams. Location British Columbia. Salary range: $150-$200 per month. File No. 4828-V.

SENIOR DRAUGHTSMAN: for structural and civil. Draughtsman capable of working up final design drawings from engineering sketches and preparing bills of material for structural and civil projects. Where required he shall be capable of checking or supervising the work of other draughtsmen. Work includes arrangement and details of dams, penstocks, power plants, buildings, etc., including detailing of structural steel, reinforced concrete and piping. Also plotting of maps from field notes. Requires good draughting ability and sound knowledge of work. Location British Columbia. Salary range: $250-$325 per month. File No. 4828-V.

INTERMEDIATE DRAUGHTSMAN: for structural and civil. Draughtsman capable under moderate supervision of carrying out the work or parts thereof described for senior draughtsman. Requires draughting ability with fair knowledge of work. Salary range: $200-$275 per month. Location British Columbia. File No. 4828-V.

MEMORIAL UNIVERSITY OF NEWFOUNDLAND, St. John's, invites immediate applications for the following position to take effect in September, 1954. Assistant or assistant professor in the Department of Engineering. The duties would include lecturing and laboratory supervision. The subjects of instruction are drawing, surveying and mechanics. The university has a liberal pension scheme and a generous sabbatical leave programme. Appointments are provisional for the first two years. Travel expenses to a maximum of $750.00 will be paid. Immediate applications or requests for information should be sent by airmail with curriculum vitae and names of three references. File No. 4830-V.

THREE DESIGN engineers required by department of Transport Ottawa. Structural, electrical, mechanical to design and develop program for new airport terminal buildings, across Canada, and also modifications to existing terminal buildings. File No. 4832-V.

MECHANICAL OR CIVIL engineer with a minimum five years up to ten year's experience to undertake work supervising installations, etc., which would be engineered in our engineering department. File No. 4835-V.

CHEMICAL OR MECHANICAL ENGINEER required by the research department of a large organization. Excellent opportunity for a progressive engineer who is interested in acquiring a sound industrial training and is capable of eventually assuming a responsible position. Preference will be given to an engineer with one to three years practical experience in an engineering or research field. Please write giving full details including experience, age, references, etc File No. 4836-V.

SENIOR PLANNER REQUIRED by suburban planning board, London, Ontario, for preparing physical phases of comprehensive plan and supervising routine subdivision and zoning work. Graduate in planning, civil engineering or architecture preferred. Salary in accordance with experience and training. State qualifications, references and salary expected to File No. 4838-V.

PATENT FIRM long established in Ottawa has a vacancy for young engineer, preferably chemical or electrical. Some experience in patent matters is desirable but not essential. Replies should outline qualifications and experience and should state age and marital status. File No. 4839-V.

THREE TECHNICAL SALES TRAINEES required to understudy various positions throughout the sales organization which include inside representative, field salesman, technical serviceman, sales administrator. Graduate from Canadian university '52, '53 or '54 Location Toronto initially, could be located in any one of six major Canadian cities. File No. 4840-V.

SALES DEVELOPMENT engineer, mechanical, civil or metallurgical required for sales force of long established fabricating plant. Experience in pulp and paper mill or mining field an asset. Location Montreal with considerable travelling. File No. 4843-V.

CHEMICAL OR MECHANICAL ENGINEER, recent graduate required by oil company in Montreal. Age limit 25-32. Preferably bilingual and car owner. Salary depending upon qualifications. File No. 4846-V.

ENGINEERING LIBRARIAN required to operate technical library with staff of seven, serving aircraft engineering department of 750 personnel. Applicants should have an aeronautical engineering degree or the equivalent aeronautical engineering experience, library training and direct experience in the operation of a technical library. Replies should indicate training and experience in detail, and salary requirements File No. 4848-V.

RESEARCH ENGINEER required by Saskatchewan Department of Mineral Resources, $326-$397 per month. Recent graduate in ceramic, chemical or geological engineering; to carry out lab. and pilot scale experimental work, field exploration, and economic surveys dealing with the non-metallic or industrial minerals of the province. Good pension plan and conditions of employment. For further information and application forms contact the Public Service Commission, Legislative Building, Regina. File No. 4852-V.

## SITUATIONS WANTED

BILINGUAL MECHANICAL INDUSTRIAL graduate engineer, age 42, with personality and experience, presently employed. Seeks opportunity where diplomatic ability, technical knowledge could be used in supervisory capacity. All offers considered. File No. 140-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc. (E.E.) McGill 1950, age 26, single, bilingual, C.G.E. test course graduate, 6 months transformer designs, 2½ years assistant electrical superintendent on construction of industrial plant. Desire work of permanent nature with responsibilities commensurate with experience. File No. 385-W.

CIVIL ENGINEER AND land surveyor, M.E.I.C., 26 years of varied experience abroad and Canada, in: railroad, airport, road, dam, watersupply, irrigation, building, factory construction and related survey layouts and location. In charge of survey parties and supervising and directing construction. Service with the Royal Engineers in the Middle East and East Africa. Married, bilingual. Seeks responsible position in Ontario or Quebec, where experience will be of value. File No. 489-W.

ELECTRICAL ENGINEER, Jr E.I.C., B.Eng. (McGill '50), age 26, married, since graduation employed by firm manufacturing pulp and paper mill machinery with experience including design, production and engineering sales. Desires responsible position with electrical firm offering an opportunity to specialize in the electrical power field. Location Montreal preferred but will consider locating anywhere in Canada. File No. 730-W.

STRUCTURAL STEEL DETAILER REQUIRES immediate employment anywhere in Canada; now in Toronto. Long term preferred, short term accepted. Have capacity for checking, supervision, estimating, and sales. Contract tenders submitted. M.E.I.C., P.Eng. (Que.) File No. 1935-W.

GRADUATE ENGINEER, B.A.Sc., M.E.I.C., P.Eng (Ont.), seeks technical development work as assistant to works manager or chief engineer of medium sized company. Experience includes office work and training course with Canadian electrical manufacturer, for years in Canadian patent office, and ten years varied work on technical phases of design, development and manufacture of domestic refrigeration and other products. Recent aptitude testing confirms suitability for this type of work. Present earnings $7,500. File No. 1958-W.

MECHANICAL ENGINEER, M.E.I.C., with apprenticeship and university background available for responsible position, on reasonable notice. Interested in representing manufacturers wishing to develop and service markets in Canada or abroad. Experience includes design, construction and maintenance in the pulp and paper industry; several years handling sales of power plant equipment. Working knowledge of French and German. Free to travel. File No. 2642-W.

PUBLIC UTILITY ENGINEER, nine years experience, water, hydro, gas, sewerage. Present contract expires June 1954. Supervising $3 million project including preparation rate structure, construction, design, purchasing. Canadian, aged 40, married. B.A.Sc., M.E.I.C., C.E., P.Eng. Desires position as public utility engineer or staff consultant anywhere in Canada. File No. 2466-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng. (Que.), 8 years experience including 3½ years with a telecommunications manufacturing concern, checking mechanical design, supervision of prototype work and liaison with factory. Interested in obtaining position with responsibility and scope for advancement, preferably in electronic or allied industry. Apply in writing to File No. 2829-W.

MECHANICAL ENGINEER, graduate 1944, single, age 34, with experience in mechanical and industrial engineering. Administrative and supervisory experience with responsibility at management level. Assistant plant manager, maintenance supervisor, plant engineer and industrial engineer in welding industry, heavy equipment, printing industry. Cost study, wage incentives, production control, plant layout, and time study. Seeking opportunity to join progressive firm in engineering, production or plant. File No. 2920-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P. Eng., B.Sc. (EE) Manitoba 1950, age 30. married, one child. 1½ years experience on induction motor design. Over 2 years experience in the supervision of transformers. Also gained experience in the specifying and supervision of installation of new testing equipment. Interested in securing a responsible position in Western Canada with either a manufacturing firm, a utility, or a governmental branch, preferably in Regina or Winnipeg. Available on one month's notice to present employer. Complete qualifications upon request. File No. 3309-W.

GRADUATE MECHANICAL ENGINEER, Sask. 1948, Jr.E.I.C., married, R.C.A.F. veteran. Three years experience in production control, method analysis, time study, cost control and industrial relations. Also some experience in steel mill maintenance. Three years experience on construction jobs supervising mechanical installations including heating, ventilating and plumbing trades, boiler installation, water treatment and mine installations. Desires position with firm requiring above mechanical experience and/or opportunities for design with consultant firm, preferably in central Canada. File No. 3516-W.

MECHANICAL ENGINEER, Jr.E.I.C., P. Eng., B.E. 1950, single, age 27, bilingual, presently employed as assistant chief engineering draughtsman with wide responsibilities, 30 months diverse experience prior to graduation in pulp and paper and automotive industries. Seeking position with increased responsibility, would consider overseas assignment. File No. 3931-W.

MECHANICAL ENGINEER, Queen's 1944, M.E.I.C., P.Eng., married, age 34, eight years experience as plant engineer, including planning, design, erection and maintenance on process steam, refrigeration, air conditioning systems, seeks employment in plant engineering, preferably, but not necessarily, in smaller city or town in Ontario or Western Canada, with growing company. References include present employer. Available for interviews and employment June 15th. File No. 3935-W.

MECHANICAL ENGINEER, Jr.E.I.C., P. Eng., 1950 honours graduate, age 27, married. One year's experience in the operation and administration of a small railway system including some supervision of personnel. Three years experience on layout and design of machinery utilizing air, hydraulic and electrical power supplies, and the setting up of controls for same. I have been responsible for the planning, layout, design and field installation of equipment in several large plants. Interested in a position involving design and development work, production engineering or plant engineering with the opportunity to take on responsiblity. File No. 3975-W.

EMPLOYERS are you looking for a potential future executive in production or management? Ambitious professional engineer (electrical) with the following qualifications desires change of employment with future possibilities of primary importance McGill 1951, age 26, married, C.G.E. test course, wire and cable engineering, presently employed as assistant project engineer with large chemical manufacturer. File No. 4014-W.

ENERGETIC YOUNG civil engineer, M.E.I.C., P.Eng., single. Varied heavy construction experience: pulpmill, steam and diesel plants, docks, houses, barracks, hangars, runways, highways, sewer and water systems, surveying. Finishing assignment as resident engineer on $16,000,000 project. Available for responsible position, field or office. File No. 4015-W.

CHEMICAL ENGINEER, McGill 1950, Jr. E.I.C., P.Eng., 3½ years experience in control, development and operation. Desires permanent position with promising future. Development work preferred, but would consider other offers. File No. 4042-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.A. Sc., U.B.C. 1950. Age 29, married, 2 children. Two year graduate training course with large electrical manufacturer. 14 months pulp and paper experience including maintenance and new installations. Desires position with more responsibility. File No. 4153-W.

CHEMICAL ENGINEER, Queen's 1949, Jr.E.I.C., veteran, 33, married. Three years supervisory experience in the development, control and production phases of a large chemical plant. Desire the same type of experience in another manufacturing field. Canadian or Foreign. File No. 4166-W.

CIVIL ENGINEER M.Sc., M.E.I.C., P.Eng. (Ont.), graduated 1947 is available. First class designer of all types of modern structures, inventive, enterprising and with flair for structures involving complex statical problems. File No. 4173-W.

MECHANICAL - CHEMICAL ENGINEER, (M-Eng. - Dresden-Karlruhe) M.E.I.C., P.Eng. Former lecturer at McGill. 15 years experience as plant engineer and assistant manager in heavy industrial and chemical plants. Process and design for chemical plants. Bilingual. Single. Location anywhere. File No. 4183-W.

CIVIL ENGINEER B.A.Sc., P.Eng., Jr.E.I.C., seeks position with contractor or manufacturer. Five years concentrated experience civil and mechanical design, estimating, supervision. Am interested in position with opportunities in Ontario. Presently employed. Available upon reasonable notice. File No. 4191-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng., McGill 1951, power option, seeks employment in construction or manufacturing line. Maintenance and construction experience. Presently employed as resident electrical engineer on large project for a firm of consulting engineers. Location no object. File No. 4202-W.

ELECTRICAL ENGINEER B.A.Sc. (UBC, 1951), age 29, experience: design and devlopment of induction motors, power stations, high voltage switchgear, surveys of manufacturing and test facilities, training course with large manufacturer; desirous of improving present position; supervisory, administrative, junior executive jobs preferred. File No. 4239-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng. (Que. & Ont.), married, age 30, presently employed, with 8 years experience ranging from construction of residential, industrial and commercial bldgs.; design of timber structures including glue laminated members; considerable purchasing cost accounting, job liaison, estimating, and responsibility for complete execution of contracts, desires position where diversified abilities may be best utilized leading to future advancement in responsible position. File No. 4244-W.

GRADUATE MECHANICAL ENGINEER, married, with family, requires employment. Diversified industrial experience. Purchasing, maintenance and machinery shop practice. Sound business training. Experience includes heating, sheet metal industries and general machinery equipment. Bilingual. Has good personality, enthusiastic, keen business acumen. Desires employment on production, sales or engineering administration. Location Montreal area. Available immediately. File No. 4300-W.

MECHANICAL ENGINEER, B.Sc. university of Saskatchewan 1950. Jr.E.I.C., age 28, married. Have been doing plant engineering work since graduation. Desire position with opportunity, location not important. File No. 4328-W.

CHEMICAL ENGINEER, 1945 graduate M.E.I.C., P.Eng. (Ont.) with several years work in anodizing, lacquering, plating, plastic and metal-spraying, phosphatizing, electropolishing. Particular consideration of corrosion problems in the chemical beverage, textile industry. Has practical experience in managing as well as laboratory work in the field of analyzing and material testing. Did extensive research on chemical durability of lacquers and on adhesion of metals and paints on aluminum and steel. Desires a position in a plant or in a developing and research laboratory. File No. 4359-W.

CIVIL ENGINEER, B.E. (National University of Ireland), Jr.E.I.C. Two years experience in structural steel design; 6 months with Canadian structural firm; also worked for short time on traffic survey. Presently employed (Montreal) in job requiring very little engineering training Desires position offering experience in varous branches of municipal engineering. Taking course leading to A.M.I. Mun.E. Location of little importance; available on reasonable notice. Age 23, married. File No 4401-W.

CIVIL ENGINEER, B. of Sc. in Eng., M.E.I.C., P.Eng., Danish citizen, age 46, married. Seeks responsible position with future possibilities. Over twenty years experience in all sorts of heavy construction: roads, concrete pavings, excavation, dikes, sewers. Reinforced concrete: bridges, piles, buildings, hangars. Design. Fully familiar with administration and thoroughly experienced in preparation, organization and supervision of construction. Preferably in larger city. Available on approximately one month's notice. Future possibilities will be considered more than starting salary. File No. 4409-W.

MECHANICAL ENGINEER, B.Sc 1st class hons. Ph.D. (Durham), G.I. Mech.E., married, age 24. Recently arrived from England, seeks position in development or production. Experience includes 18 months in general engineering and 3 years supervision and direction of a research project in the field of applied thermodynamics. Training includes stress analysis, gas and fluid dynamics and industrial management. Has also had experience in writing and editing reports an publications. Available immediately, location anywhere. File No. 4417-W.

CIVIL ENGINEER, D.L.C. Hons. (Civil Engineering), M.E.I.C., P.Eng., (Ont.), Grad. Inst. Struct. Eng., awaiting election to A.M.I.C.E., age 28, single. 6 years experience on construction of dry dock and deep-water quay, power station, airfields, bridges, roads and railways, survey, design of steel-pile cofferdams, track layout and construction schemes. Responsible for supervision of layout, construction, concrete inspection, pile-driving, underwater drilling, pressure grouting, test boreholes, diving operation, measurement of quantities and cost reports. Presently employed as area engineer on construction of chemical plant. Desires positioan of responsibility suitable to past experience. Location, anywhere in Canada. File No. 4420-W.

ADMINISTRATIVE ASSISTANT, B.Eng., Jr.E.I.C., McGill 1952, age 26. Experience includes time and methods study, job classification and plant engineering. Presently graduate student in business administration at University of Toronto. Desires position as staff assistant to an executive in a company in Toronto. Available in May. File No. 4421-W.

MECHANICAL ENGINEER, bilingual, M.E.I.C., P.Eng., age 41, M.Sc. 1938, veteran, presently employed. 16 years diversified technical experience in Air Force and industry, including 6 years Canadian experience in design and maintenance of steel mill equipment, structural steel, piping, handling equipment, transmissions, plant layouts, reinforced concrete, building, etc., desires position requiring initiative, organzing and supervisory ability. File No. 4425-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Eng., Nova Scotia Technical College 1952. Age 28, married, one child. Presently engaged as electrical inspector with corps of engineers, U.S. Army on defence projects in Labrador. Duties include diesel and steam power plants, power transmission and distribution facilities and the installation of electrical equipment in connection with extensive P.O.L. distribution Have open mind regarding position offered. Foreign location preferred. Available upon reasonable notice to present employer. File No. 4428-W.

CIVIL ENGINEER GRADUATE (B.Sc. St. Andrews University, Scotland) 1953, with some field experience, desires position anywhere in Canada. File No. 4429-W.

ENGINEERING PHYSICIST M.Sc (Physics) Delft U. (Netherlands) 1950, B.Sc. (Electrical Engineering) 1936, 7 years service and sales engineering of medical X-ray equipment, 2 years development of X-ray tubes, 3 years electrical and electronic instrumentation in university lab, 4 years representation of large European manufacturer of radio and electronic equipment, electron tubes and electronic components in national and international electro technical standardization committees. Experienced secretary of international technical conferences, good specification writer, fluent English and German, working knowledge of French. Married, three daughters. Detailed resume on request. Interview preferably in first week of April. Location Western Canada or Southern Ontario. File No. 4430-W.

ELECTRICAL ENGINEER, Jr.E.I C., B.A. Sc., University of British Columbia, 1951. Single, age 35. Seeks position in communications in British Columbia. Two years experience in meteorology and marine and aviation radio communications prior to graduation. Post graduate experience; 1¾ years of development, production, and maintenance engineering in quartz crystals manufacture; 1 year development work on microwave equipment. File No. 4431-W.

MECHANICAL ENGINEER, P.Eng., G.I. Mech E., single, age 27. Experience: 2 years general workshop practice including overhaul of steam and diesel engines and factory machinery repair. 18 months machine and structural design and draughting. Desires work on production or plant maintenance in Montreal or B.C. File No. 4436-W.

ELECTRICAL ENGINEER, M.E.I.C.| P.Eng Age 32, married, bilingual. Seven years varied experience in electric generation and distribution. Some familiarity with relays Good mathematical background. Desires opportunity to train as relay engineer with large utility. Would consider attending G.E. or Westinghouse relay course and willing to sacrifice for this opportunity. Location no object. File No. 4437-W.

ELECTRICAL ENGINEER, M.E.I.C., A.M.I.E.E., British, 37 years of age, with considerable experience in the design and development of naval and associated installations, also in testing of all types of shipboard equipment and preparation of test programmes, data, etc.; and also having considerable experience of servo mechanisms and other remote control devices, including railwaypower signalling systems; having been responsible at various times for preparation of specifications, quotations, purchase orders, estimates, etc.; and having supervised the activities of junior engineers, draughtsmen, technicians and electricians in various capacities; seeks a lucrative and responsible post in August 1954. Will serve anywhere, and would be fully prepared to travel extensively, if necessary. Seeking a post which will lead to a senior position and permanency. File No. 4441-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., married. 20 years experience industrial equipment layout, mills crushing plants, smelters, handling equipment, design and supervision of design and construction. Two years plant engineer. Location preference Toronto area. Desires position in engineering office as supervisor or assistant in plant layout and design. File No. 4442-W.

CIVIL ENGINEER, M.Sc., 1931, technical University of Warsaw, A.M.I.San.E., war veteran, age 48, 15 years experience in hydraulic works, water supply and sewerage, formerly residing in Great Britain and nearly one year in Canada. Seeks position with a municipality or a firm which offers a good opportunity for advancement. Location secondary, available in two weeks notice. File No. 4443-W.

MINING ENGINEER, P.Eng. in Alberta, M.E.I.C., Jr.C.I.M.M., graduate 1951, age 30, married, veteran Practical experience in steel work in shipyards, carpentry, contracting and sales. 2 years experience in geophysics for major oil company. Experience in water and sewerage systems and mining exploration. Highest references. Very versatile. Desires permanent position with responsibility and advancement. Preferably in Alberta. File No. 4445-W.

ELECTRICAL ENGINEER, Jr.E.I.C., 31, McGill 1950, P.Eng. (Ontario), 3½ years experience in electrical layout and design of plant distribution and services and design of automatic sequencing control for process equipment in automotive industry, desires work with consulting firm or industry with diversified and interesting work. File No. 4448-W.

ENGLISH CIVIL ENGINEER B.Sc. (Hons.) A.M.I.C.E., aged 27. Hoping to emigrate to Canada with wife in May, desires responsible job in connection with the design of water supply and sewage schemes in which he has experience. Would also consider site control work in this field and would prefer to work in Vancouver district although other facts considered. File No. 4449-W.

CIVIL ENGINEER (M.Sc., P.Eng.), University of Warsaw, Poland, age 41, presently employed. Twelve years successful experience in structural designing, which includes 8 years of site supervision. Seeks opening with progressive firm. Specialist in prestressed concrete. Bilingual. Three years Canadian experience as senior designer. Avaiable on short notice. File No. 4450-W.

CONSTRUCTION ENGINEER, M.E.I.C., age 45; no dependents. 30 years general construction and mechanical experience, 21 since graduation, 10 years sales. Now completing an operation. Free to travel or relocate anywhere. Canada or foreign. Prefer north country, frontier or foreign-general construction — townsite — supervisory. File No. 4451-W.

CIVIL ENGINEER, S.E.I.C., B.Eng., McGill 1953, with construction and field work experience, seeks position in the field preferably on construction. Single, willing to work anywhere in Canada. File No. 4452-W.

CIVIL ENGINEER, Jr.E.I.C., N.S.T.C. 1952, veteran, age 28, married. Approximately one year experience in surveying and drafting for road construction job, and one year working with municipal type of construction and maintenance. Seeks employment with either consultant engineer, municipal engineer, or town planner, doing calculations, designing, and drafting. The possibility of technical experience derived is of paramount importance. File No. 4454-W.

CIVIL ENGINEER, N.S.T.C., 1949, M.E.I.C., P.Eng., provincial land surveyor of Nova Scotia and New Brunswick, age 27, veteran, married, 2 children. Experience survey of naval base construction;

instrumentman on construction of train boat, gypsum disposal plant, topographical survey; resident engineer on construction of services for 100 houses project; 3 years resident engineer on highway construction, both subgrade and pavement; 1 year office engineer on materials takeoff, ordering, and control; 1 year design of industrial buildings, municipal services, specification writing, project supervision. Present work expected to terminate in May. Prefer construction or associated work with a good future. File No. 4455-W.

EXPERIENCED CONTROL ENGINEER, B.Sc. electrical engineering, Laval University 1947. One year post graduate studies in servomechanisms, electronics and network theory, Ohio State University. Age 30, married. Six years experience in U.S.A. on design and development of control systems such as autopilots, remote flight control systems, speed and voltage regulators for inverters and air turbine driven alternators. Also design experience on magnetic amplifier circuits. Canadian citizen desires to return to Canada and will consider any reasonable opening with Canadian firm. Would prefer position involving both administrative and technical duties and a certain amount of travel. Preferred location Montreal area. File No. 4461-W.

MECHANICAL ENGINEER (Technikum Winterthur, Switzerland, grad. 1949), 29, married. Experience in welding, design and estimating of pressure vessels, platework, piping. Completely familiar with ASME and API codes, high pressure water tube boilers. Capable of supervision desires responsible position in office or shop, vicinity of Edmonton, Calgary or Vancouver. File No. 4465-W.

CIVIL ENGINEER, Jr.E.I.C., now interested in broadening his background. Five years experience in surveying for many purposes, including construction and pulp and paper manufacture. Very much interested in design. Available April 30th. File No. 4466-W.

CIVIL AND STRUCTURAL ENGINEER, M.A., Cambridge University, graduated 1947, Professional Engineer (Ontario), Jr.E.I.C., 6½ years experience civil and structural engineering in industry, consulting engineering and research. First class administrator with considerable organizational experience. Expert in structural analysis and design in both steel and concrete. Specialist in prestressed concrete. Presently employed in Toronto, and would prefer to remain there, or would represent Canadian organization in England. Position of responsibility required, where good use can be made of organizational ability and where there is opportunity for advancement. File No. 4467-W.

MECHANICAL ENGINEER, married, age 43, M.I.M.E., Ch.Eng., attached to Dutch Merchant Navy during second world war. Twenty-five years experience in construction, operation and maintenance of high pressure steam plants, turbo generators, diesel engines and refrigeration plants. Available on one month's notice. File No. 4468-W.

CIVIL AND SOIL MECHANICS ENGINEER, Jr.E.I.C., B.Sc. with post graduate studies. Age 34, married, 3 children, R.C.A.F. veteran. 6½ years experience. Experienced in organizing soil mechanics laboratories, lab testing, interpretation of laboratory results. Slope and slide investigations. Supervision of drilling and foundation investigations for dams, buildings, highways. Earth and concrete materials investigations. Retaining walls, earth and concrete dams. Tunnelling in clay. Deep shafts in clay and gravel. Studies in open channel flow. Reinforced concrete. Reports, design and supervision of construction. Mathematically inclined. Some knowledge of German. Available after May 15th. File No. 4469-W.

BRITISH GRADUATE (Electrical), 45 years of age, married, 1 child, 5 years in Canada; P.Eng., M.A.I.E.E., M.E.I.C., etc., formerly specialist in electric traction but very adaptable and with wide experience in other engineering realms; has initiative, pleasing personality, good contact man; possesses diploma in salesmanship; good liaison engineer, correspondent, writer of specifications, reports and articles; highest references, desires scope for advancement; now resident near Montreal. File No. 4470-W.

GRADUATE MECHANICAL ENGINEER, 34 years of age desires position where high quality design work is appreciated. Experience as follows: Internal combustion engines—3 years, chemical plant machinery—3 years, agricultural machinery—2 years, at present mining equipment. File No. 4471-W.

MECHANICAL ENGINEER SASK. 1947, Jr.E.I.C., P.Eng. (Que.), age 31 with 7 years experience sales and application heating, ventilation and air-conditioning with large Canadian firm. Industrial consulting and public building mechanical specifications. Desires position with consulting engineers or architects. Location Ontario or Western Canada. Available on reasonable notice to present employer. File No. 4472-W.

ELECTRICAL OR MECHANICAL SALES. P.Eng. S.E.I.C., B.A.Sc., U.B.C., mechanical 1951. Graduates test course with C.G.E. One year preparing for outside sales, over one year successfully selling full range of electrical power apparatus in Toronto and Western Ontario for large nationally known electrical manufacturer. Experience with steam turbines, pumps and various other types of mechanical equipment. Excellent executive valuation report, together with business and education resume sent on request. Desire position leading to outside sales work or managerial position with progressive company in British Columbia or Alberta. File No. 4473-W.

RESPONSIBLE POSITION WANTED by graduate chemical engineer, McGill 1949. Presently employed by pulp mill engineers, supervising field and layout work. Veteran, age 32, with industrial and direct selling experience. Has proven initiative and willing to accept responsibility. Desires position providing executive training and a challenge. File No. 4474-W.

ELECTRICAL ENGINEER, graduate 1949, power and machinery, Edinburgh, Scotland. M.E.I.C., Grad. I.E.E., Whitworth Prizeman, married, two children. 5 years electrical engineering apprenticeship. 3 years electrical draughting. 3 years electrical engineer. Experience on rural and urban distribution; construction, maintenance and operation; H.V. and M.V. lines, cables, substations and associated gear; estimating, profile surveying, pressure testing, fault location etc. Also inspection, testing and maintenance of all types industrial electrical machinery and cabling in paper mills, quarries and other industry; i.e. generators, motors, switchgear, transformers, elevators etc. Desires employment on either distribution work, plant maintenance or with consulting engineer, commencing beginning of September. File No. 4475-W.

CHEMICAL ENGINEER B.A. 1937, B.A.Sc. 1938, U.B.C., P.Eng.(Ont.), member of the Chemical Market Research Association, married with 2 children desires responsible position in chemical or allied industry. Diversified experience in explosives, pulp and paper and plastics. Most interested in development type of work or production. Well experienced in preparation of reports on markets and economics. Resume of experience on request. File No. 4476-W.

CIVIL ENGINEER P.Eng., Jr.E.I.C., with two years experience in reinforced concrete, detailing and design. Seeks part time employment in Montreal area. File No. 4477-W.

MECHANICAL ENGINEER graduate Nova Scotia Technical College 1946 M.E.I.C. Eight years experience in design, application and installation of heating, ventilating, air conditioning and combustion equipment. Desires change of employment where past experience could be best utilized. Location preferred Ontario or Quebec. File No. 4479-W.

EXECUTIVE MANAGEMENT career development desired by Chemical Engineer, M.E.I.C., age 37, married, no children. Strongest capabilities are organization, administration, adaptability, and effective contacts. Successful and well-rounded experience in operations, technical control, research and development, and management techniques in major manufacturing industry. Seeks challenging opportunity as Manager, Assistant, or equivalent, with progressive enterprise willing to delegate responsibility upon proof of ability. File No. 4482-W.

MECHANICAL ENGINEER, M.E.I.C., Graduate of Delft Institute of Technology, Holland. 20 years experience, particularly in boiler houses, steam and condensate handling, instrumentation, water treatment, air handling, plant layouts. Also office management, business administration, sales promotion. Seeks senior position with manufacturing concern, consultants or sales organization. Sound Canadian practice. Bilingual. Location anywhere in Canada. File No. 4483-W.

MECHANICAL ENGINEER, 1947, P.Eng. M.E.I.C., with 6 years experience as sales engineer handling mining, contracting, industrial and pulp and paper machinery, desires position of expanded responsibility in sales field or with mechanical maintenance department of industry. 34 years old, married. File No. 4484-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng. (Alberta), age 35, single. 5 years general engineering training with one of the largest electrical manufacturers in U.K., 3 years mechanical design in light engineering works, 4 years in oilfields and refinery abroad on installation, erection, and maintenance of electrical and mechanical plant which included pumps, air compressors, A.C. and D.C motors, steam and diesel power plants, power distribution and lighting. Desires position in construction or in which experience can be utilized. Location anywhere. File No. 4489-W.

INDUSTRIAL ENGINEER, Mechanical engineering degree, age 38, with fifteen years experience in light industry on: manufacturing methods, time and motion study, process engineering, production control, factory engineering, administrative engineering and production supervision, available immedately. File No. 4493-W.

HARVARD BUSINESS SCHOOL and Toronto engineering and business graduate seeks marketing position with a manufacturer of consumer goods. Presently employed outside Canada with a similar firm. Prefer Southern Ontario basing. Age 25, married. File No 4494-W.

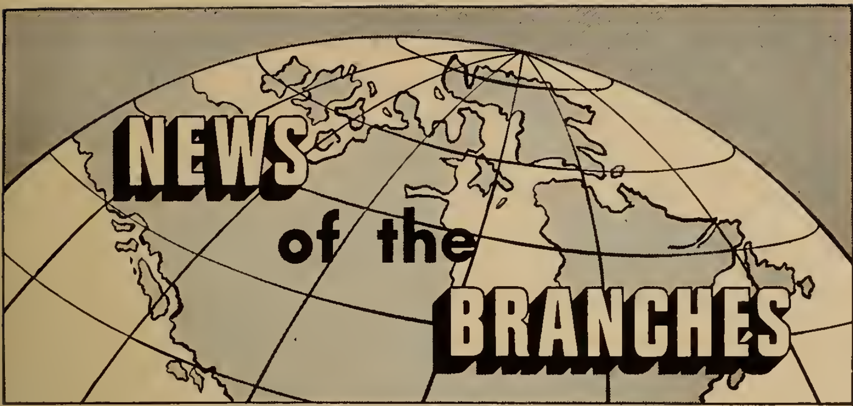
PROFESSIONAL ENGINEER with 20 years experience in chemical production. Seeks management position in chemical oil or allied industries. Experience includes labour relations, safety, cost control, preventive maintenance, supervisory training and policy draughting. Location immaterial presently in Toronto. File No. 4496-W.

MECHANICAL ENGINEER, graduate 1951, Jr.E.I.C., single, age 24, experience in materials handling, and pulp and paper desires position with opportunity for advancement. File No. 4498-W.

MECHANICAL ENGINEER, graduate, A.M.I.M.E., A.M.I.E.T., government certificate, 15 years experience design and development field work, oil refinery, material handling plants, installations, machinery grainery, conveyors, elevators, construction, structural steel, reinforced concrete, docks, timber structure. Knowledge of Spanish, Italian, Arabic little French, desires employment South America, Peru. Age 36, Canadian citizen. Past experience also includes report writing, drafting, estimates, civil engineering. Presently employed Engineering and Research Department. Salary secondary to opportunity for advancement. Free to travel anywhere at short notice. File No. 4499-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., P.Eng., age 38, married, veteran. Eight years industrial experience, mainly in chemical plant design including pressure vessels, high measure piping, material handling, steel-and reinforced concrete construction, steel fabrication, etc. and cost estimating. Also some construction and some maintenance experience. Desire employment with responsibility and with future possibilities. Preferable location Alberta. File No. 4503-W.

GRADUATE ENGINEER, B.E. Mechanical and Electrical, Sydney University, Australia, 1943. Age 32, single, 4 years experience plant engineering, construction, steel industry, sugar, hydro-electric industry. Interested in position; design, development production engineering or plant engineering; inventive. File No. 4504-W.




**Activities of the Forty-seven Branches of the Institute and abstracts of papers presented at their meetings**

## Border Cities

R. J. Trinder, jr.e.i.c.,
*Secretary-Treasurer*

W. Dave Donnelly, m.e.i.c.,
*Branch News Editor*

**Auxiliary Celebrates Second Anniversary**

The E.I.C. Auxiliary, Border Cities Branch, has completed its second successful year, with four 'interest' groups showing great progress for the year, and with membership increasing in each. The groups take part in leathercraft, smocking, bowling and bridge.

On January 29 the Auxiliary enjoyed a very informative and interesting talk on "Civic Affairs", by Alderman Mrs. Cameron Montrose. The ladies were invited to the Branch meeting of March 4, to hear Dr. Lillian Gilbreth.

The May meeting was held on the 19, at Jeanne Mance Nurses' Residence at which time Dr. S. Hardie Campbell spoke to the group. His subject was "The Eastern Arctic Region". Dr. Campbell gave a very colourful talk supplemented by slides on his experiences as ship's doctor on the "C. D. Howe". A silver collection was presented to the Cancer Fund.

The next meeting was held on November 10 at the Jeanne Mance. For entertainment at this meeting Mr. Hillman and Mr. Morris of the Canadian Cancer Society showed three films. A silver collection was taken and given to the Cancer Fund.

The annual dinner-dance for the President's visit was held at Beach Grove Golf Club on November 25. A large crowd was in attendance for a very enjoyable occasion.

The Auxiliary is planning on a bursary for a young second year engineering student. As it is not a money-making organization, the proposal was adopted that dues, after having accumulated to the amount of $100.00, be used for this purpose.

Membership in the Auxiliary is 91, and 9 members have moved out of town during the year.

On January 28, 1954, the second annual meeting was held and the slate of officers for this year was presented, as follows: president, Mrs. R. T. Waddington; first vice-president, Mrs. J. W. Greason; second vice-president, Mrs. W. D. Donnelly; recording secretary, Mrs. J. Donald; corresponding secretary, Mrs. D. G. Jamieson; treasurer, Mrs. D. S. Brown; publicity convenor, Mrs. A. G. Ackerman; group convenor, Mrs. A. Robinson, councillors, Mrs. P. S. Dewar, Mrs. C. G. R. Armstrong, Mrs. J. C. Hoba.

At this meeting the members enjoyed a very interesting film called "Packaged Power", presented by the Aluminum Company of Canada.

## Belleville

C. H. Lusk, jr.e.i.c.,
*Secretary-Treasurer*

E. L. Littlejohn, jr.e.i.c.,
*Branch News Editor*

**Branch Meeting, February**

The Belleville Branch of the Engineering Institute of Canada held its regular meeting at the Masonic Temple on February 8, with 46 members and guests present.

C. Whittemore as chairman, welcomed the members and guests to the meeting. A. E. Argue spoke briefly to the Branch on the possibility of undertaking a second Professional Development Course for the Junior engineers. S. Sillitoe then asked for an expression of opinion from the members regarding a resolution passed by the executive, stating that we are in favour of the amalgamation of the Association of Professional Engineers and the Engineering Institute of Canada. This resolution was passed unanimously.

E. G. Gurnett then spoke briefly to thank the engineers for their co-operation in the recent Belleville Hospital campaign for funds. He stated that they had more than reached their goal.

**Shell Moulding**

"Shell Moulding" was the topic of W. A. Campbell's address to the Belleville Branch of the Engineering Institute of Canada. Mr. Campbell is the sales development manager of the Bakelite Company of Canada.

Shell moulding is the term applied to a new method of casting metals. It is a process by which a synthetic resin mixed with a foundry sand is cast on a hot metallic pattern. The resin melts and acts as a binder for the sand, thus forming a shell on the hot pattern. The original process was developed in Germany by Johannes Croning in 1944. After the war the process became available to all countries. The physical metallurgist supervisor of the New York Naval Station, Brooklyn, N.Y., Bernard Ames, has this to say for shell moulding:

> In the past few years, shell moulding has been recognized as one of the major technical advancements in the foundry industry. It is perhaps the first basic change in the method of mould construction since the inception of the foundry art.

Mr. Campbell pointed out that with this new method, a better casting could be made, costing less money and holding dimensional tolerances to closer limits than with the present green sand methods.

Mr. Campbell was introduced by G. A. Bradford and thanked by J. Lawn.

**General Meeting**

At the regular meeting of the Belleville Branch of the Engineering Institute of Canada held on Monday, March 8, 1954, at the Masonic Temple, a capacity crowd heard D. H. Sharpe, project engineer of the C. D. Howe Construction Company, describe the Seven Islands iron ore development. This talk was of particular local interest since a large proportion of the machinery to be used was made in Belleville at the Stephens Adamson Company.

This development, which is a joint project of Canadian and American mining companies and known as the Iron Ore Company of Canada, is expected to be in operation in July, 1954. The project involved the building of the longest railway of the century on the North American continent, 360 miles of steel; it involved the building of shipping facilities, power plants, and air fields.

It was pointed out that due to weather conditions, actual mining operations could only be carried out for 5½ months of each year, while shipping would be open for 8 months.

Mr. Sharpe illustrated his talk with slides and the film, "Up The Line in '53". The speaker was introduced by Jim Young, sales manager of the Stephens Adamson Company, and thanked by A. D. Janitsch.

## Newfoundland

M. A. Foley, m.e.i.c.,
*Secretary-Treasurer*

**Labrador's Development Discussed**

A joint meeting of the Newfoundland Branch of the Engineering Institute of Canada, The Association of Professional

Engineers of Newfoundland and The Newfoundland Branch of the Canadian Institute of Mining and Metallurgy was held at Memorial University on January 28. The speaker of the evening was W. R. Durrell, general manager of the Iron Ore Company of Canada. The chairman for the evening was William Watson, vice-chairman of the Newfoundland Branch of the Engineering Institute of Canada. Mr. Durrell was introduced by Claude House, deputy minister of mines for the province of Newfoundland.

Mr. Durrell began by giving his listeners a brief history of the discovery of iron ore in Quebec and Labrador—where ore was first discovered in 1929 by Dr. Gill and Dr. Jacobs at Ruth Lake but it was not until 1936 that the first concessions of 20,000 square miles of Newfoundland territory and 3,900 square miles of Quebec territory were obtained.

Mr. Durrell's own connection with the enterprise began in 1947 when he was asked to build the air strip at Knob Lake. It was at first considered almost economically impossible to build a railroad from the north shore of the St. Lawrence through about three hundred and fifty miles of extremely difficult country to the iron ore deposits at Knob Lake.

By 1950 the geologists under Dr. Reddy and Dr. Moss had discovered four hundred and eighteen million tons of direct stripping high grade ore. The result was that the interested companies, five of the larger steel producing companies of North America, united to form the Iron Ore Company of Canada.

By October, 1950, the work on the railway was started and equipment was brought in. The first one hundred miles of railway were so exceedingly difficult with the high hills, deep river valleys, sheer cliffs and quicksands, that it took one and a half years to complete the section.

Fourteen air strips were built along the route of the railway as all equipment and men had to be flown in. So far, air transport alone had cost the company ten million dollars but the cost per pound for air freight has been reduced from an initial cost of 75 cents per pound to five cents per pound today. The company now operates twenty-two planes and two helicopters.

About ninety miles of the railway remained ungraded last fall and additional equipment was brought in to complete it before winter. The grading of these last ninety miles was completed in December.

The speaker reported that it is hoped to start stripping the ore in March and to start mining in May. All the mining will be open pit. The mining equipment, 34 ton trucks and electric shovels, will be brought in on the completed railway. The railway is designed to handle thirty-six million tons a year. The annual output of the mines for the first few years will be ten million tons a year. Mining will be limited to six months of the year, however, stripping will commence a month before and continue a month after the mining operations.

Two million tons of ore, Mr. Durrell said, will be stock-piled at Seven Islands so that the shipping season can be three months longer than the mining period.

Mr. Durrell pointed out that the railway could play an important part in opening up Labrador. Grand Falls on the Hamilton River, which has a potential of four million horsepower, is only ninety miles from the line. He felt sure that the railway would eventually push further northward and he advised young engineers to keep an eye on developments in Labrador.

At the conclusion of the address E. Dickinson, president of the Association of Professional Engineers of Newfoundland, moved a vote of thanks to Mr. Durrell.

## Montreal

R. J. Harvey, M.E.I.C.,
*Secretary-Treasurer*

J. A. Paget, M.E.I.C.,
*Publicity Chairman*

**Prestressed Concrete**

At a joint meeting of the Province of Quebec Association of Architects and the Montreal Branch on February 1, Professor G. Magnel addressed a capacity audience on the subject of Prestressed Concrete.

Professor Magnel, a noted author and international authority on concrete design, has made many fundamental contributions to the research and literature on prestressed concrete. The author discussed recent additions to theory, the design problems of fixed and continuous members, the corrosion problem, and the effect of bonding forces on the stress distribution in steel and concrete in regions of high wire curvature such as are found at the supports of continuous members.

Professor Magnel emphasized that the choice between steel, reinforced concrete and prestressed concrete for a particular structure should be decided on the basis of maximum economy and service for its expected life.

Meeting arrangements were by J. E. Hurtubise; R. H. Quintal served as chairman.

**Annual Students' Night**

On February 4 the Junior Section of the Montreal Branch held their Annual Students' Night in the Institute Auditorium.

The judges were J. P. Dagenais of the Bailey Meter Co., Professor T. Pavlesack of McGill and Louis Trudel of Shawinigan Water & Power. The first contestant was G. I. Fekete of fifth year mechanical engineering at McGill who spoke on "Aircraft Design".

The second speaker was D. Grimes of fifth year civil engineering at McGill who spoke on "Sheet Piling".

The third speaker was R. Takacs who is in his fifth year at Ecole Polytechnique. He spoke on "Problem Relatif et Abris Anti-Bombe".

Jean Morin, who is in his fifth year at Ecole Polytechnique, was the fourth speaker. He spoke on "A Temporary Power House on the Bersemis River".

A film on town planning was exhibited while the judges were deliberating. The first prize of fifteen dollars was awarded to Mr. Grimes and the second prize of ten dollars to Mr. Morin.

The judges congratulated Mr. Morin on his proof that he was truly bilingual.

All contestants were awarded a year's subscription to the Engineering Journal.

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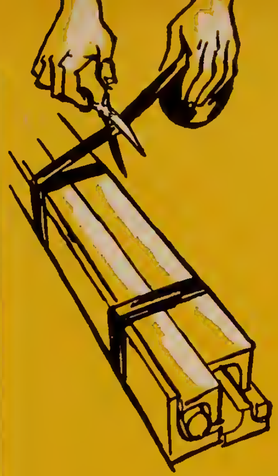

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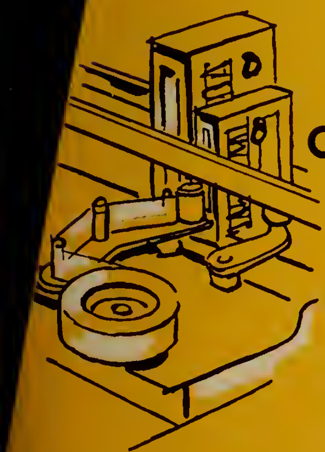

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Montreal Branch annual dinner dance. The head table, Colonel H. G. Thompson, Mrs. Hammerschmid, Dean Henri Gaudefroy, Mrs. Shaw, I. R. Tait, Mrs. Frost, Dr. J. B. Stirling, Mrs. Dunsmore, Dr. A. W. Trueman, guest speaker; R. L. Dunsmore, branch chairman; Mrs. Tait, C. E. Frost, Mrs. Stirling, R. F. Shaw, Mrs. Gaudefroy, Mr. G. N. Martin, Mrs. Thompson, L. J. Hammerschmid.

Left: Major Davies, representing the Military Engineers' Association, Mrs. Sutherland, Mrs. Davies, Dr. Sutherland, of the Canadian Institute of Chemistry, Mr. and Mrs. R. L. Dunsmore. Right: Mr. and Mrs. Bolton are received by Mrs. Dunsmore, Dr. Trueman, and Mr. and Mrs. I. R. Tait.

The meeting chairman was Pierre DeGuise, S.E.I.C., of Ecole Polytechnique.

#### Electrical Design

On February 8 a joint meeting of the E.I.C. and the A.I.E.E. heard A. A. Moline, manager of the power products division of Canadian Westinghouse, describe the mechanical side of power equipment design. The speaker pointed out that after the U.S.A., Canada ties with the United Kingdom for second place in total electrical power production and is exceeded only by Norway in per capita production. He said that Canadian problems usually involve very large outputs and can only be solved effectively by a professional staff backed by adequate research facilities.

Mr. Moline described some of the design criteria in conventional and umbrella type generators, including the manufacturing problems resulting from size, weight, and magnetic forces. Passing on to the features of hydrogen cooled synchronous condensers, the speaker mentioned the gains to be had in better cooling of transformers and steam driven generators.

In the small equipment Mr. Moline mentioned the dynamic problems of circuit breaker mechanisms some of which had an interrupting time of two or three cycles and a total time of 10 to 12 cycles.

Mr. Hawril thanked the speaker on behalf of the chairman, E. V. Leipoldt, and the 81 engineers in attendance.

Meeting arrangements were by R. E. Grout.

#### Ladies' Film Night

On Tuesday, February 9, the following films were shown: "Underground East," courtesy Imperial Oil Limited; "Story of Cellophane," courtesy Canadian Industries Limited; "Way Over the Mountain," courtesy Goodyear Tire & Rubber Co.; "Le Mans 52," courtesy Shell Oil Co. of Canada Ltd.

On February 11 the Ladies Film Night featured: "The Peribonka Power Development," courtesy The Aluminum Co. of Can. Ltd.; "Newfoundland Scene," courtesy Imperial Oil Limited. On February 9 meeting arrangements were by E. S. Yuill and P. J. Kunster was chairman.

The February 11 meeting arrangements were by L. Creighton and C. G. Kingsmill was chairman. Dr. Gordon Thomas introduced the second film.

#### Sources of Management Material

On February 11 the Ladies' Film section sponsored a most interesting panel discussion on "Preferred Sources of Management Material". With J. Edgar Dion, management engineer, as moderator, the panel consisted of A. J. Gregory, supervisor of engineering methods, Northern Electric Co. Ltd.; T. I. Lumby, personnel assistant, Canadian National Railway; T. E. Mather, woodland cost accountant, Consolidated Paper Corporation; and E. Skutezky, methods analyst, Northern Electric Co. Ltd.

Mr. Skutezky opened the discussion by stating that the universities were the best place to find potential leaders in business and industry.

Mr. Mather, the second speaker, maintained that all-round ability and enough curiosity to find out about the other fellow's problems were the most important requisites for good management material, and therefore non-technically trained people, were also a good

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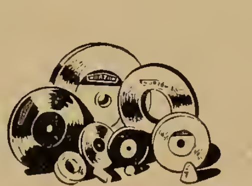

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source from which potential managers could be obtained.

Mr. Lumby declared that the primary source of managerial talent was within the ranks of the organization itself, and that the secondary source was other organizations or outside companies.

Mr. Gregory, the last speaker, said that the sound analytical training of the engineer made him ideally suited for the solution of the complex problems facing managers, but that the danger confronting many younger engineers was the fact that the tendency toward specialization was leaving many men without the broad training necessary for senior executive positions.

A lively question and discussion period followed. Meeting arrangements were made by G. H. Hoganson and W. C. M. Luscombe was chairman.

#### Annual Dinner Dance

On February 19 the Annual Dinner Dance of the Montreal Branch was held in the Rose and Windsor rooms of the Windsor Hotel, having been organized in the usual competent manner by the Entertainment Committee. After a pleasant dinner Mr. Dunsmore introduced the head table guests and briefly explained the nature of the work done by each of the committees. Dr. J. B. Stirling then introduced A. W. Trueman, Commissioner of the National Film Board, guest speaker of the evening. Mr. Trueman, a well known educator, traced the development of the National Film Board's distribution system, which had about eighty district agents before the war, to the present organization which handles many more films with half the staff.

The secret was the fully democratic Film Council Movement and the growth of film libraries. A film council consists of a group of interested citizens in the community which arranges for the renting or purchasing of films and their exhibition before interested community groups. The choice of films for rental is a true expression of local interest and serves as the principle guide for the National Film Board in its production planning.

Mr. Trueman assured his audience that he had never detected any tendency for the board to become a propaganda agency for the government in power.

Dean Henri Gaudefroy thanked the speaker and pointed out that he was still an educator in a broader sense. At the suggestion of Leo Scharry, Entertainment Committee chairman, the gathering adjourned to the Rose ballroom. A reception line was formed for those wishing to meet head table guests.

During the meal in the Windsor room a duet moved from table to table playing requests and attracted much favourable comment from the 220 dinner guests. An additional 210 guests arrived for the dance.

#### The National Housing Act

"Home Ownership and The National Housing Act" was the title of a talk given on February 15 to the Junior Section by J. C. Paradis, Quebec regional supervisor of Central Mortgage and Housing Corporation. Mr. Paradis began his talk, to an audience which exceeded the seating capacity of the Mansfield Street Auditorium, by explaining the history of the National Housing Act.

The film "Pride of Possession" with commentary by Kate Aitken was shown

## Montreal Section Annual Golf Tournament

*Date:* Wednesday, June 9, 1954

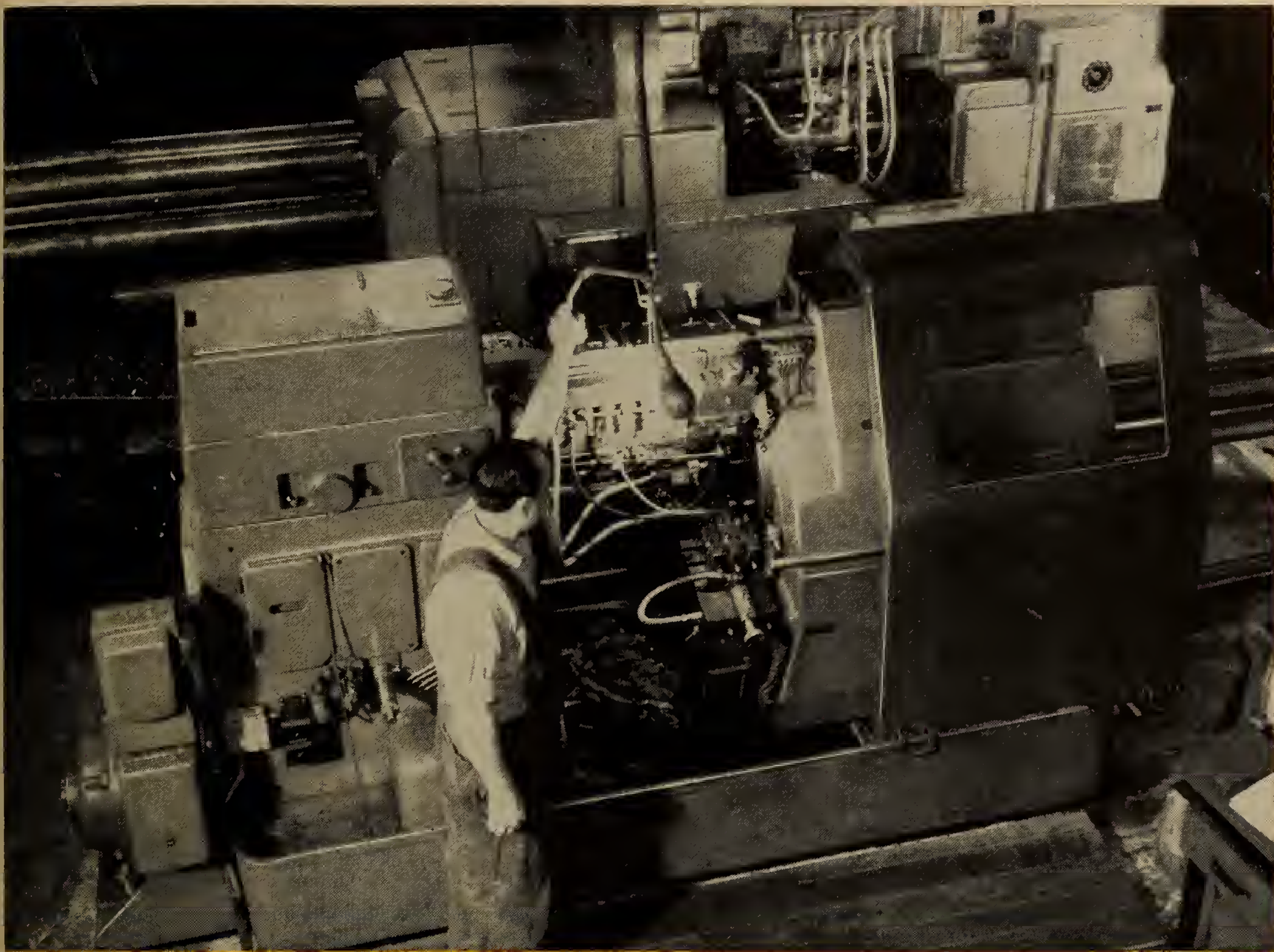
*Place:* Lakeshore Golf & Country Club Inc.

*Time:* Starting at 1 p.m. Dinner at 6.30 p.m.

*Price:* Green Fees, $2.00. Dinner, $3.00 (gratuities included)

*Tickets Available:* Leo Scharry (E.I.C.), Re. 3-5334. Pierre Bournival (C.P.E.Q.), Pl. 9486. E.I.C. Headquarter, Pl. 5078

This golf tournament is jointly sponsored by the Engineering Institute of Canada and The Corporation of Professional Engineers of Quebec



and the speaker explained the likely changes that were to be expected after the new Act became law. Mr. Paradis dealt in a realistic manner with the difficulties facing a prospective home owner and supplied detailed information concerning the economics of home ownership and the basis on which loans were granted. An interesting discussion followed the meeting.

The meeting was arranged and conducted by G. L. MacLean, Jacques Soucy and J. M. Weintraub of the Junior Section.

###### Recovering Nickel, Copper and Cobalt

Professor F. A. Forward, professor of metallurgical engineering at the University of British Columbia, gave a very interesting account of the ammonia pressure leach process for recovering nickel, copper and cobalt developed by him for handling Sherritt Gordon concentrate. The process is adaptable to continuous or batch production and begins with a pressurized ammonia leach using air for agitation. After a number of stages it produces nickel as a powder together with copper sulphide and cobalt concentrate in a form suitable for the further refining required to produce commercial metal. The process has been carried through the pilot plant stage and Sherritt Gordon are building a full scale plant which will soon supplement Canada's critical nickel supplies.

**North Eastern Ontario Branch Dinner at Cochrane Legion Hall. Left to right: D. Williams, chairman of the Kapuskasing Section, Mrs. C. D. McCulloch, Mrs. G. M. Lyon, President Dobbin, Branch chairman, G. M. Lyon, Mrs. G. Eastward, and M. D. McLean, chairman Iroquois Falls Section.**

The meeting chairman was T. T. Anderson and H. G. Burbidge made the arrangements for this meeting which took place February 25.

## North Eastern Ontario

C. D. McCulloch, Jr.E.I.C.,
*Secretary-Treasurer*

###### The President's Visit

On January 26, 1954, the Branch was host to President R. L. Dobbin. Mr. Dobbin was accompanied by J. A. Ogilvy, assistant field secretary.

The president was met at Porquis Junction by G. M. Lyon, Branch chairman and after a short rest toured a portion of Abitibi's Iroquois Falls mill. President Dobbin kindly consented to talk to the engineering staff of the Iroquois Falls mill. He spoke of engineering achievement in the Maritimes and the urgent need for engineering "know how" to assist in the development of Newfoundland.

For the benefit of non-members, Mr Ogilvy briefly outlined the work of the Institute with special reference to professional development.

Following the president's visit to Iroquois Falls, he was driven to Cochrane where the branch meeting took place. A short executive meeting was held in the Cochrane Town Hall Council Chambers. Following the executive meeting a branch dinner meeting was held at which President Dobbin met the branch members and their wives.

Following dinner President Dobbin spoke of his impressions of the coronation. His speech was followed by a short business meeting.

President Dobbin remained in Cochrane overnight and was driven to the airport the next day to catch the plane for North Bay.

## Niagara Peninsula

G. W. T. Richardson, jr.e.i.c.,
*Secretary-Treasurer*

J. H. Saldat, jr.e.i.c.,
*Branch News Editor*

#### Dinner Meeting January 28

On January 28, 1954, the Niagara Branch of the Engineering Institute of Canada held an outstanding dinner meeting at the Rose Villa Inn, near Welland.

A. J. Bennett was presiding chairman, and A. Shames introduced the guest speaker, who was H. R. Summer, radio-systems engineer of the Bell Telephone Company of Canada. Mr. Summer spoke on the recent developments in long distance telephone transmission.

The initial telephone carrier circuits were capable of carrying 20 telephone conversations per wire. High frequency losses in these carriers led to the development of 100 pair cable, where two 100 pair cables served one circuit from east to west. A load increase would allow as much as twelve carriers per pair. However, high frequency loss was again effective.

Later developments resulted in the co-ax cable which could handle 600 message circuits. With the growth of television it was found that the four meg-cycles exceeded the capacity of three meg-cycles of the co-ax cable and was not too satisfactory. High frequency losses determined the need for booster stations at three to four mile intervals. Ensuing advances in radio tubes and antennae indicated that the TD2 system was most economical and met requirements. The TD2 relay was adopted as a frequency modulated system operating in super high frequency range of 3700 to 4200 meg-cycles.

#### TV and Message Circuits

This band, 500 meg-cycles in width bears five channels, each channel being 20 meg-cycles wide, with 40 meg-cycles between channels. This capacity gives six alternate east channels and six west channels. Each channel carries one television program or 600 telephone long-distance message circuits. These channels are directed through towers at 30 to 40 mile intervals, each tower being 25 to 212 feet in height. A series of these towers have been erected from Buffalo to Toronto, Ottawa and Montreal. At present there are two channels in use over the length of this circuit.

Channels from Toronto to Montreal carry two-way TV and message circuits, whereas due to radio propagation between Toronto and Buffalo two channels are required to permit one way communication from Toronto to Buffalo for TV purposes. As yet there is no call for Canadian program transmission to the United States but the circuits are available.

The two-way circuit from Toronto to Montreal has repeater stations, consisting of towers bearing 4 antennae each. These antennae, with reflectors, weigh one ton. Two transmission and two receiving antennae constitute one tower station.

A signal received on channel A is taken down the tower by wave guide to a receiver, which converts super-high frequency down to intermediate frequency. The intermediate frequency is amplified $10^6$ times and converted back to its receiving frequency, plus 40 meg-cycles. The final output power of transmitters is ½ watt.

The signal is sent up the wave guide to a delay lens antenna which has an effective radiating power of 2500 watts. The signal is transmitted over 30 to 40 miles to the next repeater station.

Due to the high efficiency of the delay lens antenna of this system, all radio energy is transmitted in a very narrow beam, having a horizontal angle of 2 degrees at its half power point, and a vertical angle of 1½ degrees.

Relay stations are normally unattended and operate automatically. In the event of a breakdown in the apparatus, a signal is sent along a land line to the repeating station to search the 42 possible points of trouble. The equipment starts a process of scanning the 42 trouble sources, ranging from power failure through to a door being left open. A signal reports the trouble back to the central point, where an operator dispatches a repair crew to the scene.

At present one channel is being used for CBC television programs from Toronto to Montreal. One other circuit has 121 long-distance telephone circuits in operation.

#### Micro-Wave Demonstration

Following Mr. Summer's review of high frequency transmission a demonstration, using a transmitter and a receiver of 10,000 meg-cycles, revealed that the properties of micro-waves in super-high frequency range are comparable to light waves.

A demonstration showed how micro-waves differ from light waves in that they pass through materials like wood, but are stopped **by metal.**

## Nipissing and Upper Ottawa

R. A. Booy, jr.e.i.c.,
*Secretary-Treasurer*

E. A. Watson, m.e.i.c.,
*Branch News Editor*

#### Guests of Abitibi

Fifty-seven members and friends of the Nipissing and Upper Ottawa Branch of the Engineering Institute of Canada were guests of the Abitibi Power and Paper Company at Sturgeon Falls on Wednesday evening, February 10, 1954. The meeting was conducted by James Miller, vice-chairman of the Branch in the absence of the chairman, Robert Dye

Following dinner A. L. Farnsworth, manager of the Abitibi plant, and E. G. Heslop, assistant manager, described briefly the processes in both the corrugated and hardboard mills.

Contrasting the production of the corrugated paper with that of newsprint for which only spruce and balsam are used, Mr. Farnsworth stated that twenty-one varieties of trees supplied wood to the mill. Sawmill waste is also used. These factors made possible the operation of the Sturgeon Falls' mill where previously its operation as a newsprint mill was uneconomic. A large proportion of the wood is obtained from farmers in the Sturgeon Falls district and is trucked to the mill in four foot lengths.

Mr. Heslop outlined the steps in the manufacture of Abitibi hardboard. This material also makes use of all the species of wood found in this district, many of which had little or no value previously. The process and much of the equipment to manufacture this product is unique in many respects, and all design was by Abitibi's own engineering staff. Mr. Heslop also paid tribute to the operating staff all of whom were recruited in Sturgeon Falls for their part in placing this new plant in successful production.

Later the engineers were conducted on tours of both plants and all were especially impressed with the manufacturing operations in the hardboard mill. Jack Cooper expressed the engineers' appreciation and thanks to Mr. Farnsworth.

## Ottawa

G. A. Sutherland, M.E.I.C.,
*Secretary-Treasurer*

C. E. Howard, M.E.I.C.,
*Branch News Editor*

***Professor Magnel, Guest Speaker***

A special evening meeting was held on Tuesday, January 26, 1954, at the National Research Building on Sussex St., Ottawa, to hear Professor Gustave Magnel of the University of Ghent, Belgium, speak on "Recent Developments of Prestressed Concrete".

The speaker was introduced by the chairman of the Branch, R. E. Hayes and thanked by J. Irvine, Ottawa bridges engineer.

A summary of Prof. Magnel's talk was carried in the March issue under Montreal Branch News. Space requirements will not permit a repetition.

## Quebec

R. Desjardins, M.E.I.C.,
*Secretary-Treasurer*

G. Babineau, Jr.E.I.C.,
*Branch News Editor*

***Yves Guyon Is Guest Speaker***

The February meeting of the Quebec Branch was held on February 5, at the Faculty of Sciences Building of Laval University.

The French engineer, Yves Guyon,

an internationally famed authority on prestressed concrete, was the guest speaker. After briefly outlining the general principles upon which this new construction technique rests the speaker described various projects throughout the world, the design of which was based on this new theory. He also demonstrated how the use of prestressed concrete could afford considerable savings in the case of isostatic structures; in the case of hyperstatic structures, however, further studies and research work will have to be completed before the extent of the savings can be accurately predicted.

The meeting was under the chairmanship of George Demers who introduced Mr. Guyon to the audience. The usual thanks were expressed on behalf of the Branch by its newly elected president Gilles Sarault.

## Saguenay

C. C. Louttit, jr.e.i.c.,
*Secretary-Treasurer*

**Joint Meeting**

A joint meeting was held with the Saguenay Region of the Corporation of Professional Engineers of Quebec on Wednesday, January 27, 1954, at the Saguenay Inn, Arvida, at 8.30 p.m.

The first section of the meeting was devoted to the transaction of business pertaining to the Saguenay Branch of the E.I.C. under the chairmanship of G. K. Clement, P.Eng., m.e.i.c. Several new members were welcomed to the E.I.C.

Plans for the Students' Guidance meetings were announced and the members were urged to attend with a view to answering questions raised by the students.

**"A Plan for Unity"**

The Branch executive at their last meeting passed a motion recommending to the Saguenay Region of the C.P.E.Q. that a joint letter be sent to the president and secretary of the E.I.C. and all the Profesisonal Associations across Canada, with copies to E.I.C. councillors and others designated by the Saguenay Region, C.P.E.Q., recommending that the article "A Plan For Unity" by J. H. Smith, published in "The Professional Engineer," journal of the Association of Professional Engineers of Ontario, be given careful consideration as a method of supplementing the unity of Canadian engineers and recommending that a committee be set up to study the matter. This has been approved by the executive of the Saguenay Region of the C.P.E.Q. and the letter will be issued shortly.

**Nominations**

Nominations for the Branch Nominating Committee were called for and the following members agreed to serve: Messrs. L. Laventure, P.Eng., jr.e.i.c., S. T. Solinski, P.Eng., jr.e.i.c., and J. Ward, P.Eng., m.e.i.c.

Executive appointees to the Committee are Messrs. K. W. Campbell, P.Eng., m.e.i.c., and E. R. Coulthart, m.e.i.c. The proposed change to Section 2b of the Branch By-laws was approved. The letter ballot necessary for the final approval will be sent out along with the ballot for Branch elections.

The second section of the meeting was devoted to the transaction of business pertaining to the Saguenay Region of the C.P.E.Q. under the chairmanship of H. J. Butterrill, P.Eng., m.e.i.c.

**Corrosion Engineering**

The final part of the meeting was the presentation of a paper entitled "Corrosion Engineering in an Industrial Organization" by J. F. Hirshfeld, vice-president of the Hinchman Corporation, Detroit. Mr. Hirshfeld was unable to attend because of sickness so the paper was presented by F. A. Dagg, P.Eng., m.e.i.c.

Corrosion engineering is a relatively new field in importance as it is only in recent years that we have had an understanding of the processes of corrosion. Corrosion is an electrolytic or electrochemical process and is a reaction between a metal and its environment. In general its tendency is to return a metal to its natural state. The function of the corrosion engineer is to recognize, combat and prevent corrosion.

The corrosion engineer is an engineering specialist with a background of processing, manufacturing, construction or whatever field he may be working in, plus specialized knowledge about corrosion itself. Corrosion control is a continuous process and is classed as preventative maintenance. Corrosion can result in fires, explosions, interruptions of production and other serious failures and losses, so that its control is of

primary importance. Corrosion engineers should influence choice of design and materials on any new construction as well as choice of process, methods and standards in existing plants. Inspection, records and testing are amongst the various techniques used by corrosion engineers to control corrosion.

After the paper a colour film entitled "Corrosion in Action" was shown. This film was excellent and graphically showed results of corrosion as well as illustrating schematically and experimentally the technical processes by which corrosion occurs and can be prevented.

Following the film there was a discussion period with Messrs. Dagg and Butterill answering many questions dealing with corrosion. The meeting was adjourned at 11.00 p.m. at which time coffee and sandwiches were served.

#### Student Guidance

Two Students' Guidance meetings were held jointly with the Saguenay Regions of the Chemical Institute of Canada and the Corporation of Professional Engineers of Quebec. The first in French on February 5, at the Ecole Ste. Bernadette under the chairmanship of L. Simard, P.Eng. and the second in English, under the chairmanship of G. K. Clement, P.Eng. m.e.i.c., at the Saguenay Inn on February 19, 1954.

For each of these meetings a panel is formed of six to eight members representing the various fields of endeavour open to those who take university training in the sciences and engineering. Each member of the panel speaks for five minutes describing the general requirements, the activities and the future in his own field. This is followed by a question and answer period during which the panel and the other members answer questions raised by the students. At the close of the formal period refreshments are served, over which the students may informally discuss any points with the members.

These meetings were highly successful and it is planned to extend them next year.

### Toronto

L. F. Bresolin, jr.e.i.c.,
*Secretary-Treasurer*

H. Fealdman, jr.e.i.c.,
*Branch News Editor*

#### Students' Night 1954

The advance publicity for Students' Night held on February 18 promised that it would be different this year—and it certainly was. Instead of the students being invited to hear a speaker provided by the Branch, the branch members were invited to hear the students being put through their paces!

A panel of seven students, representing each of the major engineering courses were put through a variety of tests by the Inquisitor-in-Chief, W. H. M. ("Monty") Laughlin. These tests included two minute talks on subjects of professional interest, spelling tests and tests of general knowledge. This highly exacting program was drawn up and judged by Tom Dembie. Cash prizes in various amounts were awarded to the panel members. In addition, questions were fired at the students in the audience, the rewards for correct answers being free student memberships in the E.I.C. The chairman of the Civil Engineering Club of the University of Toronto was awarded a special cash prize as the members of his club had the best percentage attendance.

At the end of the proceedings, the student panel turned the tables on the inquisitors and fired questions at a panel of Branch members. The evening concluded with coffee and doughnuts being served and the operation of the '1954 Employment Clinic' ably conducted by J. Ogilvy, assistant field Secretary. Every member of the large number who attended agreed that this was one of the most successful and enjoyable meetings that he had attended.

#### Atomic Energy

F. W. Gilbert, manager of the Reactor Operations Division, Atomic Energy of Canada Ltd. visited the Branch on Thursday, March 4, and delivered a most interesting paper entitled "Mountain Climbing with Atomic Energy Engineers". The title was based on an analogy drawn between the force that prompts men to climb mountains and the force that drives engineers to the solution of problems. Mr. Gilbert's particular mountain is the development of economical power from nuclear fission.

The problem in the design of a reactor using uranium as a fuel is the control and conservation of neutrons emitted by the unstable portion of

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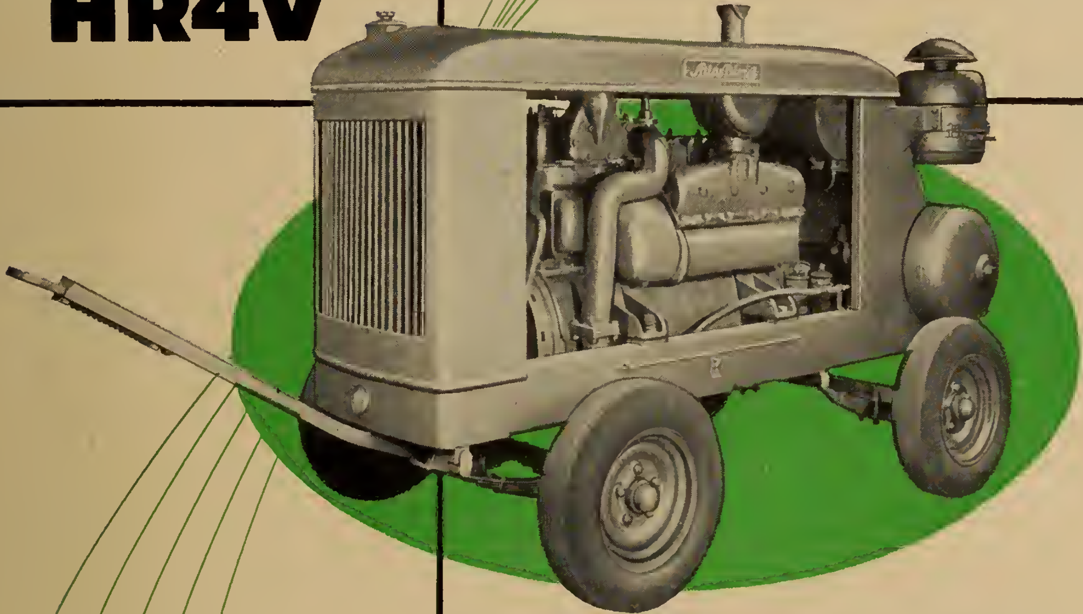

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CP-4M

uranium—$U^{235}$. Various types of reactor have been devised—the rod type in which $U^{235}$ and $U^{238}$ are present in the form of "rods" or "slugs"—the "slurry" type in which a slurry consisting of a mixture of uranium in heavy water is pumped through a boiler to remove the energy—and the "fast" reactor which is best described as a controlled atomic bomb. The paper described many of the other problems facing the atomic energy engineer.

A short film was also shown which described the problems involved in the repair of the NRX reactor at Chalk River.

The large audience was most appreciative of the trouble taken by Mr. Gilbert in preparing this most interesting paper.

## Winnipeg

C. S. Landon, M.E.I.C.,
*Secretary-Treasurer*

### Civil Section

I. B. Henderson, M.E.I.C.,
*News Editor*

**Sir Adam Beck Power Development**

The following is an extract from an address given to the Civil Section of the Engineering Institute of Canada at a meeting held February 11, 1954, in the auditorium of Canadian Westinghouse Co. Ltd.

The speaker, R. H. Self, M.E.I.C., P.Eng., generation construction engineer for the Hydro-Electric Power Commission of Ontario was introduced by Frank Hutton, resident engineer, Board of Transport Commissioners.

Mr. Self showed slides and gave an informal talk on the stages of tunnel construction for the 1.6 million horsepower Sir Adam Beck No. 2 power development at Niagara Falls, Ontario.

The two tunnels, 51 ft. excavated diameter and 5.2 miles in length, were driven through sedimentary rock utilizing a harder limestone formation as a protective cover. Five shafts were driven in order to construct these tunnels, the deepest of which was 330 ft. The arch wall was supported by steel ribs of an "I" section at 4 ft. centres together with steel lagging and timber blocking. These steel sections were left in place when the concrete lining was poured and no additional reinforcing steel was used. The steel logging and timber blocking was removed wherever possible.

The tunnel was mucked out by means of 2½ yd. electric shovels loading into trucks and thence by skips up the shafts to the surface. The exhaust from these trucks was filtered to remove noxious gases. In the initial stages a ventilating shaft was carried up to the heading in order to provide sufficient fresh air. When the tunnel was holed through, the natural ventilation was sufficient.

The three foot thick concrete lining was poured in three stages. Curbs at the side of the tunnel were poured and then by means of a travelling invert screed utilizing these curbs, the invert was formed and finished by hand steel trowelling. Finally, the main arch of the tunnel was concreted using the travelling form mounted on rails situated on the previously formed curbs. Pours were made connectively for the full length of the 80 ft. form and no construction joint was provided between consecutive pours.

In order to inspect and maintain the tunnels, five pumps were installed which are capable of dewatering one tunnel in approximately one week. At the exit of the tunnel, a trapezoidal section was found necessary due to the unstable nature of the ground. This section leads into a rectangular open cut canal. It is interesting to note that whilst the trapezoidal section by its very nature had to be concreted, the open cut canal was not. It was found that in this instance to keep the friction loss to a minimum without paving the sides, it only required additional excavation in the order of a few feet, this is less costly than concreting the sides and base. This information was obtained from models which were used extensively on this project and considerable savings in costs were effected. It was found from scale models that certain rock excavation which was at first thought necessary in the forebay was not required, and the costs were reduced accordingly.

The project started in 1951 and is now well under way, the first generator being scheduled for service this spring.

The thanks of the Civil Section were extended to the speaker by D. C. Bryden, chief engineer of the Winnipeg City Hydro.

The meeting was held under the chairmanship of W. B. White, assistant engineer, Canadian National Railways.

# LIBRARY NOTES

## Additions to the Institute Library

**Reviews — Book Notes — Abstracts**

## BOOK REVIEW

**Design and construction of general hospitals.** United States department of health, education and welfare public health service. New York, F. W. Dodge Corp., 1953. 214 pp., illus., $12.00 (U.S.)

In theory, an architect and an engineer should be able to combine and construct a hospital. But the idea, as expressed by Mr. Everett S. Jones, the vice-president of The Modern Hospital Publishing Company, presents a more practical suggestion — "The best therapeutic measure for the flat feet and frazzled nerves of hospital workers would be a requirement that any architect planning a hospital don an orderly's uniform and work for two weeks on a nursing unit. Needed too was an appreciation by architects and hospital administrators of the great contribution to be made by department heads, nurses and other hospital workers to the functional planning knowledge of those designing our hospitals."

With this in mind the United States public health service with the co-operation of such groups as the American Hospital, Psychiatric, Public Health and Tuberculosis Associations, have produced the detailed information contained in this book.

Maintaining that every hospital design should be uniquely adapted for individual requirements, the material is consequently presented only as a guide for basic planning.

It is divided roughly into four sections, namely, Schematic plans, Design and Construction, Elements of the General Hospital and "Equipment lists".

Detailed discussions of hospital planning problems, from site to equipment, including costs of specialized details of construction, are followed by detailed solutions for individual departments and rooms.

The second half of the book is devoted to architects' plans, divided as to type, with running page headings, equipment cost tables, equipment supply lists, area charts for acute general hospitals, a classified bibliography and index.

This book is rather unique in its field, and merits the considered attention of all of our readers in any way interested in hospital and residence construction. E.K.

> *Correction*
>
> **BOOK NOTES**
>
> The English edition of Guyon's **Prestressed Concrete,** was erroneously listed in these pages as having 150 pages. It carries 543 pages, and is priced in Canada at $12.00.

## BOOK NOTES

**Prepared by the Library**
**The Engineering Institute of Canada**

* Review provided through the courtesy of the Engineering Societies Library in New York.

**The casting of non-ferrous ingots.** Leslie Aitchison and Voya Kondic. Toronto, Burns and MacEachern, 1953. 370 pp., diagrs., $9.25.

The authors state that the aim of this volume is to deal with the problems of ingot-making in all the commercial non-ferrous metals and their alloys, and to present the subject as a single entity.

Numerous branches of metallurgy are concerned with ingot-casting, and this work has been limited therefore to the central topic of casting ingots, and a moderate knowledge of metallurgy is assumed on the part of the reader.

It is divided into three parts: 1) Theoretical background; 2) Metallurgical aspects, and 3) Production aspects.

Bibliographies are purposely not included, because "we believe that our digestion of the publications and our presentation of the contemporary knowledge should relieve our readers from the necessity of referring to the original sources which we have consulted exhaustively."

References are made in some chapters to standard general works, or to a body of research reports.

Block letter and dark type heading and sub-headings contribute greatly to ease of use, and the book is indexed.

**Cybernetics: circular causal and feedback mechanisms in biological and social systems.** Heinz von Foerster, ed. New York, Josiah Macy, jr. foundation, 1953. 184 pp., $4.00 (U.S.).

The fact that this is the ninth conference on cybernetics is indicative of the growing popularity and possibilities of this relatively new science for promoting meaningful communication between scientific disciplines.

Because of the rapidly advancing knowledge in wide varieties of fields, an increasing number of people are coming to recognize the potentialities of cybernetics as an effective means for the exchange and dissemination of this new information.

New scientific jargon is kept to a minimum and so keen are the participants on the furthering of their ideas and discussion, that the transactions of each meeting are published and sold at cost. The meetings are informal and the discussions lively, and illustrations, figures, charts and accurate bibliographies are contributed by the various professions represented.

These multi-professional conferences are sponsored by the Josiah Macy Jr. Foundation.

**Elements of radio,** 3rd ed. Abraham Marcus and William Marcus. New York, Prentice-Hall, 1953. 771 pp., diagrs., $6.00 (U.S.).

The information contained in this volume, and the method of its presentation, is such as to make it of maximum value to a teacher giving a one year introductory course in radio.

The first chapter deals with the basic crystal receiver, and those following show the progressive and cumulative development right up to the cathode ray tube.

Questions and problems accompany each chapter, and classroom demonstrations are provided at the end of the text, as well as a good detailed index.

**Flying saucers from outer space.** D. E. Keyhoe. Toronto, McLeod, 1953. 276 pp., $3.50.

"O.K., you're flying an F-94 jet, with a radar operator behind you. You're on a routine patrol. Ground Control Intercept calls you. They've got an unknown on their radar, which is a surveillance type, with a longer range than yours. Their tracks show the unknown is making tight turns and speeds too high for any aircraft. So they give you the word — it's a UFO" (unidentified flying object). And there is an official standing order on sighting these craft "Intercept — but don't shoot!"

When asked point blank, "What do you personally think?", a major in the United States Air Force shook his head, and said, "You can't ignore the testimony of competent pilots. We don't know the answers, but we're making a careful investigation".

On May second, nineteen fifty-three, a British Comet crashed, with forty-three persons aboard, and the wreckage was strewn about for five square miles. There was no time for the pilot even to flash a distress signal. "The comet had been hit by an unidentified flying body".† Laugh if you like, we think rather you will be baffled, fascinated, and very curious.

This is the first of a number of similar titles we hope to present to you in these pages. All of them are available on loan from the library, or may be purchased through the library, or from your local bookseller.

**Handbook of probability and statistics with tables.** R. S. Burington and D. C. May. Sandusky, Handbook publishers, 1953. 332 pp., diagrs., $4.50 (U.S.).

To provide a convenient handbook of information not otherwise readily available in one volume is the purpose of this book. It is divided into two main parts. The more important formulas and definitions of elementary statistics and probability theory are first summarized. Section two follows with tables of distributions and other quantities.

As a handbook of information, it will be of use both to the statistically trained user, and also to the reader without this detailed background.

There is a very full subject index, a separate index of names, and numerous tables.

***Industrial electronics.** R. Kretzmann. New York, Elsevier press, 1953. 236 pp., diagrs., $5.50 (U.S.).

† This case has since, of course, been re-opened for further investigation. (Ed. note.)

Written primarily for the engineer engaged in supervising or maintaining electronic equipment, this book presents the fundamentals of electronic control. Part I discusses vacuum and gas-filled tubes and their circuits; Part II describes practical electronic devices such as control relays, timers, motor control devices, and many special applications.

**Industrial wastes: their disposal and treatment.** Willem Rudolfs, ed. New York, Reinhold, 1953. 497 pp., illus., \$9.50 (U.S.) (ACS monograph no. 118).

Although edited by Willem Rudolfs, chairman of the department of sanitation, New Jersey Agricultural Experiment Station, at Rutgers University, this volume is really a compilation of the work of seventeen contributors. Each one is a specialist in his own field, and the subjects treated cover disposal problems in such industries as meat packing, leather, pulp and paper, coal, water, and radio-active wastes.

Full details of the physical chemical and biological aspects are considered with each type of problem, the principal stress being placed on treatment.

Extensive references are included with each chapter, and the book is well indexed.

This is a very popular subject with our members, and this addition to the information field should be most welcome.

**Marine steam boilers.** J. H. Milton. Toronto, British Book Service, 1953. 256 pp., illus., \$5.50.

Although intended primarily for the marine engineer who is already qualified, this book has also been written for those who are studying for the United Kingdom Ministry of Transport Marine certificate examinations.

There are many types of marine boilers in use, and in this book an attempt has been made to cover the subject in a practical manner, and it deals with the various types of boiler in general use in vessels.

The historical and theoretical development of the marine boiler, and the material used in construction are discussed, as is the actual construction. Tank, water-tube, composite and exhaust gas and forced-circulation boilers are considered, as are steam generation and boiler mountings and examinations. A final chapter enumerates the Classification Society's Rules, together with observations on each.

**Modern pumps.** E. Molloy, ed. Toronto, British Book Service, 1953. 240 pp., illus., \$4.25.

There are so many types of pump in operation today that it is useful to find a comprehensive review of them in one volume. The first five chapters of this book deal with the principles of pumping, and pumping layouts. Also considered are the three main classes of pumps, reciprocating, centrifugal and rotary, and their installation, maintenance and repair.

The remaining five chapters are concerned with pumps from the view point of their applications, and the choice of a pump for any particular use. Applications dealt with in detail are boiler feeding, the mining and oil industry, and well and bore-hole pumps. There is also a chapter on pumps for special purposes, including sewage, drainage, irrigation, and general contractors' work, and pumps for special liquids.

There are seventeen tables in the Appendix showing such things as friction loss in cast-iron pipe, suction lift for various temperatures, the weight of water at different temperatures, steam pressure, temperature and weight, barometric pressure corresponding to various altitudes, pressure of atmospheres in pounds per square inch, specific gravity of liquids, and other relevant subjects.

**The mystery of other worlds revealed.** Willy Ley, et al. Toronto, Saunders, 1953. 144 pp., illus., $4.50.

Space travel is rapidly assuming a place of attention in the scientific world, and the possibility of its reality coming daily closer.

Of a number of space travel and flying saucer books recently received in the library, this is of the more spectacular type, in that it includes pictures of fanciful biological specimens of life on other planets.

The whole is really a compilation of magazine articles, with excerpts and illustrations ranging in type from the Journal of the British Interplanetary Society to Mechanix Illustrated.

The co-operation of Paramount Pictures is indicated in their contributions of scenes from their film War of the Worlds, based on H. G. Wells' novel.

Present developments being as they are, the children may find all of this less fantastic than do our regular readers.

**Pressure vessel manual,** 4th ed. K. O. Siemon. Ann Arbor, Edwards bros., 1953. 284 pages, diagrs., $3.85 (U.S.).

Originally copyrighted in 1940, 1941 and 1942, the code requirements of this volume have since been revised and brought up to date with the 1950 edition of the A.S.M.E. Code, and the 1951 edition of the A.P.I. - A.S.M.E. Code for unfired pressure vessels. This has concerned principally changes in design formulas for cylindrical shells and heads, and some data relating to flange design.

Principal materials of construction are discussed and physical properties and fabricating characteristics of the different metals, always having in mind the needs of the designer of process equipment.

References are included with most chapters, and the book is indexed.

**Principles and practice of radar,** 4th ed. H. E. Penrose and R. S. H. Boulding. Toronto, British Book Service, 1953. 795 pp., illus., $10.00.

First published in 1949, this book is now in its fourth revised and enlarged edition. These frequent revisions are obviously necessary with the increasingly exacting requirements of modern radar installations.

Information on microwave radar has been emphasized and enlarged, with a corresponding diminution of longer wave length instruction. The chapter on feeder systems has been entirely rewritten with greater stress being placed on coaxial feeders and waveguides than to open wire feeders. Microwaves and their special problems are dealt with, and additional circuits for special purposes have been added. Some electrical symbols used differ from those in the United States, but the meaning is clear from the context.

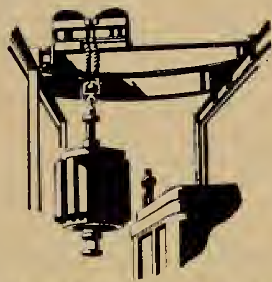
There is an excellent detailed index.

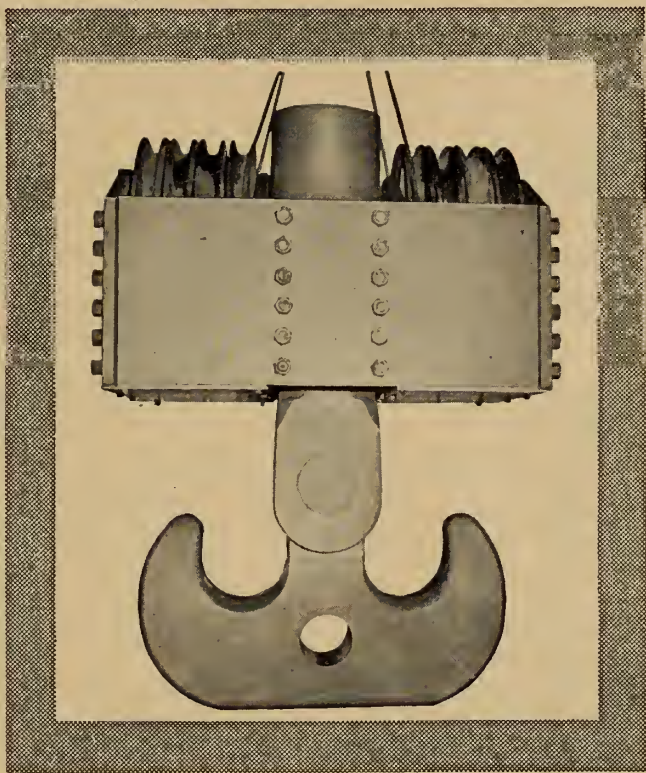
**Renewing our cities.** M. L. Colean. New York, Twentieth Century Fund, 1953. 181 pp., illus., $2.50 (U.S.).

"Worn out and static urban districts are now an old story, but the question of how they came to be, why they persist, and how to get rid of them still remains . . . A city, unless it has ceased to function . . . is always in transition . . . Because of this there can be no final once-and-for-all answer to the city's problems."

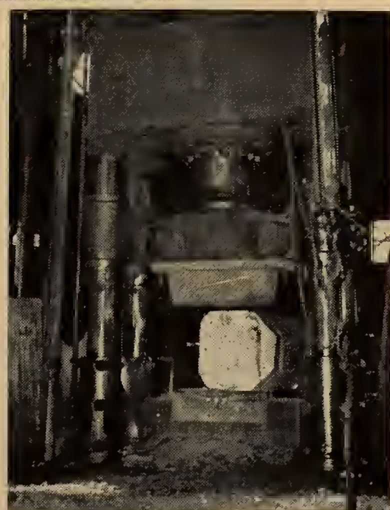
However, in spite of this statement, this volume does present a thorough discussion of the problem as a whole.











Opening with the growth of a problem, the ensuing sections, Slums and renewal, Renewal and its problems, What is being done, and Looking forward, follow in logical sequence.

Source footnotes accompany the text, and photographic illustrations are used to clarify certain points of congestion, handling of traffic, parking facilities, etc., and constructive proposals and suggestions are included in the chapter Looking Forward.

The book is well indexed, and should be a timely publication for a large number of our members.

**Retirement and the industrial worker: prospect and reality.** Jacob Tuckman and Irving Lorge. New York, Columbia University, bureau of publications teachers college, 1953. 105 pp., $2.75 (U.S.).

Published as a research study of the Institute of adult education, two major problems are dealt with in this treatise: 1) The function of adult education in community development and 2) Studies in personal adjustment to stress points in adult life. Good co-operation from the Institute of psychological research has been a great aid in the compilation of the material.

The volume is well worked out and developed, opening with a discussion of the problem of retirement and advancing to pressure of age and work, attitude of the individual and of the family to retirement, and the actual retirement.

The appendix contains interview schedules, and bibliography, and should be of great interest to a large group of our readers.



**Small motors and transformers; design and construction.** E. Molloy, ed. Toronto, British Book Service, 1953. 176 pp., diagrs., $3.50.

"It is the purpose of this book to provide, in a convenient form, sufficient data to enable any engineer to undertake the design, construction and rewinding of small motors and dynamos, and the design and construction of small motor transformers for a wide variety of purposes."

A.C., D.C., universal and fractional horse power, and squirrel cage induction motors are all considered, along with the design and construction of small power transformers.

The presentation is practical, and the illustrations excellent.

**Toxic solvents.** Ethel Browning. Toronto, Macmillan, 1953. 168 pp., $3.00.

"For the purpose of this publication an organic solvent may be broadly defined as an organic liquid in which substances can be dissolved without changing their chemical properties."

The increasing use of solvents for industrial purposes correspondingly increases danger to operatives handling them. The large number of deaths in industry due to this toxicity led the British government to appoint a committee to investigate the whole problem, under the direction of the author of this volume, Dr. Ethel Browning. The object of the publication is to present this information in a readable form. Special attention has been given to fields of action, chemical properties, and potentialities for injury of these chemicals, and fairly detailed descriptions of physiological effects.

The arrangement of the text proper is classified according to type of solvent.

"Precautions against health hazards" follows this, and then a glossary of medical terms, and an index.

It should be of particular appeal to works managers, chemists, engineers, and safety officers.

## BOOKS RECEIVED

**Abaques ou monogrammes.** A Giet. Paris, Dunod; Montreal, Fomac, 1954. 224 pp., figs., $7.50.

**Absorption towers.** G. A. Morris and J. Jackson, Toronto, Butterworth, 1953. 159 pp., figs., $5.00.

**Aide-mémoire Dunod: métrologie appliquée,** 2d ed. M. Denis-Papin and J. Vallot. Paris, Dunod; Montreal, Fomac, 1954. 300 pp., figs., $2.25.

**Applications pratiques des rayons infrarouges,** 3d. ed. M. Déribéré. Paris, Dunod; Montreal, Fomac, 1954. 436 pp., illus., $16.65.

**Architectural lettering for plans and ornamental design.** A. E. Burke. Chicago, American technical society; Toronto, General Publishing Co., 1953. 187 pp., illus., $6.50 (U.S.).

**Billings and water power in Brazil.** A. J. Ackerman. New York, American society of civil engineers, 1953. 129 pp., illus., $7.00 (U.S.).

**Britain's atomic factories.** K. E. B. Jay. Ottawa, United Kingdom information office, 1954. 100 pp., illus., $1.25.

**Calcul et exécution des ouvrages en béton armé. v. 2. Fondations et superstructures des bâtiments. Silos, canalisations, réservoirs,** 3d ed. V. Forestier. Paris, Dunod; Montreal, Fomac, 1954. 232 pp., figs., $5.00.

**Clay mineralogy.** R. E. Grim. Toronto, McGraw-Hill, 1953. 384 pp., illus., $10.80.

**Construction methods and machinery.** F. H. Kellog. New York, Prentice-Hall, 1954. 415 pp., illus., $10.00 (U.S.)

**The design of dams.** A. Bourgin, tr. by F. F. Ferguson. Toronto, Pitman, 1953. 344 pp., figs., $9.00.

**Dictionnaire technique anglais-français chauffage industriel.** I. Duniscekis. Paris, Dunod; Montreal, Fomac, 1954. 144 pp., $3.55.

**Elements of statistics.** H. C. Fryer. New York, Wiley, 1954. 262 pp., $4.75.

**Etude de la lubrification et calcul des paliers, lois théoriques et expérimentales.** L. Leloup. Paris, Dunod; Montreal, Fomac, 1954. 296 pp., figs., $9.50.

**The Firestone story; a history of the Firestone Tire & Rubber Co.** Alfred Lief. Toronto, Whittlesey House, 1951. 437 pp., illus., $4.50.

**Flying saucers have landed.** Desmond Leslie and George Adamski. London, Book Centre, 1953. 252 pp., illus., 12/6.

**Fourth symposium (International) on combustion, September, 1952.** Baltimore, Williams & Wilkins; Toronto, Burns & MacEachern, 1953. 926 pp., diagrs., $7.00.

**The growth of integrated oil companies.** J. G. McLean and R. W. Haigh. Boston, Harvard Business School, Division of Research, 1954. 728 pp., figs., $12.00 (U.S.).

**Hydraulique technique.** Charles Jaeger. Paris, Dunod; Montreal, Fomac, 1954. 510 pp., figs., $21.50.

**Introduction à l'électronique.** P. Grocu. Paris, Dunod, Montreal, Fomac, 1954. 212 pp., figs., $7.75.

**Maintenance engineers' pocket book.** E. Molloy, ed. Toronto, British Book Service, 1953. 256 pp., diagrs., $3.00.

**Materials and processes,** 2d ed. J. F. Young. New York, Wiley, 1954. 1,074 pp., figs., $8.50.

**Métallurgie. v. 2 Elaboration des métaux,** 2d ed. C. Chaussin and G. Hilly. Paris, Dunod; Montreal, Fomac, 1954. 202 pp., figs., $4.15.

**Les moteurs électriques à puissance fractionnaire.** C. G. Veinott. Paris, Dunod; Montreal, Fomac, 1954. 538 pp., figs., $20.25.

**Proceedings of Athabasca Oil sands conference, September 1951.** Edmonton, Oil sands project, 1951. 371 pp., illus., $2.50.

**Proceedings of the Canadian Conference on prestressed concrete, 1954.** Toronto, University Press, 1954. irreg. paging, illus., $2.50.

**The radio amateur's handbook, 1954 ed.** West Hartford, American radio relay league, 1954. 788 pp., illus., $3.50 (U.S.).

**Refuse collection and disposal for the small community.** U.S., Public health service and American public works association. Chicago, American public works association, 1953. 39 pp., illus., $2.00 (U.S.).

**Reinforced concrete water towers, bunkers, silos and gantries.** W. S. Gray, 3d ed, rev. by G. P. Manning. London, Concrete Publications, 1953. 223 pp., illus., $2.80.

**Résistance des matériaux, théorique et expérimentale. v. 1 Théorie de l'élasticité et des structures élastiques.** R. L'Hermite. Paris, Dunod; Montreal, Fomac, 1954. 860 pp., figs., $33.60.

**Saben's Uganda directory. Commercial directory and handbook of Uganda, 1953/54.** Kampala, Uganda, Saben, 1953. 432 pp., maps, 25/–.

**Shell moulding.** London, Machinery Publishing Co., 1953. 94 pp., illus., $1.00.

**Sudbury basin.** D. M. LeBourdais. Toronto, Ryerson, 1954. 210 pp., illus., $3.00.

**The synchronous induction motor.** J. Griffin. London, Macdonald, 1954. 136 pp., diagrs., 18/–.

**Technologie professionnelle d'électricité, v. 1.,** 2d ed. R. Merlet. Paris, Dunod; Montreal, Fomac, 1954. 386 pp., figs., $3.95.

**Theory of machines.** B. B. Low. Toronto, Longmans, Green, 1954. 472 pp., figs., $4.50.

**Timber; its structure and properties,** 3d ed. H. E. Desch. Toronto, Macmillan, 1953. 350 pp., illus., $3.00.

**Le titane et ses composés dans l'industrie,** 2d ed. M. Déribéré. Paris, Dunod; Montreal, Fomac, 1954. 278 pp., figs., $7.75.

**Traité théorique et pratique des engrenages, v. 1 Théorie et technologie,** 2d ed. G. Henriot. Paris, Dunod; Montreal, Fomac, 1954. 394 pp., figs., fold. maps, $15.75.

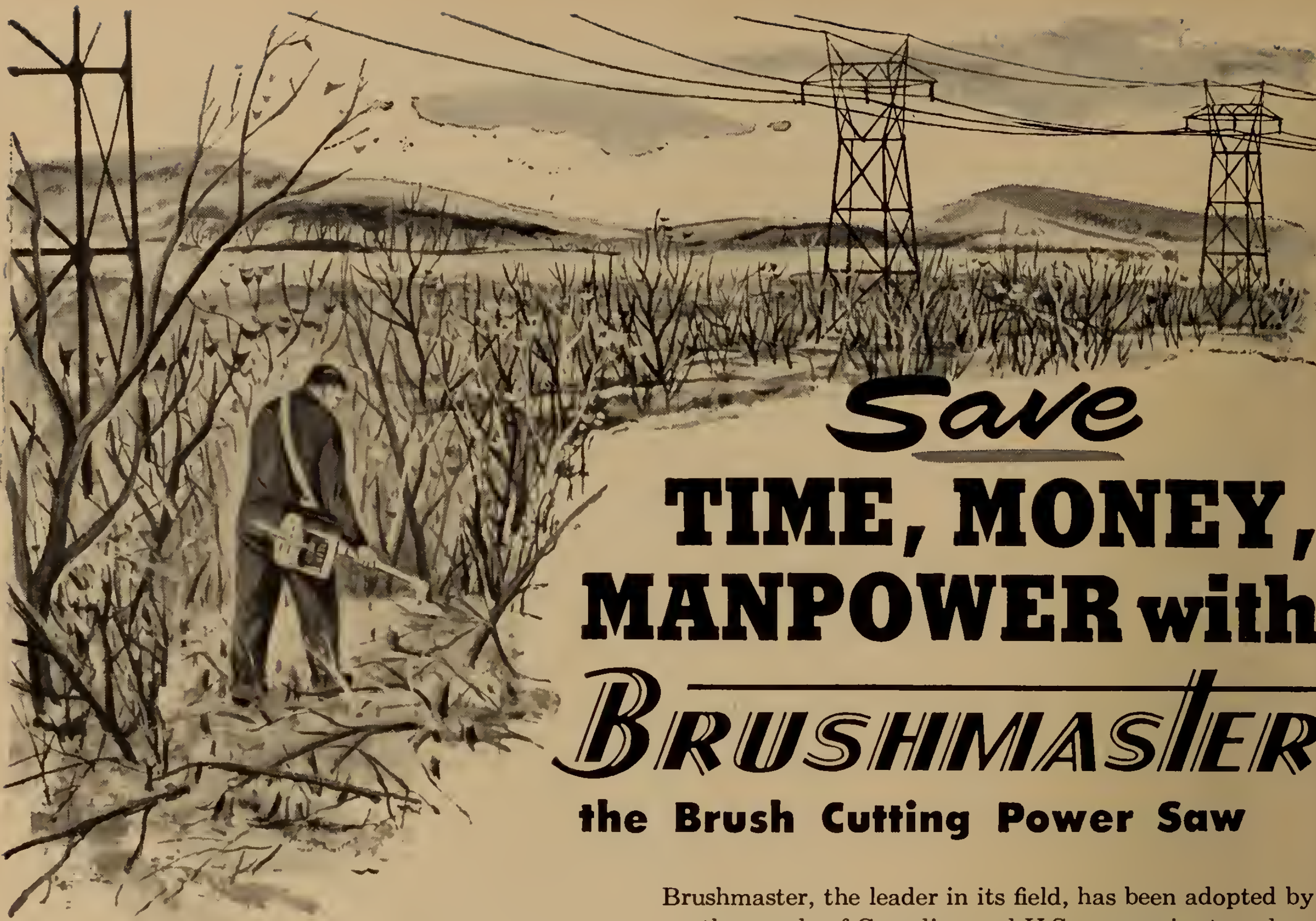
**The Van Nostrand chemist's dictionary.** J. M. Honig and others, eds. Toronto, Van Nostrand, 1953. 761 pp., $12.00.

**With rod and transit; the engineering career of Thomas S. McNair, 1824-1901.** J. B. McNair. Los Angeles, The Author, 1951. 267 pp., illus.

**The year that made the day.** London, British Broadcasting Corporation, 1953. 79 pp., illus., $1.50.







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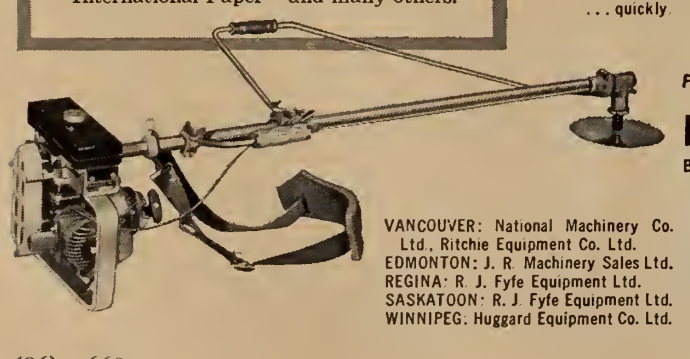

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# Business & Industrial Briefs

## A Digest of Information received by The Editor

## Appointments and Transfers

**Donald H. McLaren.**—Donald H. McLaren, vice-president, of the Foundation Company of Ontario Limited, has been appointed chief engineer of Defence Construction (1951) Limited. Mr. McLaren is being made available on loan, he succeeds C. G. Kingsmill, who is returning to Angus Robertson Limited.

●

**Duncan W. Fraser.**—The retirement of Duncan W. Fraser as chairman of the board of directors of Montreal Locomotive Works, Ltd., was announced recently to be effective on April 30th.

Mr. Fraser has been associated with Montreal Locomotive continuously for 50 years, and is currently a director of American Locomotive. He has also served as director of Canada Iron Foundries, Ltd., and Dominion Steel and Coal Company, Ltd.

●

**Canadian General Electric.** — W. F. Smith, becomes manager of the new component products division which was recently established within the industrial products division of Canadian General Electric Company. The new department replaces the former industries department.

●

**Cominco.**—A. G. Robertson has been appointed superintendent of concentration for the Consolidated Mining and Smelting Company of Canada Limited. Mr. Robertson will continue to act as superintendent of the Sullivan concentrator, Kimberley, B.C. and will also be responsible for the technical direction of all other Cominco concentrators.

●

W. T. Allen

**Automatic Electric Sales Appointments.**—C. R. Hughes, president of Automatic Electric Sales (Canada) Ltd., recently announced the following staff appointments:

R. W. Robb, formerly supervisor of telephone sales in Toronto becomes Winnipeg district manager with headquarters at 115 Phoenix Bldg., Winnipeg.

W. R. Boast, previously engaged in sales and field work in Montreal is named Toronto district manager.

C. H. Beggs, in charge of telephone sales in the Montreal district, becomes Montreal district manager with headquarters at 54 Decarie Blvd., Ville St. Laurent, Montreal 9.

L. C. Kelly, in charge of telephone sales at Vancouver, becomes Vancouver district manager with headquarters at 527 West 8th Avenue, Vancouver.

●

**W. T. Allen.** — H. E. Cole, executive vice-president and general manager, Trane Company of Canada Limited, announced the appointment of W. T. Allen as franchise holder of the London territory effective April 1.

Mr. Allen, a successful sales representative in this territory for several years, now becomes manager of the company's branch office in London.

●

**English Electric.**—John Michael Sowry has been appointed executive assistant to H. E. Style, president of the John Inglis Co. Ltd., and the English Electric Company of Canada Limited.

●

*(Continued on page 664)*


What's the Connecting Link?
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Associate Company Warehouses at: AMHERST, N.S., SAULT STE. MARIE

*(Continued from page 662)*

**Toronto Iron Works Limited.** — The appointments of John C. Udd of Montreal as director and Arthur J. LeBlanc as general manager have been announced by G. E. Ellsworth, president of the Toronto Iron Works Limited. Mr. Udd's appointment as director of Central Bridge Company Limited was also announced.

**Wallaceburg Brass Limited.** — J. A. Burgess, vice-president of Wallaceburg Brass Limited, recently announced the formation of a new company, Wallaceburg-Singer Limited, set up to manufacture hot brass pressings in Canada. Head office is in Wallaceburg, Ontario. Mr. Burgess is vice-president and general manager.

**Northern Electric.**—Powerlite Devices Limited, announces the appointment of Northern Electric Company Limited as its exclusive distributor of Powerlite Street Lighting Equipment in the Dominion of Canada. This will include the well-known Powerlite line of incandescent luminaires, new mercury vapor luminaires, brackets and ornamental street lighting standards. A new fluorescent street lighting luminaire is now available for use with the new T12 rapid start lamp. Photoelectric controllers and relays are also included in the arrangement.

**Bepco Canada Limited.**—Bepco Canada Limited has announced the appointment of Jack H. Crisp as publicity manager. Mr. Crisp was previously employed by Cables, Conduits and Fittings Limited, St. Johns, Que., in the capacity of advertising manager.

*(Continued on page 666)*

*(Continued from page 664)*

# New Equipment and Developments

**Flexible Cylinder Arrangement.** — A new line of Oxweld stationary manifolds, introduced by Dominion Oxygen Company, features advantages that enable the user to realize the many economies of a dependable and continuous gas supply. Centralization of gas supply, by means of manifolds and feed lines, saves time and money for those who use large quantities of compressed gases. Manifolding the cylinders reduces floor space requirements, cuts labour costs, eliminates many handling and maintenance costs, and increases production by providing a continuous flow of industrial gases at controlled pressures.

This new line offers a wide choice of both single-regulator and dual-regulator manifolds.

In the dual-regulator series the reserve bank of cylinders picks up the gas load automatically — with no interruption of service — when the usable supply in the operating bank of cylinders is exhausted.

The single-regulator series has one pressure regulator to control flow of gas from both cylinder banks, and change-over from depleted to reserve bank is done manually. Separate control valves allow the use of one bank at a time or both at once.

Both series include manifolds for use with oxygen; water-pumped inert gases, such as nitrogen and argon, or water-pumped air; oil-pumped inert gases or air; high-pressure fuel gases, such as hydrogen; and liquified petroleum gases. All manifolds mount against a wall or on floor supports in any size or shape room. They are approved and listed by both Underwriters Laboratories, Inc., and Factory Mutual Laboratories.

●

**Listing Symbol.**—Underwriters' Laboratories of Canada has recently announced to its subscribers the development of a Listing Symbol for use in advertising and other printed matter covering listed products. The symbol will provide a convenient method whereby a manufacturer may inform the public that the product described in published advertisements, catalogues, and other literature, has been tested by the Laboratories and is listed under one of its inspection services.

The symbol is available in four official variations and the use of each is governed by the type of inspection service under which a product is listed.

The first three forms of symbol are similar in design, consisting of two concentric circles with the letters "ULC" enclosed within the inner circle and a definitive statement in the space between the inner and outer circles. A single circle enclosing the letters "ULC" comprises the fourth form of symbol.

Form I, which constitutes the basic design, includes the statement "Listed by Underwriters' Laboratories of Canada" and may be used universally in printed matter covering products listed under any of the several inspection programs. Form II is identical to Form I, except that substitution of the word

*(Continued on page 670)*


TRANSF.2D.
C B A

(*Continued from page 666*)

"labelled" for the word "listed" confines this design for use only in connection with products listed under label service. Form III is specifically intended for use on the package or carton in which a labelled product is packed and the statement appearing thereon is worded accordingly.

●

# Publications

**For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.**

**Please mention *The Engineering Journal* when writing.**

**Elevators.**—Automatic Programs Selection, Automatic Elevatoring, and an Electronic Detector which initiates door reversal by "sensing" the presence of a passenger are the titles of three booklets recently issued by the Otis Elevator Company.

Basic traffic programs and features of automatic and semi-automatic operation, are discussed. Also available is a list of Otis contracts for automatic electronics elevators. Address correspondence to the Otis Elevator Company Limited, Hamilton, Ont.

●

**Power Transformers.**—A new bulletin prepared by Reliance Electric & Engineering (Canada) Limited which gives useful data on how to select power transformers is now available. Selection data is given in terms of the latest standard specifications of the Canadian Standards' Association on power transformers. The bulletin attempts to show the economies of selecting standard equipment and points out what makes a power transformer special.

A discussion is included on the merits of selecting single phase or three phase units. The bulletin also describes the various types of cooling power transformers. It is available from the company at Welland, Ont.

●

**Rolling Doors.**—Three Bulletins about rolling wood doors, and rolling steel doors have been issued by G. Brady & Co. Ltd. Included are detailed drawings of the installation, and illustrations of some typical applications.

The bulletins are available from David C. Orrock and Co., 1405 Bishop Street, Montreal 25, Quebec, Canadian representative of the company.

●

**Turbo Blowers and Compressors.** — The latest Brown Boveri publication is a special brochure on "Turbo Blowers and Compressors". This publication should be of considerable interest to plant and design engineers in chemical, mining and engineering industries where large volumes of oil free compressed air or other gases are required.

Address inquiries to Brown Boveri (Canada) Limited, 1015 Beaver Hall Hill, Montreal 1, Que.

●

# THE ENGINEERING JOURNAL

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# CONTENTS



*Indexed in The Engineering Index*

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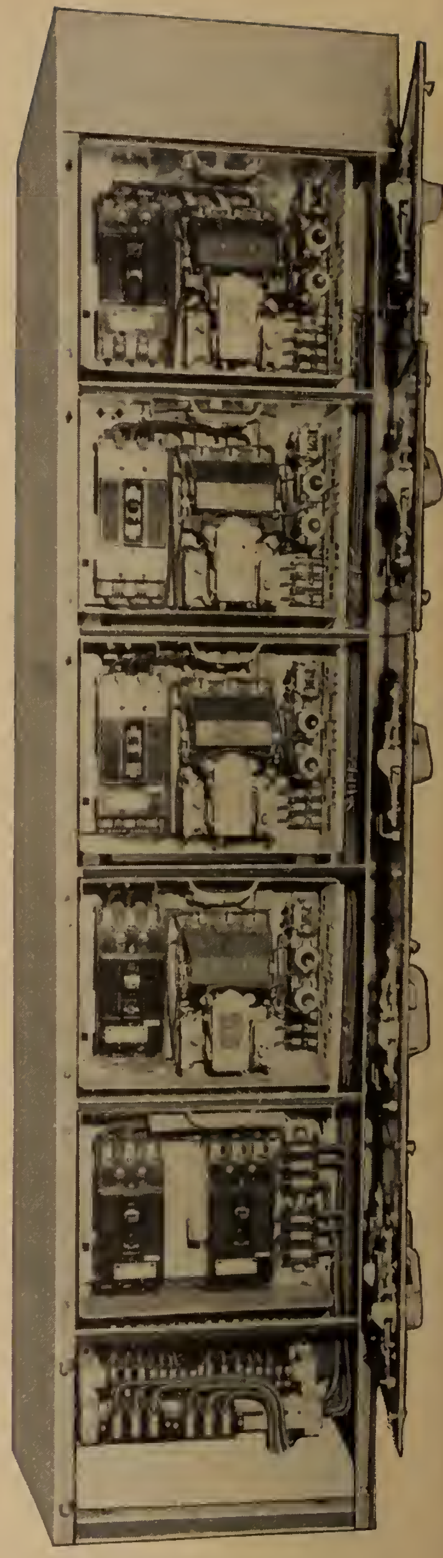

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# Westinghouse

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# CONTROL CENTERS

During those years of the war when the Japanese threatened to get a footing in Alaska — in fact, did get a toehold there — the Alaska Highway was much in the public eye. Now interest in it has subsided considerably, except among those in Alberta, British Columbia and the Yukon whom it serves. The 1,221 miles of it in Canada, rechristened the "Northwest Highway System" poses problems of maintenance and development of most interesting character; these are what Brigadier Love discusses in this paper, delivered before the Vancouver Branch on October 15, 1953.

# The Northwest Highway System

*by*

Brigadier H. W. Love, O.B.E., C.D., M.E.I.C.

*Commander, Northwest Highway System, Canadian Army.*

The object of this paper is to give a picture of the problems of maintaining the Northwest Highway System and the engineer organization and management, or, in military terms, "the administrative aspects" of the task. An appreciation of the geography and topography, the connecting transport systems and particularly of the distances involved, is essential to a proper understanding of the problem.

### Physical Features

The Canadian portion of the Alaska Highway extends from Dawson Creek, B.C., Mile 0, to the Yukon-Alaska Border, Mile 1221.4. (Fig. 2.) Included in the Army's responsibility are eight airfield access roads: Fort St. John, Beatton River, Fort Nelson, Smith River, Watson Lake, Teslin Lake, Aishihik and Snag. These total 220 miles. In addition, the Army maintains seven emergency landing strips immediately adjacent to the main road at Miles 148, 223, 507, 722, 843, 1013 and 1096.

The Army is also responsible for the Haines Cut-Off Road from the Yukon-Alaska border to its junction with the main highway, approximately 117 miles. This road, the Northwest Highway System (NWHS) operates in summer only, opening in May or June and closing in October or early November, depending on weather conditions. The airfields, other than the emergency landing strips, are maintained by

Fig. 1. Slims River, Mile 1059, is one of the typical glacier-fed streams crossed by the Alaska Highway. The crossing in the foreground is part of the pioneer road and the existing crossing is located three miles downstream. Identifiable in the background are mountains of the St. Elias Range including Mount Logan (El. 19,850 ft.) to the right, Mount Vancouver (El. 15,700 ft.) just left of the center, and Mount Hubbard (El. 14,950 ft.) to the extreme left.


**Fig. 2. Map of the Northwest Highway System.**

the RCAF and the Department of Transport.

The Highway is served by two railways, the Northern Alberta Railway (Edmonton to Dawson Creek), and the Whitepass Railway (Skagway, Alaska, to Whitehorse). It is served by two provincial highways from the South—Edmonton to Dawson Creek and the Hart Highway in British Columbia from Prince George to Dawson Creek. It joins the Alaska Road System at the border at Mile 1221.4. The McKenzie Highway from Grimshaw, Alberta, to Hay River, is also an important feature in northern transportation, but there is no interconnection between the NWHS and the McKenzie basin. The Canol Road from Norman Wells to Mile 836 on the NWHS was abandoned in 1945. Yukon and British Columbia communities are gradually being connected to the Alaska Highway.

Throughout the 1,600 miles of road operated by NWHS, there is a wide range of topography, soils and climatic conditions. From Mile 0 to Mile 360 the soil is almost uniformly silt and decomposed shale, with long stretches of flat ground overlaid with muskeg up to 25 feet deep. The rivers are characteristically meandering, silt laden, sluggish in low water, but still capable of sudden high floods, since they originate in the Rocky Mountain ranges to the west and south. The geology is similar to that of the Prairies. Oil and gas exist in quantity in the Fort St. John area and are suspected almost everywhere in the area north and east of the Rockies.

From Mile 360 to about Mile 490, the highway crosses the northwest end of the Rocky Mountain Range. (Fig. 3.) This is the only section of the highway which is actually mountainous. It is characterized by numerous small, but torrential, streams which are subject to flash floods, by rock cuts and narrow stretches, but also by predominantly good road building material. The summit at Mile 393 is 4,200 ft. above sea level, the highest point on the highway.

**Fig. 3. Mile 409, a typical section of the highway traversing the Rocky Mountains.**

From the Lower Liard River crossing at Mile 496 to about Mile 660, the highway traverses the Liard Plateau, a region of low mountains with some sections of very poor drainage, particularly along the Liard River itself. The soil here is silt and clay and causes a great deal of frost trouble — icing on side hills during the winter and innumerable frost heaves in the breakup. Here also some of the lowest temperatures are experienced and the heaviest snow fall is recorded. Much trouble is experienced from ice and drift wood in the many small streams during the spring.

From the Liard Plateau the road crosses the Cassiar Mountains — the Northern projection of the Stikines — the Nisutlin and Teslin Plateaus, and then the Coast Mountain Range, low here, to the edge of the St. Elias, about Mile 1,016, the Haines Junction. The Coast Mountains branch northward here and the St. Elias extend to the west and slightly northward into Alaska. This stretch has generally similar conditions to the Liard Plateau, but better soil and fewer difficult flood channels. In this area begins the first permafrost, but it is generally widely scattered and in small patches only. (See Fig. 1.)

From Haines Junction to Mile 1,170 the highway parallels the Kluane Range of the St. Elias Mountains, crosses three rivers of major size and glacial origin — Slims River, Donjek River and White River, — and many short, but torrential, flood channels. Here again in the vicinity of the mountains the soil is generally good sandy gravel with adequate binder readily available. This is the section which has given NWHS the most flood trouble in the past three seasons. There have been 60 washouts in a 70-mile stretch and five bridges lost, all overnight. It is relatively easy to restore traffic because of the readily available material. Permafrost throughout this area is frequent, but not continuous and occurs mainly on north-facing slopes and in the few stretches where the soil is silty.

North of Mile 1,170 and to the Alaska border the road leaves the St. Elias Mountains and crosses the White River Plateau, which is generally flat, almost completely muskeg and almost continuous permafrost. This is an interesting portion of the road from the maintenance point of view, because of the muskeg condition and the permafrost. This plateau is also very cold, being sheltered from the Pacific Ocean influence; Snag Airfield has recorded 83.6°F below zero.

### Soil Problems

Despite the permafrost which is met in the North, the Army's most vexing soil problems exist at the southern end of the road, which is geologically similar to the Prairies. The Bear Paw silts or shales are the chief cause of the troubles. There are numerous cases of bridge abutments and piers moving from soil pressures and innumerable side hill slides, large and small. (Fig. 4.) The soil is non-cohesive and if loaded will not stand for long even at a flat slope. In places the Army is faced with finding a location completely free from side hill slopes to avoid sliding.

The effect of these soils on abutments is largely the result of insufficient knowledge of conditions. There is little doubt that the failures could have been avoided by placing clean material in major fills and in back fills behind bridge abutments. Presumably, the rush to complete the road prevented a complete study of the problem. Also the use of unsatisfactory material in many places was expedient, because of the long hauls required to get good fill. With intimate knowledge of the ground, NWHS has managed to find usable gravel in most places, with a maximum haul of 5 to 10 miles. In one stretch of 45 miles straddling a good-sized mountain, however, there is a complete absence of usable rock.

A wide range of attempts has been made to stabilize these soils by drainage, growth of long-rooted grasses, reducing slopes to one in three or flatter, and so on. None of these has been wholly successful. The Army is presently trying out electro-osmosis stabilization under the advice of Dean R. M. Hardy, M.E.I.C., of the University of Alberta, in an attempt to avoid the costly replacement of the existing fills behind bridges. Elsewhere on the highway, the predominant soil problem is to find the best possible surfacing material. In some cases, pit-run material can be used right from the crusher, without adding binder. In others, binder must be added; this is usually done by applying it to the road in a thin layer and mixing it into the surface by blading. The Army has not so far contemplated the undoubtedly best, but expensive, method of grading and mixing materials to give a theoretically ideal surface.

There is remarkably little trouble which can be attributed directly to permafrost. During initial construction, the United States Army engineers, with no previous knowledge of this phenomenon, attempted to ditch a considerable stretch of the highway at the north end and, of course, ran into difficulties. In some places the road sank 10 to 15 feet, as the permafrost table was lowered by the penetration of heat through the ditches. NWHS has benefited from their experience and from subsequent study of the problem. In 1951, a cut was made extending 30 feet into permafrost off the north approach of the Donjek bridge. Four to five feet of clean fill was placed as a subgrade over this cut, and while the surrounding side hill has gradually receded, the road surface itself has remained sound. Although NWHS anticipated that it would have to refill this approach periodically for perhaps three or four years, it has apparently placed the correct amount of insulation to retain the permafrost table stable at the bottom of the cut.

Occasionally it is necessary to drive piles into permafrost. While this is slow, it is readily done with a steam jet. The pile follows the jet down with a minimum of driving and freezes into position, giving a very solid foundation. Some of the original timber trestle bridges have pile bents resting on frost lenses. Occasionally, the over burden is eroded by a flash flood and the frost melts out with awkward results on the structure. Such defects are gradually being corrected, as the original temporary bridges are replaced.

### Bridge Problems

Some of the bridge problems which result from the soil have already been mentioned. These mainly concern the smaller permanent bridges built during the original highway construction. There is a total of 171 bridges of 20-foot span or over, 32,000 lineal feet in all, and of these 44 are permanent, including those with treated timber trusses. Soil pressures have resulted in the cracking of abutment walls, in a few cases in the cracking of concrete piles under the abutments, and in three cases, in the cracking of the tops of piers from horizontal thrust transmitted through the girders. None of these are very difficult to repair once soil condition has been corrected. Of the remaining permanent bridges, only the largest has been a serious problem. This is the 2,267-foot suspension bridge over the Peace River at Mile 35. (Fig. 5.)

The north pier of this bridge rests on shale, which disintegrates when

**Fig. 4 Gardiner Creek Bridge, Mile 358, illustrates the extent of soil movement.**

exposed to water action. Excessive scour exposed this foundation rock in the spring flood of 1948, the water velocity being accentuated by an unfortunate circumstance. An attempt was apparently made to salvage the sheet piling used as a coffer dam when the pier was built, but the salvage was incomplete and left in a distorted condition several sections which served to funnel the current into the toe of the footing. Movement was first observed in the pier during the summer of 1948 and subsequent boring and diving revealed that a cavity some 8 feet deep extended under the toe of the pier for a distance of some 25 feet. This was corrected by driving another coffer dam, dewatering after placing jacks under the toe of the pier, and pouring new concrete to fill the cavity and extend the footing below the calculated maximum scour depth. This work was completed in the summer of 1949.

After the 1951 high water, it was discovered that scour was again occurring to a point dangerously close to the new footing level. This was corrected during the 1951-52 winter by placing some 2,000 yards of precast concrete blocks, poured in grain sacks. To date this has served to prevent further scour.

The original movement of the footing was not corrected and the north tower is out of line at the top, 190 feet above water level, by some 20 inches. The pier also rotated outwards, or toward the center of the stream, causing a visible bow in the tower legs. Obviously, these two movements created unwelcome stresses in the tower legs and cables, which are being closely watched. The conclusions of the original designers, the engineers of the Public Roads Administration in Washington, and of the NWHS consultant, Dr. P. L. Pratley, M.E.I.C., of Montreal, are that these stresses are not serious, though further movement may make them so.

A minor, but interesting, fault occurred in the cables of the Peace River bridge and also in those of the Lower Liard Bridge, which is the only other suspension bridge. The hanger clamps were made with sharp edges at the points where the cables pass through them; continuous vibration in the cables resulted in wear and the snapping of single strands of the cable at the hanger points. This was corrected by placing wooden clamps at the center points between each pair of hangers, so that the cable vibration was damped sufficiently to prevent further wear.

The temporary bridges range in size from a 2,326-foot trestle at Mile 804, Nisutlin Bay, (Fig. 6,) to single-span timber trestles scattered throughout the highway. These have been classified according to condition and remaining economic life and it is proposed to replace them on a long-term program. There are four bridges now under contract; that at Nisutlin Bay, which will be reduced to a 1,916-foot bridge, consisting of seven 250-foot through truss spans and two 70-foot girder spans; a 500-foot-span bridge across the Yukon River at Mile 898, and two smaller ones across the Rancheria River at Miles 687 and 721. Subsequently, NWHS hopes to carry out, by contract, the replacement of the Slims River Bridge, which is now a timber trestle 1,217 feet long in the center of a long causeway across the flood plain of the Slims River. This is a three-phase job involving, first, the construction of guide banks to canalize the river, which now changes its channel frequently from one side to the other of the flood plain; second, the construction of a temporary crossing; and, finally, dismantling the present bridge and constructing the new one on the center line of the causeway.

The completion of these five bridges by contract will, according to present planning, put the Army in a position where the gradual replacement of all remaining temporary bridges can be accomplished over a long period with its own forces, supplemented now and again by contract as necessary.

There are, of course, numerous locations where it is at present unsound to put in permanent structures. These are in the flash-flood areas close to the mountains, where a sudden high-level melt will bring down a rapid flood, carrying with it huge quantities of gravel and silt. Frequently the smaller creeks dam themselves off and take a new course a mile or more from their former channel. After each flash flood, it is normal to have to find names for one or two new bridges and to find one or two others with

**Fig. 5. The Peace River bridge at Mile 35, with an overall length of 2,267 feet, the centre span being 930 feet.**

dry stream beds under them. Ultimately, NWHS hopes to effect stream control well upstream of the bridges. Until then, rough timber bridges will continue to be used for replacement.

The bridge replacement program envisages the use of standard steel or concrete spans of 250, 100, 60 and 40 feet and NWHS is attempting to develop a standard, light, precast concrete deck slab. Also under construction is a completely precast concrete bridge which was made in Calgary (Fig. 7). Surprisingly, this structure so far compares favourably in cost, in spite of the apparent waste in shipping sand and gravel as well as cement over the distances involved.

### Road Location

Another major task with which NWHS is attempting to deal on a long-term basis, is the gradual improvement of the highway to the equivalent of Trans-Canada Highway specification. The original intention was to follow a specification considerably higher than the Trans-Canada. When the magnitude of the job became apparent, this was rapidly changed and those sections of the road which were completed to the design alignment and grade were, in fact, done very closely to Trans-Canada specifications. However, in 1943 when the strategic situation in Alaska and the Aleutians altered, and the highway lost its immediate urgency, it was decided to avoid the further cost of completing the road to the established standard and simply to improve the original pioneer trail to an acceptable two-way route. This has left some 800 miles of sub-standard road, of which approximately 160 miles require complete relocation.

The portions requiring complete relocation are, rather naturally, those in the most difficult locations. Over the past several years reasonably complete studies of the best routes have been made. It is proposed during the coming year to make a start in the Prophet River section, which is probably the most difficult on the highway. There is no good soil anywhere. This area presents the worst traffic bottleneck and the most expensive maintenance, due to slides. Further progress in improvement depends, of course, on government policy. It is probable that the NWHS will be permitted to carry on with gradual improvement, since it is readily demonstrated that the work proposed will, in the long run, reduce maintenance costs to an extent which will amortize the cost of the new work in a period varying from 15 to 20 years. Further, the volume of traffic is increasing annually and the accident rate in the badly designed sections is high in comparison with that on the good stretches of road.

**Fig. 6. Nisutlin Bay trestle, Mile 804; ice damage each spring requires continual maintenance.**

### Maintenance Problems

In this category are included all the recurring commitments required to preserve the road in its present condition. The most important, of course, are the day to day blading of the surface, the periodic replacement of surface material and the maintenance of drainage.

The surface is kept in better condition than is normal for gravel roads of the provinces. A gravel road traversing such long stretches of uninhabited country is essentially a through highway, and military as well as civilian freight considerations require that it be capable of carrying uninterrupted traffic at a reasonable speed. Further, the amount of blading done is justified by a reduction in the major repair costs which would occur if NWHS permitted the road to rut or its surface to deteriorate unduly from any cause.

Resurfacing aims to replace the surface material once in five years as a minimum. In practice, certain sections require replacement more frequently; in some places in the vicinity of Fort St. John, Fort Nelson and Whitehorse, where there is a great deal of local traffic, the frequency may be as high as once in three years. More frequent replacement is required in the badly located sections, where more gravel is thrown off and the surface takes a heavier pounding because of numerous sharp turns and grades.

Ditch and shoulder maintenance presents a wide range of conditions. In the best sections it can be carried out with an ordinary motor grader; others require pull graders or scrapers and a few sections in muskeg have no proper ditches, but require special treatment to lower the water table generally in the vicinity of the road.

There is a total of some 7,800 culverts. During the original construction, the majority were built of poles cut in the vicinity of the road. Most of these have now been replaced by corrugated iron and wood-stave pipe culverts for the smaller sizes and by built-up creosote timber culverts for the larger. There are also a large number of 10-foot to 20-foot single-span bridges. In a number of locations, where non-cohesive silts cause considerable trouble with short-span bridges, the Army is contemplating replacement of the present structures with steel plate culverts up to 12 feet in diameter. If these can be obtained at a reasonable cost, it can appreciably reduce the maintenance commitment for small bridges.

Winter maintenance on the whole is easy. Generally speaking, the highway traverses areas of light precipitation and snow clearing can be done with motor graders. In the Fort St. John area and in the section north of Haines Junction, where the road is relatively high, blizzard conditions occasionally prevail and require rotary and "V" plows. The road has only once been closed because of snow conditions, when an erring foreman allowed his equipment to become snowed in at the Fort St. John airfield. The winter surface is maintained with two to three inches of hard packed snow, which remains tacky in cold weather and gives an ideal driving surface. In the fall and again in the spring there is a period of two or three weeks when slopes exposed to the sun are apt to be slippery at midday, but this condition is of short duration and so infrequent that it can be dealt with by sanding.

The only serious problems which occur during the winter result from icing; in very cold weather ground water flowing beneath the surface is frequently arrested by the deep penetration of frost and may develop sufficient pressure to burst through the surface. It then spreads out over the surface in an evergrowing glacier. This occurs most frequently on side hills and in permafrost areas where ground water flow cannot divert itself downward. The frequency and severity of icing is almost completely dependent on the conditions of freeze-up, that is, on the moisture content of the soil at freeze-up. One outstanding example, which has not yet been completely corrected, occurs on the Haines Road just south of the Junction. Here a sheet of ice 8 to 12 feet deep has at times covered a half mile of road. Methods of control depend greatly on the local circumstances, but, in principle, are based on reducing the trouble to a small area and removing water by means of a narrow deep channel to a culvert and away to the low side of the road, so that the icing may develop harmlessly away from the highway. Sometimes a simple ditch will accomplish this; sometimes the ditch requires to be covered to provide insulation, making, in effect, a very long culvert; sometimes the flow must be allowed to build up, by erecting barriers along the ditch and continually raising them as the icing develops.

The working season is, of course, relatively short. In the southern part of the road, gravel crews usually start shortly after the middle of May, when the pits thaw out sufficiently to permit crusher operation. In this area the winter close-down occurs early in November. At the northern end, some pits are not workable until July and start to freeze up about the middle of October. In general, 130 productive working days is a good average.

**Organization**

The maintenance work on the highway is controlled by a senior highway superintendent, with a staff in Whitehorse, through three highway superintendents, each responsible for approximately one-third of the highway. The southern area extends from Dawson Creek to Mile 496, the central area from 496 to Whitehorse, and the northern area from Whitehorse northward. Each area is subdivided into sections varying from 50 to 90 miles in length, depending on the local conditions and the emergency landing strips and access roads. Each section crew comprises a foreman and five or six operators, with a mechanic. They live in a small camp roughly in the center of their section, and carry out all routine maintenance. Resurfacing, pulling shoulders, reshaping ditches, etc., is performed by special roving crews under the direction of the area superintendent. Special roving crews are also used for routine bridge maintenance, culvert replacement, sign painting and so on.

Major bridge repair, bridge replacement and road relocation work is carried out by a military unit which is based in Whitehorse and operates throughout the length of the highway. In principle, basic maintenance and recurring work is carried out by civilians under military direction and new work or major repair is done by soldiers in order to obtain training.

Supporting this engineer activity are military units, again based in Whitehorse, for the supply of fuel, food, materials and equipment and the repair of equipment. These units are larger than the organization which would be required for the maintenance of the highway only, as there are other military commitments which they also support.

Basically, the center of control and management of the highway is at Whitehorse, with main installations located there, supplemented by a railhead installation at Dawson Creek for the receipt and onward movement of equipment and materials and a second major workshop at Mile 295, near Fort Nelson. In addition to this, there are three small workshop detachments at Mile 0 (Dawson Creek), Mile 635 (Watson Lake), and Mile 1,083 (Destruction Bay). Other than the technical engineering aspects of the highway operation, probably the most interesting and complex problem is that of balancing reserves of equipment with workshop capacity and spare parts holdings. Some bad mistakes can be made in excess provision of reserve equipment on the one hand and, on the other, attempting to hold enough spares and have sufficient workshop capacity to keep all equipment on the road in usable condition all the time.

There is a basic allotment of equipment to each maintenance section, a small reserve controlled by each area superintendent and a large pool controlled from Whitehorse, with which roving crews are equipped, major repair and new construction jobs supplied and as reserves for emergencies. The disposition of this equipment is planned in the fall for the following work season, and is coordinated with the winter output of the workshops, so that the right equipment will be available at the right time and place. It costs 10 cents a ton-mile or in round figures $200 per 100 miles to move a heavy piece of equipment. Consequently, an error in planning or in establishing the coming season's program, or the failure to anticipate adequately the possibility of an emergency, such as a flood, may waste several thousands of dollars by requiring an unplanned move of equipment.

Similarly, it requires a nice judgment on the part of all concerned to resist the constant pressure to have more and more equipment in operation by building up workshop capacity and spare parts holdings to the point where the overhead gets out of proportion. The Northwest Highway System has some 650 pieces of heavy equipment, including 75 motor graders, 56 heavy tractors and 36 power shovels. To maintain this, some 40,000 items of spare parts are held. This figure is high because of the impracticability of standardizing makes under government procurement. The delivery time for spare parts from manufacturers throughout North America is rarely less than 45 days and for special equipment sometimes six to nine months. Thus, it is easily seen how rapidly holdings can get out of line with true economy.

NWHS equipment is precisely similar to the standard construction equipment used throughout North America. In the past, particularly shortly after the Second World War, some military pattern equipment, particularly dump trucks and load carrying vehicles, were tried out on the highway, mainly because they were available at relatively low cost from stocks held by the Army. They have been found to be inferior to the product produced by the trade. This highway task is no different from any other; military vehicles are designed primarily for different conditions and particularly for cross-country performance, which is not required and which reduces the vehicle capacity. Further, mechanics, military and civilian, are more familiar with the standard makes. Many of the military patterns are obsolete or obsolescent and therefore spare parts are no longer readily available.

Winter operation is, of course, expensive because of the need for special lubricants and because of excessive wear and breakage. However, there is no requirement for modification of equipment or vehicles in winter use on the highway, except for the provision of larger capacity heaters and radiator protection. Normally, 30° below zero is the lower limit of operations, since at that temperature breakage becomes excessive and the output per man hour is so low as to be uneconomical.

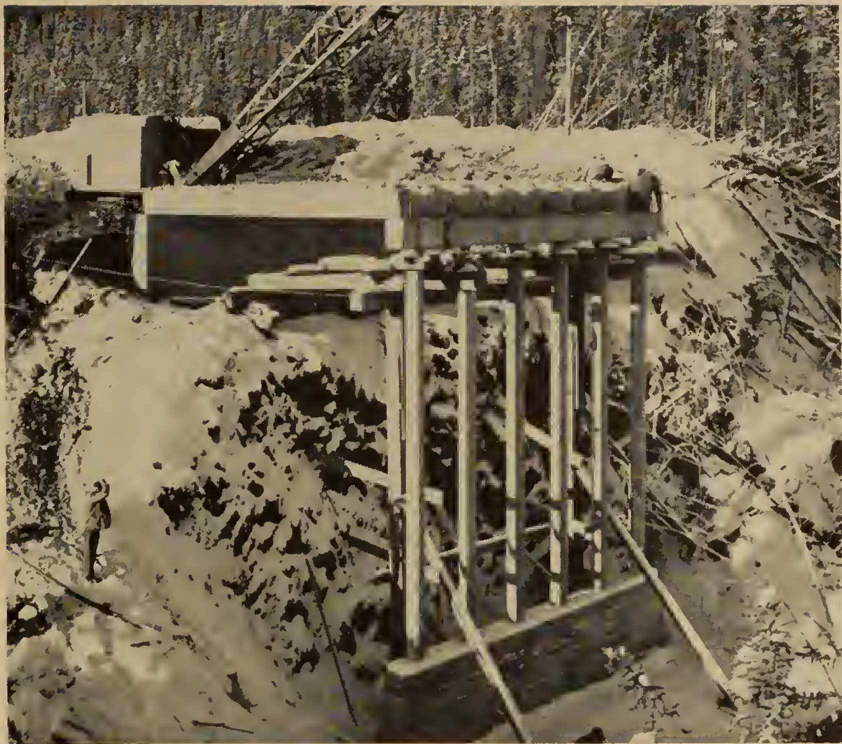

**Fig. 7. The first precast concrete bridge to be constructed on the Alaska Highway located at Mile 457; the precast members were made in Calgary.**

#### Long-Term Programming

It has been said in dealing with bridging and road location that the work on the highway has been planned ahead. In fact, all the presently foreseeable work has been reduced to three programs; one which is a recurring unavoidable commitment for resurfacing; one which envisages the replacement of all the bridges which are now temporary, over a period of some 20 years, which will allow the retention of each bridge to the end of its anticipated economic life; and the third which envisages the relocation of the 160 miles of the road which are now below the Trans-Canada Highway standard. Added to this latter is a further program of minor relocations and curve and grade adjustments for the remaining 640 miles which were not originally built to the design standard. The completion of the bridging and relocation programs, of course, depends on government policy. Nevertheless, assuming the continuation of the road as a main highway, the Northwest Highway System is now in a position to proceed with this work on a planned basis in priorities in a manner which will retain the usable life of each structure and gradually develop the highway to its full traffic capacity. Once the four bridges now under contract are completed and the Slims River Bridge has been initiated, it is anticipated that all the remaining work can be completed with NWHS's own forces over a period of 15 to 20 years. The earlier completion of these programs would require considerably more contract work.

#### Future Development

Before the construction of the Highway, and neglecting the relatively small amount of traffic carried by air, all freight and passenger movement into the Yukon and Alaska was carried by sea from west coast ports to Skagway and thence by Whitepass Railway, or to the South Alaska ports. In the Yukon and in northern British Columbia, further distribution was accomplished by water transport on the major river systems. The sea route is still the most economical method of bringing bulk materials into the northern part of this area. Until recently, and even after the construction of the highway, it has been cheapest to ship by sea to Skagway and rail to Whitehorse, and distribute along the road from Whitehorse northward and southward roughly as far as Mile 600. The economical means of transportation for the southern portion of the road below Mile 600 is by rail to Dawson Creek and thence by road.

Recently, however, it has been found that there are some changes occurring in this pattern. Perishable commodities and any items requiring special packaging for sea transport can now be delivered anywhere along the road more cheaply through Dawson Creek than by sea. Thus there is a trend towards road transport, both in Army operations and in the ordinary commercial transactions both in the Yukon and Alaska. Sea transport will probably always be most economical for heavy items which do not require special packaging. With this increase in freight movement there is a corresponding increase in passenger traffic on the highway; the over-all increase is approximately 25 per cent per year.

A good deal of the movement, of course, is military, either direct, or commercial movement induced by military activity in Alaska. The Alaska Road Commission is nearing completion on a program of paving the main road network in that territory, and it is often asked when the Canadian portion of the highway will be paved. Such a development is very far in the future. While it would be pleasant for summer driving to remove the dust hazard, the gravel surface is at present only taking a small portion of its capacity. The cost of paving has been estimated at upwards of $75,000 per mile, mainly because of high material and labour costs, and the experience of the Alaska Road Commission is that maintenance costs do not decrease but, in fact, slightly increase after paving. √

# Transistors

## and

# The Electrical Industry

*by*

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Although only about eight years old, transistors, the "mighty midgets" of electronics, have already made a place for themselves in divers fields and it is evident that they are going to be widely used to replace vacuum tubes. This paper, presented at the Quebec Annual Meeting, May, 1954, describes the transistor and its manufacture and use in language any engineer can understand.

The transistor was invented by Bardeen and Brattain of the Bell Telephone Laboratories and was first made public in 1948. Since then much research and development effort have been expended in producing improved transistors and in designing circuits to use them. The development of transistors in the laboratory has been rapid, but their quantity production and use in commercial equipments has not kept pace with these advances.

Transistors are now not widely used, except in Bell Telephone equipment and by some hearing-aid manufacturers. This situation is due in part to the fact that transistors have only recently become available in quantity and that since their characteristics are radically different from those of vacuum tubes, a complete re-education of all circuit designers is mandatory.

The transistor has the advantage of small size, extremely low power consumption, since no heater power is required, and long life, though this latter virtue requires some qualifications. These factors make the transistor eminently suitable for low power, light-weight, portable equipment.

Recent developments have produced transistors capable of controlling relatively large amounts of power and it is clear that the transistor will shortly be used in power control circuits and industrial electronic equipment.

In the light of the presently possible uses of transistors in communication and computer circuits and the future uses of transistors in higher power circuits, it appears worth while to review briefly the present status of transistor development. It is hoped that this review will stimulate consideration of some of the possible future uses of transistors in electrical and electronic engineering.

### Principles of Operation of the Transistor

The transistor is an active semiconductor device which may be used to amplify signals or to generate various waveforms. One method of connecting a point contact transistor is shown in Fig. 1.

The material most generally used is germanium; other materials show transistor action, but this paper will be restricted to the discussion of germanium. Germanium can be prepared as "p" or "n" type by the addition of suitable impurities. This nomenclature indicates the sign of the charge on the majority of the charge-carriers in the material. In n-type material the charge carriers are electrons, in p-type material the charge carriers are positive holes.

Consider only the junction type

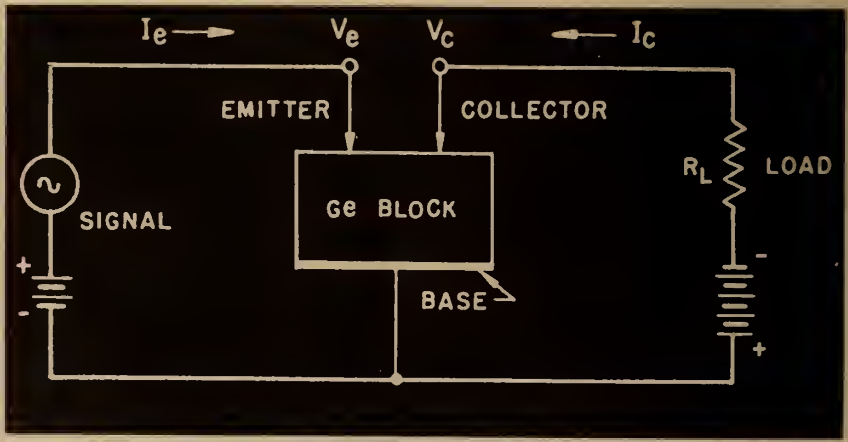



Fig. 1. Schematic circuit for amplification of an a-c. signal.

of transistor (Fig. 2). In this type the emitter and collector currents are almost equal and thus the following analogy with a triode may be drawn.

| *Transistor* | | *Vacuum Triode* |
|---|---|---|
| Emitter | = | Cathode |
| Base | = | Grid |
| Collector | = | Anode |

This analogy should not be used too rigorously, but it is useful in giving a simple picture of transistor operation. It is seen that the base electrode acts like a grid to control the current flowing in at the emitter and out at the collector in a p-n-p transistor. For an average low-power transistor, typical operating conditions might be:

| | |
|---|---|
| Collector voltage, | −1.0 volt |
| Collector current, | 0.5 ma. |
| Emitter voltage, | 1.0 volt |
| Emitter current, | 0.5 ma. |

In power transistors, higher voltages are used and the currents may be an ampere or more.

The circuit resistances and the current gains obtainable are shown in Table I, for the three different connections of a junction transistor, for a load resistance of 10,000 ohms and a generator resistance of 1,000 ohms.

**Table 1. Circuit resistance and current gains.**

| Connection | Resistance, ohms Input | Output | Current gain |
|---|---|---|---|
| Grounded base = Grounded grid . . | 70 | 880,000 | 0.96 |
| Grounded emitter = Grounded cathode | 850 | 67,500 | 24 |
| Grounded collector = Cathode follower . | 200,000 | 80 | 25 |

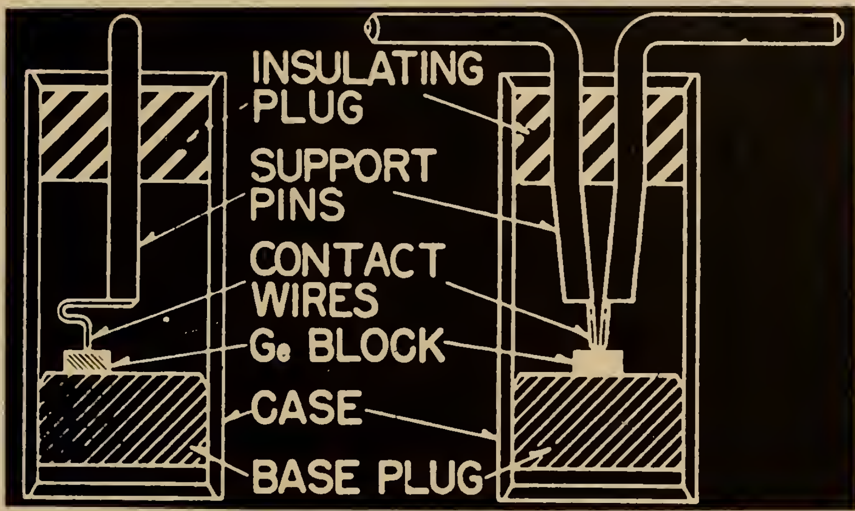



**Fig. 3. Cross sections of a point contact transistor.**

### Types of Transistor

Various general categories of transistors are now well established and they will be briefly discussed in the approximate order of their development.

***Point Contact Type***

The point contact transistor was the first type made available, as the Bell Telephone Laboratory Type "A". It consists of two wire electrodes, sharpened to chisel shaped points pressing on a wafer of germanium (Fig. 3). The point contact type has been superseded in many applications by the junction type, which has more reproducible characteristics and a lower noise figure. However, the point-contact type can have high current gain and a frequency response up to about ten megacycles. It is particularly suitable for switching applications.

***Junction type***

Two entirely different methods of manufacture lead to the "diffused junction" and "grown junction" types of transistor. These two methods of manufacture will be discussed later; at the moment the properties of junction transistors in general will be considered.

In the junction transistor of the p-n-p type a region of the n-type germanium is sandwiched between two regions of p-type material (Fig. 4). The p-type regions are the emitter and the collector, respectively, and the n-type region is the base. N-p-n junction transistors are also in use; here the types of material in the three regions have been reversed.

The large area contacts involved permit higher power dissipation than in point contact transistors. Recently junction transistors have been built in the laboratory capable of dissipating 50 watts. This indicates that the transistor will shortly invade the high power field which

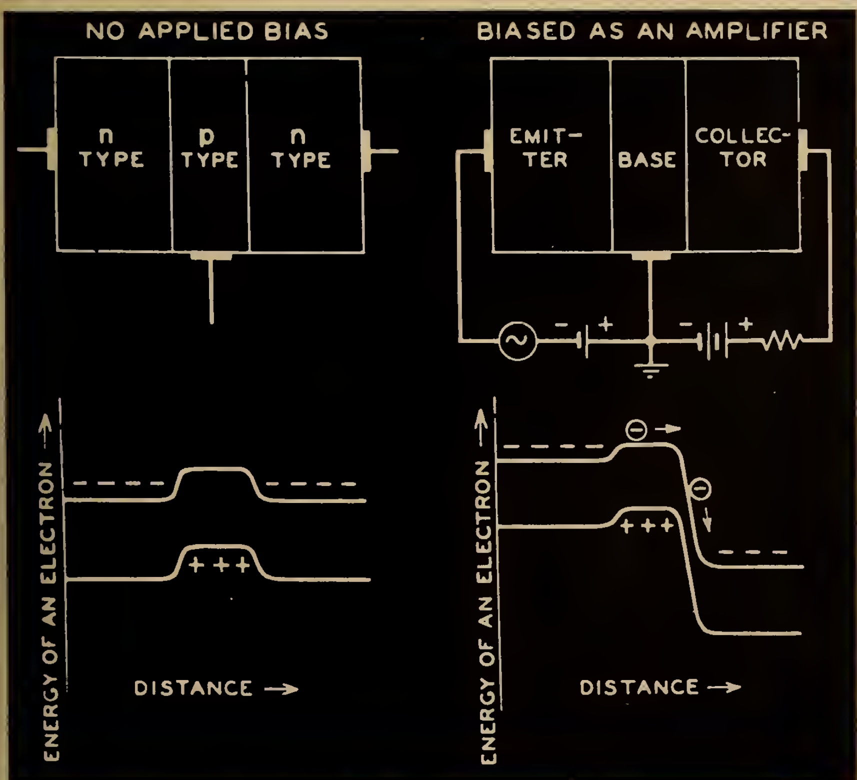



**Fig. 2. N-p-n structure and energy relationships.**

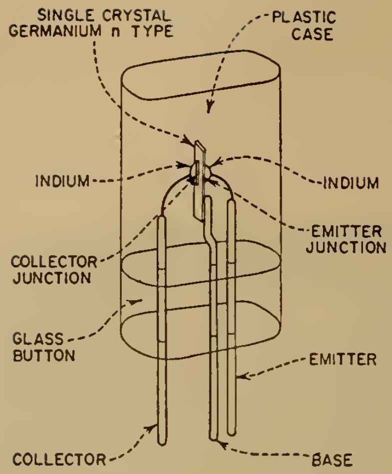



**Fig. 4. Diagram of a junction type transistor**

has, up to now, been the exclusive province of the vacuum tube.

The low power junction transistor can be made extremely small; early models in plastic capsules were no larger than the head of a match.

***Photo-transistors***

A p-n junction in germanium is strongly photosensitive and this property has been used to construct photo-transistors. These units are extremely small ($\frac{1}{4}$ x $\frac{1}{16}$ x $\frac{3}{8}$ in.) and rugged and have a high sensitivity (30 ma/lumens for light of 2,450° Kelvin colour temperature) (Fig. 5). These units are being extensively used in the Bell Telephone long-distance dialling system.

***Surface-barrier transistors***

Surface-barrier transistors are a recent development of the Philco Company. These transistors consist of a thin wafer of germanium, 0.006 in. thick, with two pits on opposite sides of the wafer in which are deposited the material forming the emitter and collector electrodes (Fig. 6). These pits and the deposited electrodes are formed by electrolytic etching and subsequent electroplating with a suitable electrolyte. The final thickness of the germanium is about 0.0002 in. between the two electrodes.

Owing to the extreme thinness of the base region of the germanium between emitter and collector, this type of transistor is capable of handling only small powers, but will operate satisfactorily to very high frequencies. Present surface-barrier transistors have been operated up to 70 megacycles per second. The method of manufacture of these transistors may lend itself to quantity production within closely controlled limits.

Numerous other specialized types of transistors have been developed such as the tetrode transistor, field effect transistor, etc., but are not yet in wide use.

**Methods and Techniques of Construction**

Transistor methods of manufacture are changing rapidly. Present techniques are not entirely suitable for quantity production and much research effort is going into investigating new methods that will permit quantity production of transistors with closely controlled characteristics.

However, in spite of the fact that these methods may shortly be outmoded, it may be of interest to discuss some current manufacturing methods to illustrate the techniques involved, some of which are new to the electronics industry, and which raise interesting problems for the production engineer to solve.

***Germanium production***

The first step in the manufacture of transistors is the production of extremely high purity germanium. The chief source of germanium on this continent is germanium dioxide, obtained as a by-product of zinc refining. The oxide is reduced to the metal by heating in an atmosphere of hydrogen. The germanium now has a volume resistivity of 1.5 to 3 ohm cms., but is not yet pure enough for transistors; it is further purified by "zone refining". After this process the germanium has a volume resistivity of 50 ohm cms. Pure germanium has a volume resistivity of 60 ohm cms.

Zone refining is accomplished by placing the germanium in a pure graphite crucible and slowly pulling the crucible through a series of induction heating coils, so that the germanium is alternately melted and solidified. The impurities in the germanium move towards the rear end of the ingot.

The result of the zone refining process is a germanium bar of very high purity except at one end, where the impurities are concentrated. The impurities in the germanium are now about 1 part in $10^8$, a very high purity indeed. This figure indicates the scrupulous care necessary to avoid contamination and is many times greater than

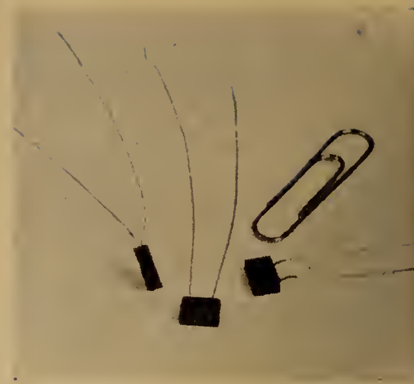


**Fig. 5. Photo-transistors.**

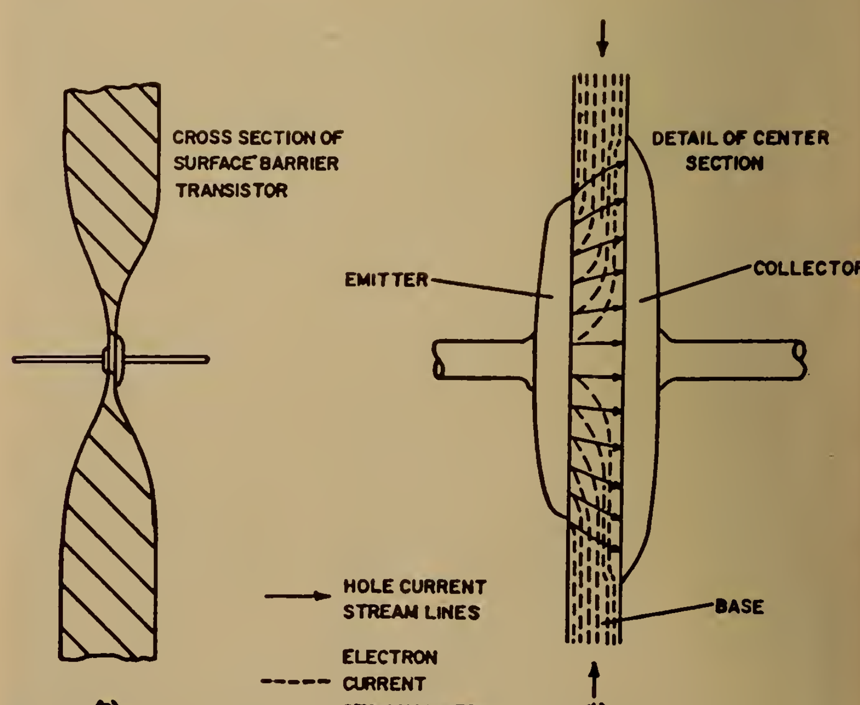



**Fig. 6. (a) Cross section of surface barrier transistor. (b) Detail of centre section.**

the purity necessary in any other mass produced product.

The bar of germanium is now formed into a single crystal and the required amount of impurities added in a vertical crystal growing machine (Fig. 7). The zone-purified germanium is melted in a hydrogen atmosphere and a small single crystal of germanium, called the "seed" is placed on the surface of the melt by means of a mechanically driven rod.

The rod is rotated and withdrawn slowly from the melt, the molten germanium crystallizes around the seed and forms a single crystal about one-half inch in diameter and six to eight inches long. This process takes several hours. These bars are then sawn up into small pieces about 0.45 inches square by 0.010 inches thick for point contact transistors, and 0.1 inch square by 0.005 inches thick for junction transistors.

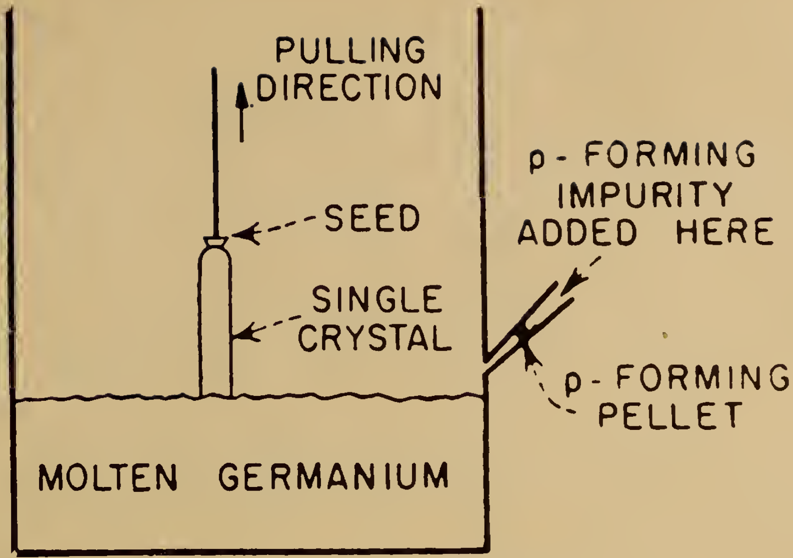



**Fig. 7. Crystal growing machine.**

***Making point-contact transistors***

The square pellet of germanium is etched to produce a smooth surface and soldered to the supporting base. The pellet and base assembly is then acid cleaned.

The preformed emitter and collector assembly is now brought into contact with the germanium wafer in a suitable jig and a slight pressure applied. The electrode spacing is about 0.0015 in. and is held to ±0.000125 in. The completed unit is encapsulated, to be discussed later, and is put through an electrical forming process. This consists in discharging a capacitor across the terminals several times.

***Making diffused-junction transistors***

The same germanium material is used as for the point contact types, though the wafers are usually slightly larger and thinner. The thickness of the wafer is critical and must be held to ±0.00025 in.

The emitter and collector electrodes are small pellets placed on either side of the germanium wafer; the pellets are 0.015 in. thick, the emitter pellet is 0.015 in. in diameter and the collector pellet is 0.045 in. in diameter. For p-n-p junctions indium pellets are used, for n-p-n junctions lead-antimony is used. These pellets are placed on the germanium and the whole assembly is heated in a hydrogen atmosphere. The indium diffuses into the germanium to form the emitter and collector regions. Connections are then made to the emitter, collector and base, and the unit is encapsulated.

***Making grown junction transistors***

In this type the n-p-n junction is made during the crystal growing process. The germanium in the melt is normally n-type; as the crystal is slowly withdrawn, a small pellet of suitable impurity is dropped into the melt causing the formation of a layer of p-type material. As soon as the p-type layer has formed, a further pellet of material is added which over-compensates the initial impurity and causes the melt to become once more n-type.

On withdrawing the crystal completely, a layer of p-type material about 0.002 in. thick is found, sandwiched between two portions of n-type germanium. The crystal is sawn up into small wafers and connections made to the three regions, the p-type region being the base connector.

The production of grown-junction transistors is not readily adaptable to large quantity requirements.

***Encapsulation***

It has been found that transistors deteriorate rapidly when exposed to minute amounts of water vapour or other contaminants. These contaminants act on the surface of the germanium and destroy transistor action.

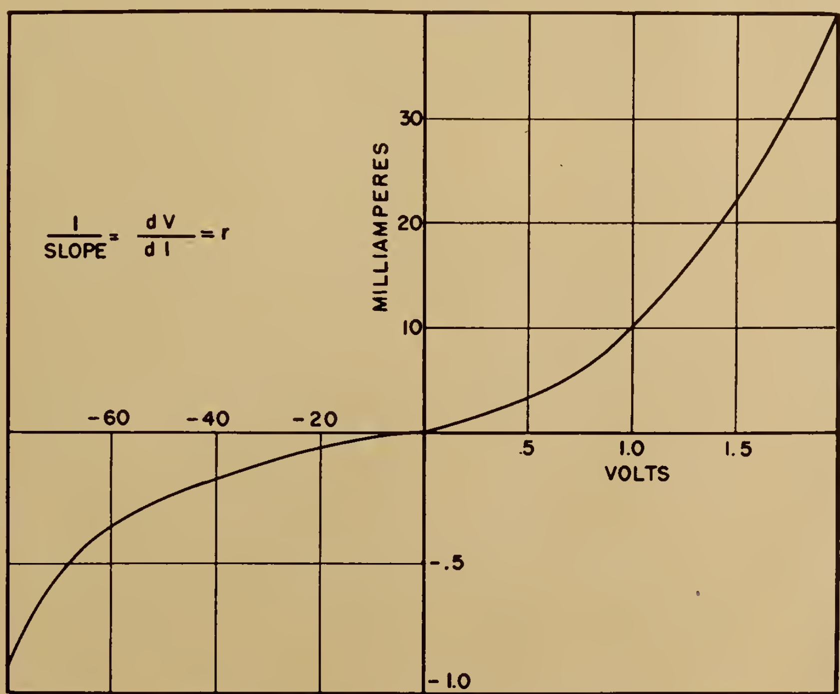



**Fig. 8. Characteristic curve for a typical semi-conductor diode.**

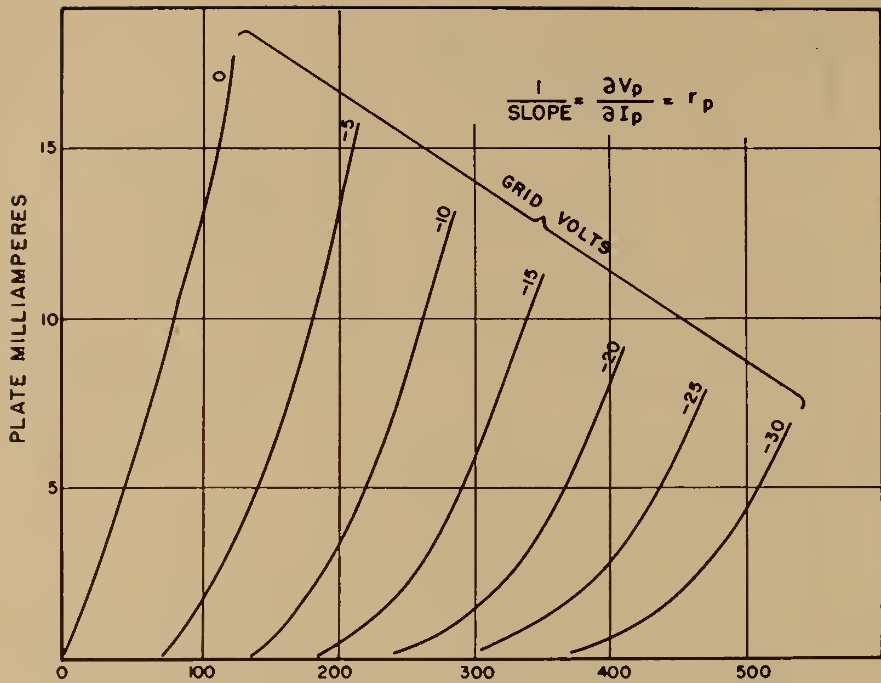



Fig. 9. 6C4 characteristics

Early commercial transistors were encapsulated in various types of plastic cements. None of these plastics is completely satisfactory in preventing the penetration of the minute quantities of water which will produce deterioration in the transistor, thus plastic encapsulated transistors are not recommended where long life is required.

Better quality transistors are nowadays hermetically sealed in metal or glass envelopes in an inert gas. Some transistors are also being evacuated; this precaution is well worth while when extended life and constancy of characteristics are desired.

*General remarks on manufacturing techniques*

From the foregoing descriptions it can be seen that the manufacture of transistors is no simple matter. The processes involved have many features which are entirely new to mass production. Rigorous cleanliness; the minute size of component parts, requiring manipulation under the microscope; and the extremely small and critical dimensions involved are the chief problems.

Of the present types, the diffused junction and the surface-barrier transistor are probably the most suitable for mass production. Automatic machinery for the production of transistors is being developed, but owing to the small dimensions and close tolerances involved, the problems are very difficult. Much remains to be done in the design of automatic machinery for these precision operations.

### Electrical Description

Interesting and necessary as the manufacturing technology is, the end product is not very useful unless put to work. The transistor being an electronic device, it requires an electrical description so that the designer may intelligently incorporate it into his circuits.

Unfortunately, the electrical description of a transistor is more complicated than that of a simple vacuum tube. In the case of the general (non-linear) two terminal network, a full description involves only one voltage and one current, possibly as functions of frequency; this current and voltage can be associated with one of the two available terminals, the other being taken as the reference. A typical e-i characteristic might look like Fig. 8.

The negative grid vacuum triode may be considered to be a degenerate case of the general three terminal network in which the input current may be neglected. However, the description must include an input voltage. A typical set of plate characteristic curves are shown in Fig. 9. Although convenient for reading off mutual conductance as a slope, the corresponding grid family does not contain any essentially new information, but is merely a restatement.

In the case of the three terminal transistor, because of the usually low input impedance, the full decription requires two voltages and two currents. The situation is further complicated by the possibility of choosing any one of three terminals as the reference terminal and, of course, it can be made worse by using two reference terminals, one for voltage, another for current. Believe it or not, this has been done.

Unlike the vacuum triode, where the simplest physical picture indicates the flow of plate current being controlled by the grid voltage, the transistor appears to be a current controlled device.

The early workers chose to use that terminal known as the "base" as the reference electrode; a typical set of emitter and collector characteristics is shown in Fig. 10. Initially, there was no general agreement as to definitions of polarity nor as to whether abscissas should represent voltage or current, and so characteristic curves appeared in a confusing variety of arrangements.

The one chosen here agrees with vacuum tube conventions and with present-day transistor practice. Since $r_{11}$ is substantially constant in this case, manufacturers usually quote a nominal value for it and for $r_{12}$ and omit the emitter characteristic. A value for

$$a = \left.\frac{d\,I_c}{d\,I_e}\right|_{V_c}$$

is usually given numerically because of the practical impossibility of determining it accurately from the collector curves.

The foregoing applies directly when the transistor is used in the common base connection, corresponding to the grounded grid connection in tubes, which is not the most usual connection. Recently, manufacturers have shown a tendency to publish characteristics based on the use of the emitter as the common or reference terminal, in which case the curves appear as in Fig. 11. Some suppliers give both characteristics (Figs. 10 and 11) and, in addition, sufficient numerical information about input impedance and/or branches of an equivalent circuit, to give a fairly complete picture.

### Applications and Limitations

Until recently the only transistors available have been low power units capable only of handling powers of the order of 50 milliwatts, or about 1/100 that of common vacuum tubes. There are now available fairly reliable vacuum tubes in the 5 to 50 watt class.

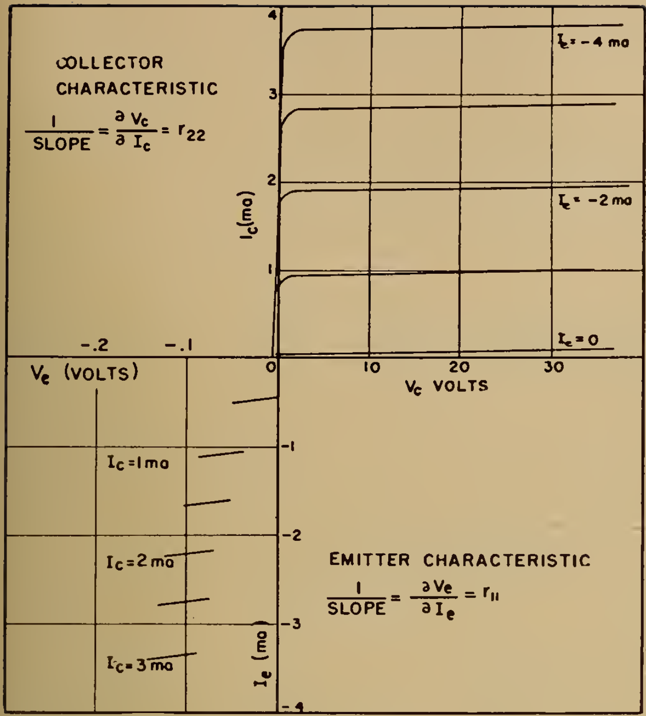
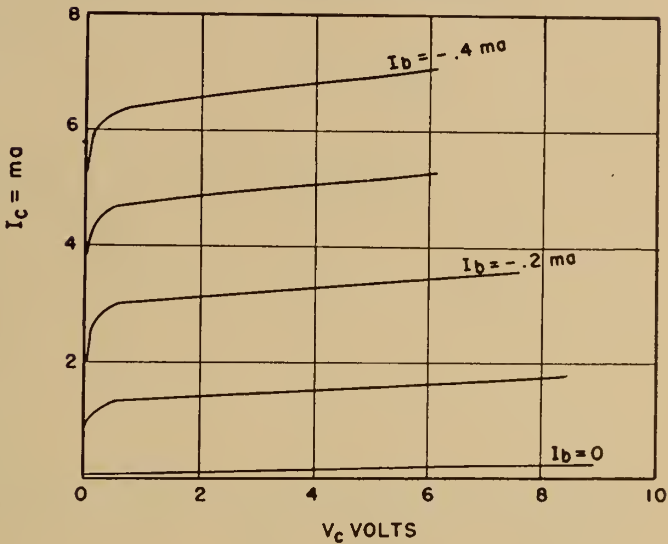



Fig. 10. (left) Emitter and collector characteristics for a fictitious n-p-n junction transistor.

Fig. 11. (right) Collector characteristics for a fictitious n-p-n junction transistor common emitter connection.




This does not necessarily mean that tubes are always used at full rating; in fact, a great many operate far below their thermally imposed limits. However, there is a stage in almost every device, usually near the output limits, beyond which 5 to 50 watt tubes are not usually operated. Thus it would appear that until power transistors are economically available, transistors will tend to be used in hybrid, tube-transistor equipments.

The application of transistors has been slowed by the fact that they differ significantly from vacuum tubes and new ranges of associated components have had to be developed. For example, the impedance levels are generally much lower and new coupling devices are needed. Also, because transistors can be operated at power levels 1/1000 that of tubes, ordinary audio transformers are simply too big and hence have prohibitive losses when used with transistors.

Perhaps the greatest single advantage of the transistor is that it operates cold, i.e., has no filament or heater and from this fact derive several subsidiary advantages:

1. No heater power required, therefore no hum.
2. Has no warm-up time; operates instantly when the voltage supplies are turned on.
3. No failure from heater burnout.
4. Freedom from microphonics and shock.
5. Possibility of long life.
6. Reduced cooling problem when used in large numbers in compact assemblies, e.g., in computers. This should tend to offset their limitations due to temperature sensitivity; although in one known case miniature mechanical refrigeration was included in the package, perhaps to protect the transistors from their environment as much as from themselves.

Another fundamental advantage is the possibility of producing twin transistors alike in all respects except for polarity, an impossibility with vacuum tubes. This is called "complementary symmetry" and gives rise to new circuit arrangements with important savings in associated components and improved performance (linearity).

The first useful applications to take advantage of the portability, low-power, low microphonics, no hum properties, centre around audio preamplifiers, special microphones and hearing aids. Although the high noise level inherent in many early transistor designs proved a serious limitation, reasonably low noise units are now available.

Almost every electronic organization of any size has a back-room group devoted to developing the use of transistors in some aspect or other, e.g., transisterized communication system, electric organs, phonograph amplifiers, etc., but very few have a product on the market today. Perhaps the biggest single user is the organization that first produced the transistor, the Bell System. However, there are at least a dozen manufacturers of transistors in the United States, a similar number in Britain and Europe and one or two here in Canada.

Secondary effects on industry include the provision of new ranges of components suitable for use with transistors, the stimulation of the sale of standard items, such as microscopes and electron microscopes, and the development of new high precision production machinery.

The principal limitations of present transistors lie in their temperature sensitivity, which will be overcome by the use of new materials, in high noise figure, in limited speed of response, and in low power handling capability; the last named limitation is rapidly disappearing.

All the activity alluded to earlier cannot have failed to have some impact on the electrical industry up to the present, but nothing like what it will have when the transistor becomes as readily available as the vacuum tube.

Were one asked to pick the field in which transistors have the greatest potential use, one would say in computers, particularly if transportable or even airborne computers on a large scale are desired, where one could pack several hundred units into a cubic foot, consuming only a few tens of watts of power. √

*A paper presented before the 68th Annual General and Professional Meeting of The Engineering Institute of Canada at Quebec City, May, 1954.*

# Manufacturing Processes for a New Cement Plant

*by*

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European ideas and Canadian methods have been merged to produce a cement plant, soon to go in operation near Quebec City, which differs in many aspects from the standard Canadian practice. In this paper the author discusses cement production in many countries of the world, and tells of the many new ideas incorporated in its design. He shows that it is not merely a reproduction of existing Canadian plants, but embodies features which should be of interest to designers of cement plants or plants for storing any powdered or granular materials.

Only five miles from Quebec City on the north shore of the mighty St. Lawrence river, in the municipality of Villeneuve, a new cement plant is presently being constructed in something like record time.

This plant is of interest for several reasons:

1. It is the major construction enterprise going on in the Quebec City district to-day.
2. It will give rise to an industry essential to the Canadian economy, if it is considered desirable for Canada to be self sufficient in cement production.
3. It incorporates several unique features in design, believed to represent the most up-to-date solutions to certain problems confronting cement making. These same problems, however, are also common to the chemical and allied industries in general.
4. It has been designed and is being built under an extremely tight schedule. One of the definitions of an engineer is "one who can construct for $10 something which others can only do for $20." In this case, every day's delay in construction means a loss of profits in operation. This fact has motivated all our planning and expediting. The results to date have amazed everyone concerned . . . consultants and contractors, as well as the author himself.

According to the Dominion Bureau of Statistics, expenditures on construction of this plant represent 95 per cent of the total being spent on construction at present in Quebec City district. The capacity of the plant will be 1,500,000 bbls. or 6,000,000 bags per annum. Its estimated cost is $13,000,000.

With this plant in production, the present capacity of all Canadian cement plants will be increased by 7 per cent. Cement consumption in Canada in 1953 was 18 per cent higher than in the preceding year. If this rate is to continue, and there appears to be evidence that it will, Canada needs to add at least one new plant like the Villeneuve plant every year.

### Organization

Before discussing the unusual design features, it is proposed to outline the conception and planning of the project to date, and then explain the problems underlying the solutions arrived at.

A Swiss concern is providing the technical and financial background for this enterprise. The Quebec plant is the first constructed by this group in North America. They have interests, however, in 21 cement plants on all the continents other than Australia.

The group sent an engineering staff to Quebec who had experience in several European cement plants. This staff is responsible for the whole project, from layout to final operation. There was close co-ordination between this staff and the Canadian consulting engineers on the design details.

Every industrial processing plant has to consider construction primarily from a utility point of view. It is therefore sometimes not too easy to get a satisfactory architectural effect for the exterior. Some attention has been given to the architectural features. The objective of our engineers was to obtain an attractive exterior without incurring extra cost.

It was, of course, a big venture for our engineering staff to relocate from Europe to Canada. They needed time to familiarize themselves with Canadian methods, but the engineers, who are all young, came over with open minds, and readily accustomed themselves to Canadian conditions and methods.

The merging of European ideas and Canadian methods has been an interesting experience for these men, and it is believed that a plant which differs in several ways from standard Canadian practice will be of interest to the profession generally. Although methods of cement manufacture are similar on both sides of the Atlantic, they differ in a number of important details.

### Planning

It is believed that the prime requisite of any efficient enterprise is careful planning. The proof of good planning lies in a close and well co-ordinated schedule. It is the responsibility of management during construction to offer sufficient incentive to the contractors to get the work done on time. It is the responsibility of the engineering staff to remove any bottlenecks.

With these principles in mind, the first step was decentralisation of responsibility for planning the various phases of the work in order to get the basic information to make a master schedule. Frequent meetings were and are being held between staff and contractors. Contracts have been let on a firm-price basis, with attractive bonuses for early completion.

Another important part of the policy was the determined effort to avoid delays in the issue of drawings to the field, and in revising drawings, with a view to avoiding costly and time-consuming delays. With this in mind, full detail drawings (some 1,300 in number) were all prepared before the main construction began. Only foundations (and two non-processing buildings) were built during this design period.

On the completion of the drawings, a system was put into force making it about as difficult to get approval for a revision to a contract drawing, as it is to get a rebate from the income tax authorities. This was perhaps hard on the perfectionists, but vital for keeping the time schedule. As the drawings progressed, the construction schedule was prepared, key dates from which were incorporated into the contract documents. Finally expeditors were put on the job and any indications of possible delays receive immediate attention and action.

### General Flow Sheet

#### *Raw Materials*

The new Quebec plant is a wet process plant. Raw materials are right at the site. Two raw materials enter into the processing: One is a limestone containing about 81 to 86 per cent of $CaCO_3$. The other is a shale containing oxides of aluminium, silicas, iron and some calcium carbonates. To get the right composition of cement, 91 per cent of limestone is mixed with 9 per cent of shale. The excavation of these materials is quite an ordinary problem.

#### *Initial Grinding*

The raw materials go through a 42-in. gyratory crusher, and then through an impactor crusher which brings the size of materials down to ¾ of an inch. Two vibrating screens are located in the flow, so that the fines will flow to the storage bin and the material over ¾ inch diameter will return to the impactor crusher. This arrangement of crushers in a closed circuit is standard procedure today.

It is important to get the correct composition of all raw materials, limestone, shale and additives as exactly as possible. For this reason, the ball-mills will be fed by Waytrol feeders. The slurry is produced in two ball-mills of 8-ft. diameter and 32 feet length. Each unit is driven with a 900-hp-motor. After passing through the mills, the slurry is pumped into two slurry basins, which act as storage mixing tanks for producing homogeneity in the composition of the raw materials.

#### *Kiln Department*

In the next department, the slurry is burnt to cement clinker in a rotary kiln, which has a diameter from 11 ft. 6 in. to 13 ft. 2 in., and which is 402 ft. long. The kiln has a slope of 4 per cent. The slurry is brought in at the higher end, and flows against the fire of pulverised coal from the other end, where the temperature is about 2,700° F. The output of the rotary kiln will be

**This picture of the St. Lawrence Cement Plant was taken on May 7, 1954. It shows:— at extreme right—crushing plant foundations; right centre—construction of smoke stack; centre—foundations of slurry basins and erection of steel shell, columns for crane rail beam of storage hall, scaffolding ready for the whole length, slurry mill bin walls poured, temporary storage shed, and workshop and offices already occupied; extreme left—foundations and platform of packing station completed, column form work started. Railway siding ready to receive trains with material in the yard.**

about 4,500 bbls. per day. The burnt cement clinker leaving the rotary kiln is cooled in an air quenching cooler, and then reduced to a size of about 5/8-in. in a gyratory crusher.

The rotary kiln will have, as far as is known, one of the highest outputs on this continent. The biggest kiln ever built is in a Belgian plant in Obourg, near Brussels. This kiln is 539 ft. long, and produces 7,600 bbls. per day. This installation went into operation last year, and may be considered an outstanding achievement in the history of cement plants.

### *Finish Grinding*

Next comes the finish grinding department, where the cement clinker is first mixed with 4 to 5 per cent of gypsum. There are two ball-mills of 10-ft. diameter and 28 ft. long, driven by a 1,200 hp motor. The whole installation is working in a closed circuit with air separators, which take away the fine cement and send back the rougher part. The finished cement from this department is transported to the shipping department by compressed air in a pipeline. In the shipping department are twelve silos, from which cement may be loaded in bags or in bulk. The plant has facilities for loading cars and trucks. The port of Quebec is only four miles from the plant.

Let us now discuss three problems not confined to cement making, but of general interest in many industries and, therefore, to a number of engineers. These three problems are:

1. What is the most efficient way to homogenize a slurry ?
2. How far can dust be recovered and how can it be best utilized or reintroduced into the process ?
3. Which is the most efficient arrangement of a packing station for material in powder or granular form ?

### Homogenizing the Slurry

The first problem, namely to get slurry mixed and homogenized in the most efficient way, is most important for a cement plant. The raw materials may be weighed exactly, but it is impossible to get an exact composition without a slurry basin, where the slurry is homogenized and where corrections can be made. Before we can reach a practical solution, we must consider the theory. With a given number of slurry basins there are two main ways to arrange the flow of the slurry: One arrangement is in parallel, and the other one in series.

### *Slurry Basins in Parallel*

Let us first consider the parallel arrangement. This problem is easily understood if we compare, for instance, one slurry basin of a volume V, with four slurry basins each of which has a volume 1/4 V, so that the total volume in both cases is V. Suppose a certain amount of liquid is added and taken away from the slurry basins, that this amount will be the same in both cases, and therefore the four small slurry basins will each have one-fourth of the added liquid.

It is easy to understand that under these circumstances the efficiency of homogenization in both cases is exactly the same. The conclusion is that it would not be reasonable to consider parallel slurry basins, since one big slurry basin will do exactly the same work, and will be cheaper than a number of smaller units.

### *Slurry Basins in Series*

For slurry basins in series, we may compare the efficiency for homogenization for 1, 2, 3 and 4 basins. It may be assumed that the total volume of the basins in each group will be the same, and that the amount of liquid fed and taken away, per unit of time, is the same too.

### *One or Two Basins Give Best Results*

It can be shown that the average variation of slurry is at its lowest if there are only one or two slurry basins. The curve clearly shows an increase in the average variation if the number of basins is increased. The conclusion, then, can only be that one or two slurry basins will give the highest efficiency in homogenization, while a large number of slurry basins results in lower efficiency at higher cost.

The arrangement of slurry basins in cement plants on this continent is standardized. Usually, there is a group of four or more blending tanks. The slurry is mixed and homogenized in these blending tanks and chemically tested. To get the right composition of slurry, contents of three or four tanks are mixed together in certain proportions. This mixed slurry then goes into two slurry basins. An arrangement like this one needs at least six units, with all necessary mechanical and electrical equipment.

The Quebec plant will have only two units, and should give at least the same result. Much research work has been done in connection with this problem. It was found that the best way to get a constant composition of slurry is to control the calcium carbonate content right in the mill, where the slurry is produced. Afterwards two slurry basins containing production of about fifty hours are sufficient to eliminate the variations.

The maximum difference in the content of calcium carbonate in our raw material has been found plus or minus 3 per cent from the average. The average variations of the slurry leaving the basins will be 8/100 of one per cent. In practice, we accept a tolerance of 1/10th per cent, and therefore the mixing effect of the slurry basins will be usually sufficient. The theory of slurry basins is an example that sometimes, in production, the simplest way is also the best.

### Dust Recovery

The next problem is the recovery and economical use of dust. For most people a cement plant means production of much dust leaving the chimney with smoke gases. It is a fact that the problem of dust is a serious one for a number of plants. An investigation made in eleven cement plants showed the importance of this problem. The plant with the lowest percentage of dust production, compared with the production of cement, has 6 per cent dust. The plant with the highest production has 52 per cent dust.

This latter plant loses, therefore, about a third of the raw materials with the dust, and only two-thirds are transformed into cement. The average of dust production in these eleven plants is 19.2 per cent of cement production. The importance of dust depends naturally on the location of the plant. The problem may be less important for a plant in a desert region like Egypt, for example.

The same may be the case for a cement plant in nearby Lebanon. This plant, too, is not in a populated area, and natives there may be less allergic to dust than in the western part of the world.

The estimated dust production of the new Quebec plant will be 20 per cent, or about 50,000 tons a year. This dust production would be sufficient to cover a circle around the plant of one mile diameter, with four inches of dust in a year. Obviously, no people in the area would accept such a situation. The new plant is situated between four villages, which have together some 20,000 inhabitants. Therefore, the problem of dust control had been studied carefully.

The electrostatic precipitators developed on both sides of the Atlantic really do wonders in dust recovery. One new cement plant in Holland, for instance, which belongs to the Holderbank Group, went in operation in 1951 with a new electrostatic precipitator, guaranteed for a dust recovery of 99.4 per cent.

In practice, the efficiency was even higher than the guaranteed figure, and measurements over a long period proved that the efficiency is 99.7 per cent. This is one of the best performances a machine as complicated as a dust recovery unit has ever reached. The dust output of the five chimneys of this plant is very small.

The new cement plant in Quebec will have an electrostatic precipitator combined with multiclones. The guaranteed figure for dust recovery is about 99 per cent.

### Reintroduction of Dust

The highly efficient recovery of dust is no more a problem in technology. But it is still a problem to utilize this dust economically. Most plants reintroduce their dust in the slurry. This doesn't work very satisfactorily, because more water has to be added, which then has to be evaporated in the kiln. Moreover, the fine dust tends to produce more dust in the kiln, so that the operation becomes a vicious circle.

A new way to reintroduce dust has been used in the plant in Holland already mentioned. This plant had serious troubles, and was not able to reintroduce all the dust they produced into the kiln. Sometimes necessity may be the mother of invention. The engineers tried to introduce the dust into the kiln, not from the feed end, but with the pulverized coal from the discharge end.

They have been successful in their experiment, and the invention of blowing in the dust with the coal and of smelting it in the fire, so that it can't go through the kiln stack, may be considered as one of the most interesting developments in cement industry. The reintroduction of dust shows that it is sometimes possible to turn a serious defect into an economical advantage for a plant. This principle will be applied in the new Quebec plant.

### Packing Station

Usually, a packing station is composed of two parts: One part is the cement silos for the storage of the finished cement. The other part is a packing house, where the cement is filled in bags and is loaded into trucks or cars.

For example, in a cement plant near Capetown in South Africa, the cement silos are on one side of the packing station and the packing house is on the other. This arrangement may be considered as a standard throughout the world, but it has a serious disadvantage. A lot of transportation equipment is needed to bring the cement from the bottom of the silos up to the packing house. A costly arrangement of pumps, screw conveyors, bucket elevators and other equipment is needed to transport the cement from the mills to the packing house.

An engineer who made a special study of this problem thought the easiest way for any transport is by the use of gravity. For this reason, he took the cement silos and located them on top of the packing house. With this arrangement, there was no need for material handling equipment. All cement can be mixed and conveyed under gravity.

This idea, which seems at first to be impractical, has since been developed and has given very satisfactory results. A cost study has been made between a packing station with the usual arrangement, and one where the silos are on top of the packing house. The new arrangement with silos on the top is about 20 per cent cheaper to build and equip, and saves about a third in operation cost.

The packing station at Quebec consists of three similar units. Each unit has four silos and one bag-filling machine. In case of extension of the plant, one unit or more may be added. These units are entirely independent from each other operationally. An addition, therefore, is easy to build, and no changes in existing installations will be involved.

On one side of the packing station are the railway tracks, on the other is the road for trucks. Shipments can be made from each of the three units, in bulk and in bags. The capacity for bag shipment is about 3,600 bags or 900 bbls. per hour. The capacity for bulk shipment is nearly five times as high.

There are twelve silos in reinforced concrete, each with 35 ft. interior diameter, and 42 ft. high. The weight of one silo, filled with cement, is about 1,500 tons. The silos are supported by only three columns. The walls of the silos will therefore be subject to considerable torsion. The problem of a high circular wall serving as a beam from column to column was a most interesting one for our civil engineers, and has been studied carefully.

But it is to be expected that a cement plant would foster advertising for the application of reinforced concrete. It is believed that this new arrangement of a packing station may be not only of interest for cement plants, but for any plants storing powdered or granular products.

These examples were taken from design, in order to show that this new cement plant in Quebec is not merely a reproduction of another plant, but incorporates new ideas which may be of interest to engineers in this and other industries.

### Climate Influences Design

Some people may think that the production of cement is more or less standardized, and that there are no new developments. This is entirely wrong. Every cement plant is different from another, and every plant has to be adapted to the local circumstances. A plant in Canada has quite different characteristics to a plant in Florida.

For example, at a cement plant in South Africa, near Johannesburg, there is no frost and little rain. Installations are mostly uncovered in the open air and the plant is generally adapted to the local conditions in South Africa. By contrast, in a cement plant in Holland, the rotary kiln is entirely covered. Here there is frost in wintertime and a fairly heavy rainfall.

These two plants belong to the same cement group, and illustrate how engineers have to consider different local conditions. It may be mentioned here, that all buildings in the new Quebec plant are connected by means of galleries, so that a man can go from one department to another without any exposure to bad weather. This is important in wintertime.

There is a certain temptation for engineers in cement plants to realize some outstanding construction in reinforced concrete. An interesting application of reinforced concrete design appears in a cement plant in Switzerland, which went into operation in 1953. It is entirely constructed in reinforced concrete. The plant presents a pleasantly harmonious appearance, and is located in scenic countryside near the lake of Geneva.

In the Dutch plant mentioned above the storage hall is a shell construction only 2½ in. thick. The span in one direction is 86 ft., in the other 80 ft. The roof construction is also interesting.

*(Continued on page 702)*

Fig. 1. S.S. Andros Venture.

*A paper presented before the 68th Annual General and Professional Meeting of The Engineering Institute of Canada at Quebec City, May, 1954.*

# Canada's Super Tankers

*by*

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Production of the two 28,000 ton tankers discussed in this paper has given a Canadian shipyard the opportunity of showing that Canada's shipbuilding facilities have made rapid strides since pre-war days, and have raised the prestige of shipbuilding in Canada in the eyes of all maritime nations. Detailed descriptions of the hull, equipment and methods of construction are given by the authors.

During October, 1951, negotiations commenced between Davie Shipbuilding Ltd. and the Andros Shipping Co. with a view to the construction of a 28,000 ton super tanker, similar to the Bethlehem type. This project had previously been discussed with the Canadian Maritime Commission and had won their support.

At that time it appeared beyond the wildest of hopes that these negotiations would result in an order being placed for such a vessel, but in December, 1951, a contract was signed between these two companies for the construction of one 28,000 ton tanker, with a sixty day option for a second vessel. The order for the second vessel was placed in January, 1952.

This put Canadian shipbuilding on the front page, for the post war era, in the eyes of our cousins across the border, and gave to a Canadian shipyard the opportunity of proving that Canada's shipbuilding facilities had made rapid strides since pre-war, and could compete on a much larger scale than had previously been foreseen. This paper details the technical features of these tankers and deals with the problems and organization entailed in their construction.

### Building Berth

As these vessels are 175 feet longer than any previous vessel built by the company, considerable thought and planning was needed to determine the ideal building berth. Much of this had already been looked into prior to signing, as obviously it would mean large scale capital expenditure.

Proposals for extending the launchways beyond the lower limit then existing were first considered. Eventually it was decided that excavation at the upper end of the ways and re-routing of railway tracks, coupled with a 125 foot extension of one of the crane runways, would considerably improve the lifting facilities. This would also provide better launching conditions.

The maximum weight of these vessels on the building berth being some 8,000 tons, it was necessary to check the fill at the berth and introduce concrete footings in way of the keel blocks.

### Shop Facilities for Steel Work

The steelwork shop facilities, while quite adequate for all previous construction, had to be carefully checked to determine whether lifting facilities and door openings were adequate for the larger prefabricated sections. It was decided to convert one large steel storage shop to a fabricating shop, thus giving 29,000 square feet of additional fabricating space, allowing a much larger volume of work at one time.

The use of fluted bulkheads called for a hydraulic press of greater capacity than that available. Time did not permit awaiting delivery, so shipyard personnel set about designing and building the press required for this work. This piece of equipment proved to be invaluable during construction of the tankers, as well as on other vessels since.

### Welding Equipment and Operators

A study of available welding equipment both manual and automatic, disclosed the need of many more welding machines. It also called for maximum possible use of automatic welding equipment, in order to meet scheduled progress. The lack of qualified welding operators for peak demands made it necessary to set up a welding school, to train operators and have them classed by the relevant authorities.

### Pipe Shop Work

As one would expect, one of the major items in tanker construction is adequate pipe shop facilities to handle the amount of pipe work, which exceeds that handled during average cargo or passenger vessel construction. Existing facilities proved fairly adequate with the exception of the welding of carbon molybdenum pipe, which called for a special procedure, expert welding and X-raying of each weld, and annealing. This problem was readily overcome.

### Engine Installation Facilities

Early investigation must always be made with regard to engine installation, bearing in mind lifting facilities, how much ship space should be left open, etc. With a tanker, this problem was aggravated by the weight of machinery to be handled. Discussions took place

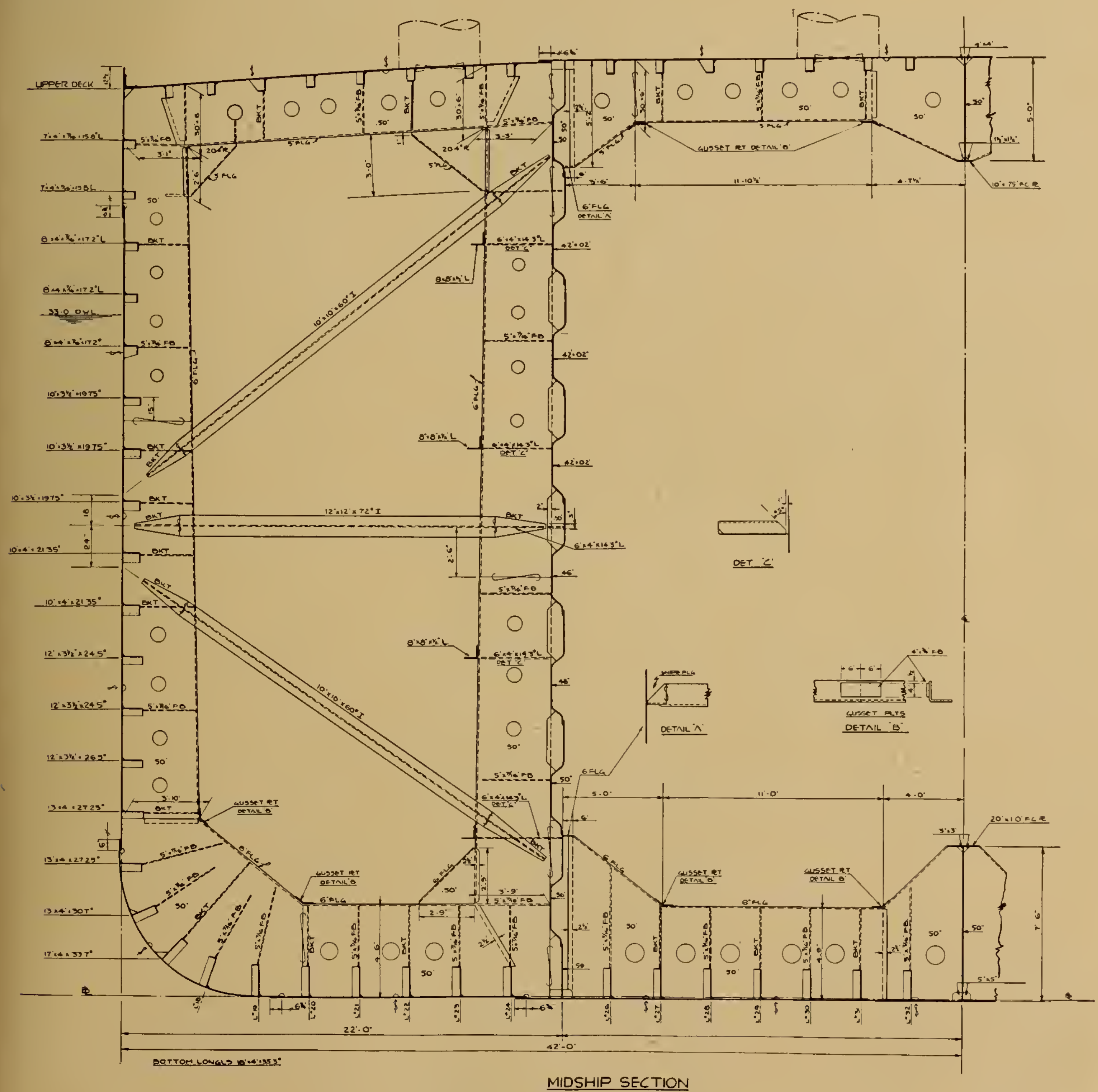



**Fig. 2. Midship section of S.S. Andros Venture.**

between machinery manufacturers and shipyard officials to determine best possible methods of handling, and also the degree of care to be exercised. Careful early planning greatly reduced the work of installation.

### Drawing Office Work

The technical work entailed in the construction threw a heavy load on the drawing office personnel. The main engines and much of the auxiliary equipment was changed from that for Bethlehem type tankers. This necessitated a new engine room layout, and changes to piping systems throughout the engine room, new seating plans, checking of technical features on all auxiliaries relative to the main machinery, etc.

Changes to steering gear, deck equipment, ventilation systems and accommodation layouts, and changes to steel construction plans to suit shipyard methods and new requirements, all needed careful study to achieve the most economical vessel from both the shipowner's and shipbuilder's point of view.

All material and equipment had to be ordered with despatch, in order to meet scheduled construction commitments. The drawing office, working in conjunction with the purchasing department, was often sorely tried to keep up with these commitments. However, the only complaint received was that the shipyard stores were bulging at the seams. A tribute for a job well done!

There were many other items requiring careful and speedy planning. The keel of the first vessel, the "Andros Venture", was laid on September 25, 1952. Nine months later, on July 3, 1953, this vessel was launched. It was handed over to the owner in November, 1953, after a construction period of only thirteen months. Canada's first super tanker has now completed three successful round trips between the United States and the Persian Gulf. Her sister ship the "Andros Fortune" will shortly go on trials prior to being handed over to the owners.

## PART I

### General Description

The principal technical characteristics of the 28,000 ton tankers are as follows:

| | |
|---|---|
| Length Overall | 624 ft. 7½ in. |
| Length between perpendiculars | 595 ft 0 in. |
| Breadth (moulded) | 84 ft. 0 in. |
| Depth (moulded) | 44 ft. 0 in. |
| Draft (extreme) | 33 ft. 3⅝ in. |
| Corresponding displacement | 36,410 tons |
| Deadweight | 28,070 tons |
| Cargo oil capacity (100% full) | 240,400 barrels |
| Dry cargo capacity (bale) | 65,300 cubic feet |
| Power-steam Turbines | |
| Normal | 12,500 shp @ 100 rpm |
| Maximum | 13,750 shp @ 103 rpm |

These vessels are "three island types", in other words the deck erections consist of a poop, bridge and forecastle. They have a curved raked stem and a cruiser stern. Propulsion machinery is located at the after end driving a single five-bladed propeller. The actual oil cargo space takes up a total of 370 feet of the vessel's length. This is divided by two longitudinal and nine transverse oiltight bulkheads, into a total of 30 cargo oil tanks.

Forward of the cargo oil tanks the vessel is divided into compartments such as the fore peak, chain locker, boatswain's stores, carpenter's shop, dry cargo spaces, deep tank for fuel oil or water ballast, and transfer pump room. The after portion contains the pump room, engine and boiler room, fuel oil bunker tanks, and aft peak and steering gear compartment.

The total complement carried is thirteen officers and thirty-one crew. Accommodation is provided in the bridge house for the captain, deck officers, quartermasters and radio operators, in addition to the wheelhouse, chart room, radio room, hospital, etc. The engineer officers, steward and crew, etc., are located aft in the poop enclosure and the poop deckhouse.

The main propulsion machinery consists of a geared steam turbine of 12,500 shaft horsepower (normal), driving the propeller at 100 r.p.m. through double reduction gears and line shafting. Steam condition at the boiler superheat outlet is 600 psig @ 850°F., and at turbine throttle is 585 psig @ 840°F.

The entire plant is designed to operate at an all purpose fuel rate of 0.54 lbs/shp/hr. The main boilers are water-tube type, arranged for burning oil under forced draught and fitted with superheaters, desuperheaters, waterwalls, economizers, steam type air heaters, and automatic combustion controls. The boiler feed system is the deaerating type, with two stages of feed heating.

The main electrical plant consists of two 400 k.w.—450 volt alternating current, geared turbo-generator sets, complete with all necessary auxiliaries and switchboards. An emergency 75 k.w.—450 volt a.c. diesel generator is provided for emergency lighting, etc., and dead ship starting. The cargo oil pumping system consists of four turbine driven centrifugal pumps with a combined capacity of 14,000 gallons per minute, and four steam driven reciprocating cargo oil stripping pumps.

These vessels, their equipment and propelling machinery have been constructed under the special survey of the American Bureau of Shipping, Lloyd's Register of Shipping, and to the requirements of the Canadian Board of Steamship Inspection for carrying petroleum products in bulk with a flash point below 150°F.

### Steel Structure

The total steel required for a vessel of this size and type is about 8,000 tons. The transverse sections (pages 689, 691) show the type of construction. The vessels are all welded construction excepting for 14 rivetted seams running fore and aft in the shell plating and the upper deck. These rivetted seams serve as crack arresters. All steel used for plating is American Bureau special weldable quality steel, with a low carbon content.

The main hull structure, inway of the cargo oil tanks, is framed longitudinally. Size of frames varies from 18 in. x 5 in. angles cut from channel sections at the bottom, to 7 in. x 4 in. angles at the upper deck level. Framing forward and aft of the cargo oil tanks is transverse. Deck framing of the upper deck inway of the main hull is longitudinal. The forecastle, poopdeck and upper deck inway of the forward and after peaks are transversely framed.

The shell and decks, bulkheads, inner bottom and deck erections were designed for maximum prefabrication within the limits of shop handling and lifting facilities. Generally speaking the limiting factors are an overall size of 40 ft. x 40 ft. or a lift of 30 tons.

A double or inner bottom, with an intact watertight tank top, is fitted inway of the machinery space only. This inner bottom is of cellular construction, with solid floors and longitudinal girders. It is divided into five tanks for ballast by watertight divisions, watertight or oiltight pockets being arranged as required for propulsion machinery, lube oil sumps, sea chests, and fathometer space.

Oiltight bulkheads dividing the cargo oil space are the "Frear fluted" or corrugated type. This type is particularly adaptable to oil tankers due to the form of the vessels, the weight saved and reduction in labour involved. In the

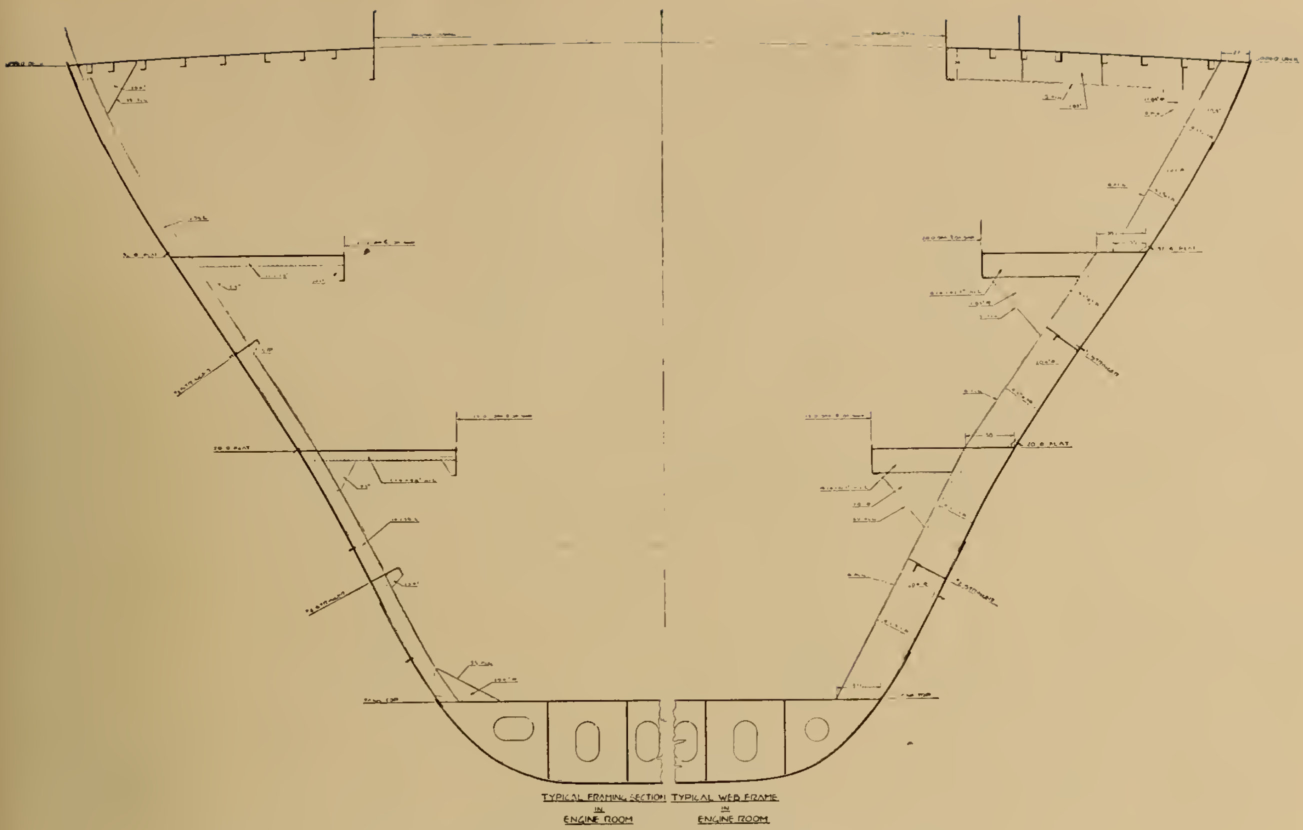



**Fig. 3. Typical framing section in engine room.**

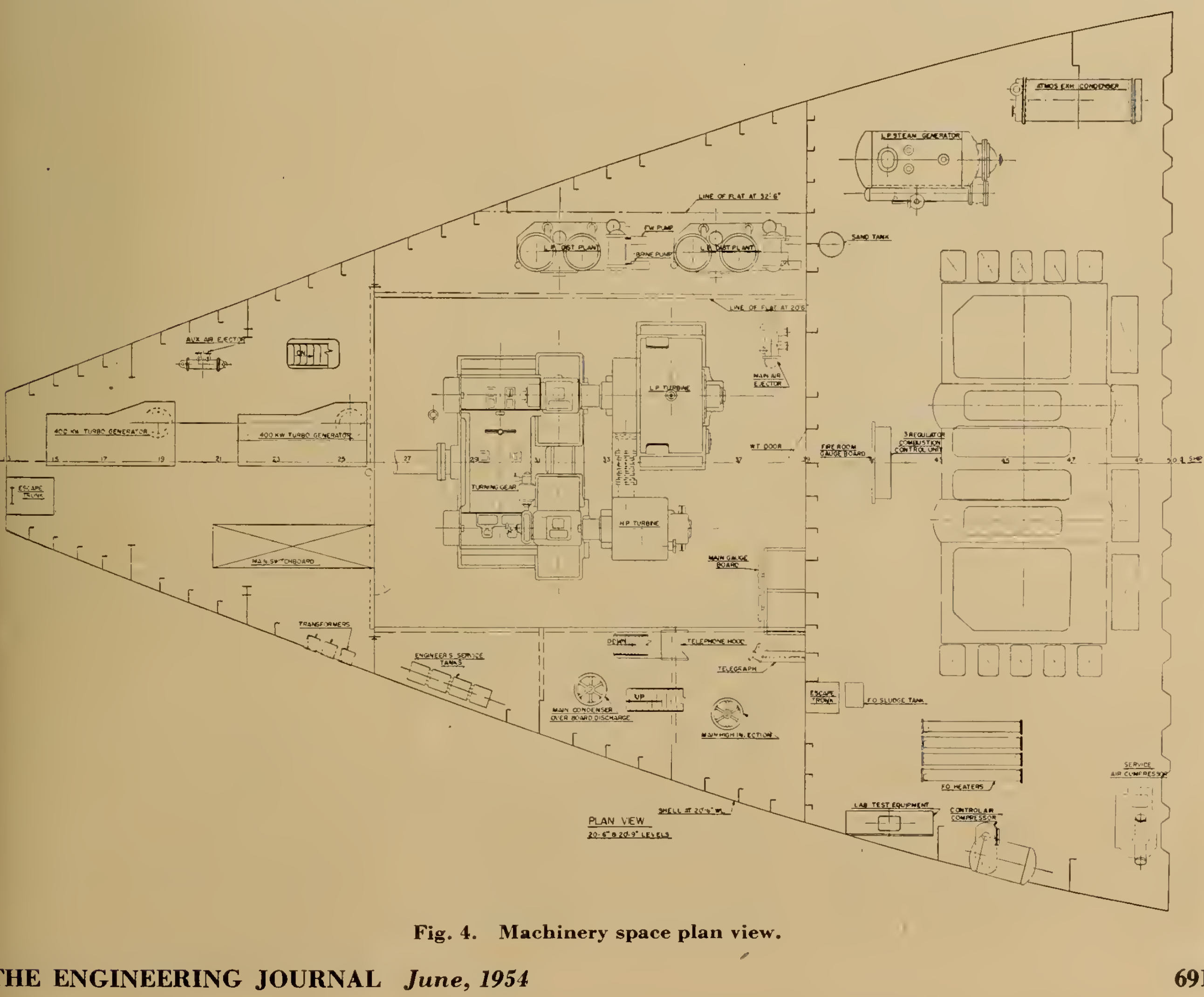



**Fig. 4. Machinery space plan view.**

case of the 28,000 ton tankers 130 tons of steel were saved on each vessel due to the use of "fluted" bulkheads. Bulkheads elsewhere are of the conventional type with flat plating and toe welded angle stiffeners.

Particular attention has been paid to the design of the super structure to obtain a pleasing appearance. The sternframe is cast steel made up in three sections, the total weight being 51.84 tons. The upper section of the stern frame is arranged to form the base of the rudder trunk and the centre section is bored to suit the tail shaft. The rudder is of balanced streamlined form of double plate construction on a cast steel frame. The rudder stock is of forged steel.

### Deck Equipment

The steering gear is of the four-ram electro-hydraulic type, the rams being driven by a Heleshaw pump. Two pumps are provided, one either to serve as a standby or to provide additional power for quick manoeuvring. The steering gear is controlled by a telemotor steering control stand located in the wheelhouse, with an extension to a steering stand on the wheelhouse top. A trick wheel control is provided in the steering gear compartment for local control. A steering stand on the poop deckhouse top is connected to this trick wheel, with connecting shaft and clutch for emergency steering from the aft end of the vessel.

In addition to the telemotor control, a gyro-pilot system is provided, the control unit being located in the wheelhouse and the power unit in the steering gear compartment. This installation provides automatic or hand steering from the wheelhouse independent of the hydraulic telemotor system. The steering gear is capable of moving the rudder from hard-over to hard-over through 70° in 30 seconds, using one pumping unit, and in 20 seconds using both pumping units, and at full speed of 16.75 knots.

The anchor windlass is a horizontal spur geared type driven by a two-cylinder steam engine. Wildcats are fitted suitable for the 2 11/16 in. diam., stud link cable, and warping heads for general use when mooring. The windlass can lift both anchors together with 40 fathoms of chain at a speed of 30 feet per minute.

Two bower anchors weighing 16,345 lbs. each are fitted, and one spare weighing 13,895 lbs. The anchors are stowed in cast steel hawse pipes. A stream anchor weighing 5,915 lbs. is also provided. The anchor chain is 2 11/16 in. dia. steel di-lok stud link chain. Two lengths of 165 fathoms are fitted, made up of 15 fathom shots or lengths joined together with detachable links.

Three deck winches are installed, two on the upper deck and one on the poop deck aft. These are driven by two-cylinder horizontal steam engines, each arranged with warping heads fitted on extended shafts. Each winch develops a line pull of 16,000 pounds at 100 feet per minute. The forward winch is provided for the 5-ton derrick and general warping duties, the midship winch serves the four 4-ton derricks and general warping duties, and the after winch is for warping duties only. The 4-ton derricks fitted amidships are for general use, such as oiling at sea, handling of hoses, storing ship, etc.

Hatches 14 ft 10 in. x 18 ft. 0 in. are fitted on the forecastle deck and the upper deck servicing the dry cargo space forward, the forecastle deck hatch-cover being of watertight hinged steel construction, and the upper deck hatch covers of wood. The hatches are served by a single 5-ton derrick for general cargo handling.

One feature worthy of special note is the cargo oil tank hatch covers fitted on the "Andros Venture". These covers are all aluminum of welded construction, thus reducing the weight to approximately one third of similar steel hatch covers, of great assistance with regard to handling.

### Accommodation Spaces

The entire accommodation spaces have been designed with a view to reducing the fire hazard to a minimum. Marinite has been used for all divisional bulkheads, except where steel bulkheads are fitted, also for all sheathing in ship's side or deckhouse sides and for ceilings where fitted. All furniture is of steel construction and deck coverings are either magnesite, ceramic tile or quarry tile. This feature of reducing the fire hazard whilst important on any vessel, is even more important in the case of an oil tanker, where any fire carries with it the danger of an explosion.

All spaces where bulkheads or decks are exposed to the weather, are insulated for comfort with 2 in. mineral wool type insulation, or as in the case of toilet spaces and C.O.2. rooms, with 1 in. sprayed asbestos.

Spacious and comfortable cabins are provided for all officers and the crew. The captain's quarters on the upper bridge deck consist of his stateroom, office, and bathroom. The chief engineer's quarters on the poop deck aft are similar to the captain's. All officers have single cabins well furnished, bathrooms being arranged between two cabins, except in the case of the chief officer and 2nd engineer who have private bathrooms.

A tastefully decorated lounge located on the poop deck is provided for the use of the officers during their leisure moments. The officers' mess, with seating accommodation for eighteen, is located adjacent to the galley on the portside of the after end of the poop deck. This mess is served from the officers' pantry.

The crews' quarters are located aft on the upper deck. Each cabin is shared by two men, but as usual in tankers, their cabins are far more spacious than the average cargo vessel. Separate toilet spaces are provided for engine department, deck department, and the steward's department. The crew have a recreation room on the upper deck aft on the starboard side.

The crews' messing space is located adjacent to the galley on the port side of the poop deck aft. This space is divided off to accommodate ten petty officers and stewards, and twenty-two crew members. The mess space is served from the crew's pantry.

The galley has been arranged on modern lines, and is complete with an electric range, electric bake oven, steam tables, steam kettle, refrigerator, dough trough, cook's table, and stainless steel dressers and sinks. The officers' pantry is equipped with a refrigerator, coffee urn, stainless steel dresser and sinks and all necessary glass racks, dish racks, etc. The crew's pantry is equipped similar to the officers' pantry.

The hospital located on the bridge deck amidships is fitted with five berths, lockers, settee, desk and chair. A bathroom is located just forward of the hospital. Space is also provided for a ship's office, linen lockers, service lockers, steward's stores, laundry, etc.

### Navigating Equipment

Complete and up-to-date navigation equipment is fitted on these super tankers. Gyro compass equipment consisting of a master gyro fitted in the gyro room on the navigating bridge; two steering repeaters—one in the wheelhouse and one on the wheelhouse top; two bearing repeaters, one at the radio

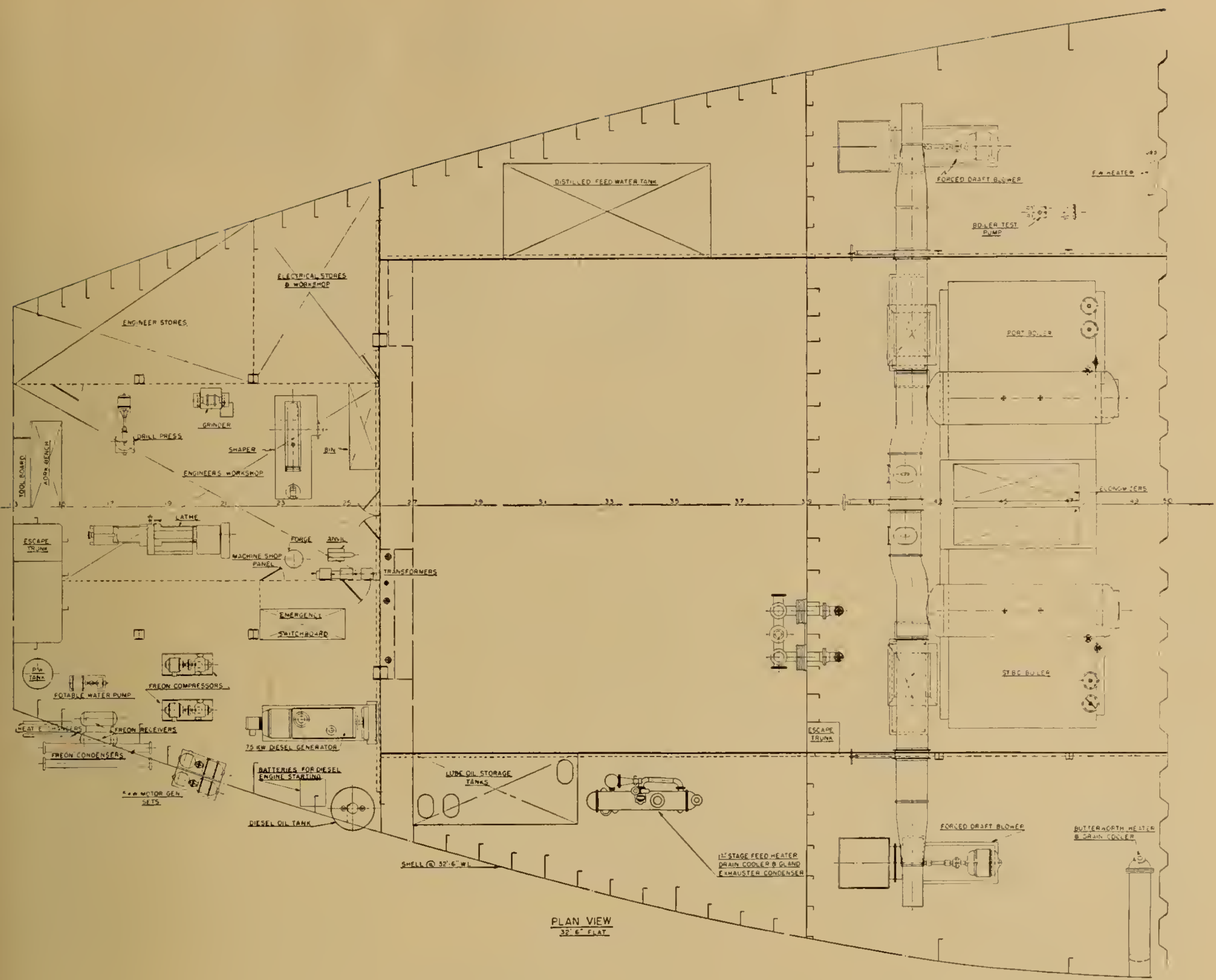



Fig. 5. Machinery space plan view.

direction finder in the chart room and one on the wheelhouse top. A gyro pilot system for hand electric steering and gyro automatic steering is also installed in the wheelhouse.

The usual magnetic compasses are fitted consisting of a liquid compass at the wheelhouse top, one in the wheelhouse and one at the aft steering position on the poop deck. An automatic course recorder is fitted in the chart room, along with an I.M.R. 20. direction finder and echo sounder recorder.

The telegraph system is the electrical self-synchronous type, one system being provided for the engine orders consisting of a 12 in. transmitter-indicator in the wheelhouse, and a 16 in. transmitter-indicator for repeat back at the engine room control station. An indicator is also provided in the boiler control station. A separate system is provided for transmission of docking orders, one transmitter indicator being fitted in the wheelhouse and one at the poop deck aft.

Indicators, electrically operated, are provided for indicating shaft revolutions and direction and also for rudder angle indication, these indicators are located in the wheelhouse. An 18 in. 1000-watt searchlight mounted on the wheelhouse top and controlled from the wheelhouse, and a 12 in. 1000-watt signalling searchlight are also provided. A radar unit is installed in the wheelhouse.

The radio transmitting and receiving equipment is housed in the radio room on the upper bridge deck, this equipment consists of a main transmitter, medium frequency—I.M.R. 51, 400 w. output; a high frequency transmitter, type 53, 400 w. output; an emergency transmitter, type 61, 50 w. output, an all-wave receiver, type 54; and an emergency receiver, type I.M.R. 60.

Such items as leads man's platform, navigation lights, flags, a mechanical sounding machine, fog horn, ships bells, morse light and voice tube system between engine room and wheelhouse, etc., are provided as usual on vessels of this class, thus completing a very modern installation.

### Lifesaving

The lifesaving equipment, which complies with the latest Convention Requirements, consists of 2—32 person lifeboats, and 2—21 person lifeboats, one of the 21 person lifeboats being motor propelled. These boats are located on the upper bridge deck and the poop deckhouse top, giving a lifesaving capacity of 53 persons on each side of the ship.

Eighteen lifebuoys, nine equipped with lights, are distributed around the decks, and a life preserver is provided for each person on board. A line throwing apparatus is provided for use in lifesaving, this consists of a mounted type line throwing gun with line containers, lines, powders, charges, projectiles, etc.

### Heating and Ventilation of Accommodation Spaces

Natural ventilation, by means of cowl supply ventilators or gooseneck and mushroom type exhaust ventilators, is provided to such spaces as the dry cargo hold forward and aft pump rooms, passageways in accommodation spaces, toilet spaces, store rooms and cofferdams.

Mechanical ventilation is provided in all living quarters, the hospital, messrooms, gyro room, radio room, chart room, galley, pantries, dry stores and laundry. The rate of supply for all living quarters is about fifteen air changes per hour.

The mechanical supply is taken care of by four centrifugal fans, three centrifugal fans are provided together with a streamline exhaust unit for the mechanical exhaust systems. Three of the centrifugal supply fans are used to provide heated air, or air at atmospheric temperature, to the accommodation spaces, one supplying air amidships and two supplying air to the after spaces. The other fan provides air to the galley, food handling and meat cutting rooms, and store rooms aft.

All supply fans are fitted with steam air heaters on the inlet side, capable of raising the ambient air from 0°F. to 75°F. as necessary. The heaters are controlled by thermostats in the trunking at the discharge side of the fans, set at 75°F.

One centrifugal exhaust fan is utilized to exhaust air from the toilets and W.C.'s amidships, and one is used for similar services aft. The third fan provides exhaust ventilation from the cordage room, steering gear compartment and the meat handling room.

The streamline exhaust unit is used to exhaust air from the galley, drawing from a canopy fitted over the range, etc. The ventilation system is designed to provide for possible installation of air conditioning at a later date.

### Main Turbines and Gearing

The main propelling machinery consists of a cross-compound, double-reduction, turbine-gear set. The turbine set is comprised of a high-pressure turbine and a low-pressure turbine, having a continuous combined normal rating of 12,500 shp. at 100 r.p.m. when operating with steam at 585 psig. 840°F. total temperature, and an absolute back pressure of 1.5 inches mercury. The maximum rating of the set is 13,750 s.hp. at 103.2 r.p.m.

A reversing element for astern operation is included in the forward end of the low-pressure turbine. When operating astern the set may be run continuously at speeds not in excess of 70 r.p.m.

The turbines are of the impulse type throughout. There are eight stages of blading sections in the high-pressure unit and in the ahead section of the low-pressure unit. There are two stages in the reverse element. The ahead steam flows aft through the high-pressure turbine, through a cross-over pipe to the low-pressure turbine, and then exhausts downward to the condenser.

With the high-pressure turbine operating at 6,540 r.p.m. and the low-pressure turbine at 4,128 r.p.m., the propeller shaft speed is 100 r.p.m. This low propeller speed is achieved by coupling the rotor of each turbine to a double reduction gear. The speeds of the two turbines are separately reduced to the same value by a pinion and gear arrangement, so that the turbines drive a common low speed gear coupled to the propeller shaft.

Three connections are provided for the extraction of steam from the turbines for supply to the low-pressure steam generator, feed water heating, boiler combustion air heating, distilling plant operation and several other auxiliary services, as later described.

The control of steam to the turbines is effected at a manoeuvring valve and steam strainer manifold, mounted on the engine room bulkhead, and operated by means of handwheels at the control station. The manifold consists of ahead and astern throttle valves, an astern guardian valve and the steam strainer.

Close adjustment of steam flow to the high-pressure turbine is accomplished by a turbine-mounted set of three hand control valves. Each valve controls the steam flow through a group of nozzles in the first stage of the high-pressure turbine, and permits adjustment of the total first-stage nozzle area to suit any particular operating condition. By proper adjustment of the hand valves, the turbine can be operated with the main throttle valve wide open over a range of power, thereby reducing the throttling losses to a minimum.

Independent operation of either the high-pressure or the low-pressure turbine is possible, in case of emergency, by permitting the inoperative turbine to stand idle and to place the other turbine in operation. This is accomplished by disconnecting the defective unit, altering the position of a tee-piece in the crossover piping and fitting blank plates and piping. For operation with the low-pressure turbine disconnected, a blank plate is inserted between the crossover pipe and the inlet to the low-pressure turbines.

The tee-piece is connected to the exhaust casing, allowing the steam to enter the condenser. With the high-pressure turbine out of operation, the high-pressure outlet to the low-pressure turbine is blanked off, and the tee-piece connected to the desuperheated steam supply. An orifice plate is located in this line to reduce the pressure to that of the normal crossover pressure.

The turbine glands are of the steam-sealed labyrinth type; the glands being provided with sealing and vapour leak-off pockets. The sealing steam supply is piped directly to the steam-seal regulator from the auxiliary steam line. The steam-seal regulator consists of two steam valves, a spring-loaded pressure relay, an oil controlled pilot valve and a bellows assembly.

The oil, which serves as an operating medium for the regulator, is led to the pilot valve from the lubricating oil service pumps. During normal sea operating conditions, the steam supply to the packing is automatically shut off and the steam from the high-pressure packing is permitted to flow to the low-pressure packing.

Steam, in excess of that required to seal the low-pressure packing, is piped from the high-pressure packing through a valve to the low-pressure turbine. Should the pressure in the system fall, the regulator opens to supply steam to the sealing system. Vapours from the glands are removed to the gland exhaust condenser, by means of a motor-driven centrifugal fan.

Safety devices include an oil-operated governing system, designed to limit the shaft speed to 118 r.p.m. and to afford protection against low lubricating oil pressure. A sentinel valve is mounted on the exhaust casing of the low-pressure turbine to give warning of excessive exhaust back pressure.

The reduction gear is of the two-pinion, double-helical, articulated type. The rotating elements of the gear consist of two first-reduction pinions, two first-reduction gears, two second-reduction pinions and one main gear. The pinions are made from solid forgings; the first-reduction gears and the main gears are fabricated of steel.

The end play of each first-reduction gear is limited by thrust bearings at the forward and after end of the gears. The propeller thrust, in both the ahead and astern directions, is absorbed in a pivoted, segmental-type thrust bearing located at the forward end of the main gear.

### Main Boilers

The main steam generating plant consists of two "D" type steam generators. Each unit includes a two drum, bent tube boiler section, side and rear waterwalls, convection type superheater and an extended surface economizer. A desuperheater for supply of low-temperature auxiliary steam, is installed below the normal water level of the steam drum.

A steam air heater, consisting of a removable assembly of U-tube finned elements mounted in an airtight casing, is attached to the top of the windbox inlet for preheating the air before it enters the burner registers. The heater is capable of heating air from 100°F. to 270°F., when supplied with steam at 63 psia, and at a temperature of 405°F.

Four oil fuel burners are installed in the front wall of the furnace of each boiler. The burners are of the mechanical atomizing type. Steam-operated, valve-in-head soot blowers, designed to operate at full boiler pressure and desuperheater outlet temperature, are installed to serve the boiler section, superheater and economizer tubes.

An electrically-operated combustion control system is arranged to regulate the fuel and air supply, in accordance with the demand for steam, by maintaining the pressure at the superheater outlet of each boiler within predetermined limits. The ratio of fuel to air on each boiler is also maintained.

The burner header pressure is automatically prevented from falling below the minimum for safe operation, regardless of the number of burners in service.

Two horizontal, centrifugal, forced draught blowers, driven by two-speed squirrel cage motors, are provided. Each fan has sufficient capacity for both boilers at normal evaporation. The blowers take suction from the boiler room and discharge through the air heaters to the boiler front air castings. The ducts are arranged to permit operation of one or two blowers with two boilers and one or other blower when only one boiler is steaming. Inlet vane controls are fitted at the blowers.

Due to the weight of the completed boiler being in excess of our lifting capacity, the boiler materials were furnished "knocked-down" and erected on board ship. This erection work included all cutting and expanding of boiler and superheater tubes, casing work, installation of brickwork, etc. The manufacturer provided a supervisory staff.

### Low Pressure Steam Generator

A low-pressure steam generator in the boiler room supplies steam to and receives condensate from all services which may be considered to be subject to oil contamination. The danger from this oily condensate is thus confined to the contaminated system and the main boiler feed is completely isolated.

The low-pressure steam generator is a steam heated low-pressure boiler or steam transformer. It has a rated output of 35,000 pph. of steam at 120 psig. when the steam supply is 300 psig. Steam is supplied to the tube nest from the desuperheated steam system through a regulating valve, designed to maintain the output steam at 120 psig.

Bled steam from the high-pressure extraction point is used as the heating medium at sea when tanker services are not in use. The tube nest drains are led to a drain cooler and discharged to the de-aerating feed heater.

### Electrical Generating Plant

The electrical system is of the alternating current type at 60 cycles, single or three phase as required; 450 volts distribution is provided for power requirements, 230 volts for galley and laundry services and 118 volts for lighting, fractional horsepower motors, etc. A 120 volts, 2-wire, direct current system is available for special services.

Power for the electrical auxiliaries and ship's lighting is supplied from the two turbo-generators during normal conditions. For emergency purpose and cold ship starting, a diesel generator is provided. Provision is made for automatic starting of the emergency set upon failure of voltage at the main switchboard.

Each turbo-generator has an output of 400 kw., 450 volts and 60 cycles. Steam is delivered to the turbines at 585 psig., 840°F., total temperature and exhausts into individual condensers at 28½ inches vacuum. The turbines are of the impulse type, have six stages of blading and run at 10,059 r.p.m. The turbine shaft is directly connected to the reduction gear.

The reduction gear is of the single-helix, single reduction type, and reduces the turbine speed to the generator speed of 1,200 r.p.m. The synchronous generator and 7.5 kw. 120 volt d-c. exciter are two individual machines, and are of the self-ventilated type with drip-proof enclosure.

Each unit is equipped with a constant speed governor of the oil relay type, and protective devices to shut off steam on overload and an alarm system to warn the operator of low lubricating oil pressures. Each unit has an individual lubricating oil system, with heat-exchangers.

The engine driving the 75 kw., 450 volts, 3 phase 60 cycle emergency generator is of the four cycle, high-speed type. The unit is complete with batteries for cold starting and with radiator type heat exchanger. Two 5 kw., 120 volt compound wound, direct current generators, each driven by a 7½ hp. induction motor supply power to the gyro compass and echo sounder.

Three switchboards control and distribute the power. The main switchboard services the turbo generators output and an emergency board is connected to the diesel set and the motor generator sets. The third switchboard is for forward ship's service and emergency distribution.

### Main Condenser and Air Ejectors

The main condenser is bolted directly to the exhaust flange of the low-pressure turbine. It is of the

**Table 1 — Boiler Design Data**

| | Normal | Maximum |
|---|---|---|
| Superheater outlet pressure — psig | 600 | 600 |
| Superheater outlet temperature — °F. | 850 | 865 |
| Total evaporation, each boiler — lbs°hr. | 47,500 | 65,000 |
| Superheated steam, each boiler — lbs°hr. | 44,000 | 47,000 |
| Desuperheated steam, each boiler — lbs°hr. | 3,500 | 18,000 |
| Feed temperature to economizer — °F. | 250 | 250 |
| Air temperature to burners — °F. | 265 | 270 |
| Efficiency — per cent. | 88.0 | 87.5 |
| $CO_2$ in uptake — per cent | 14 | 14 |

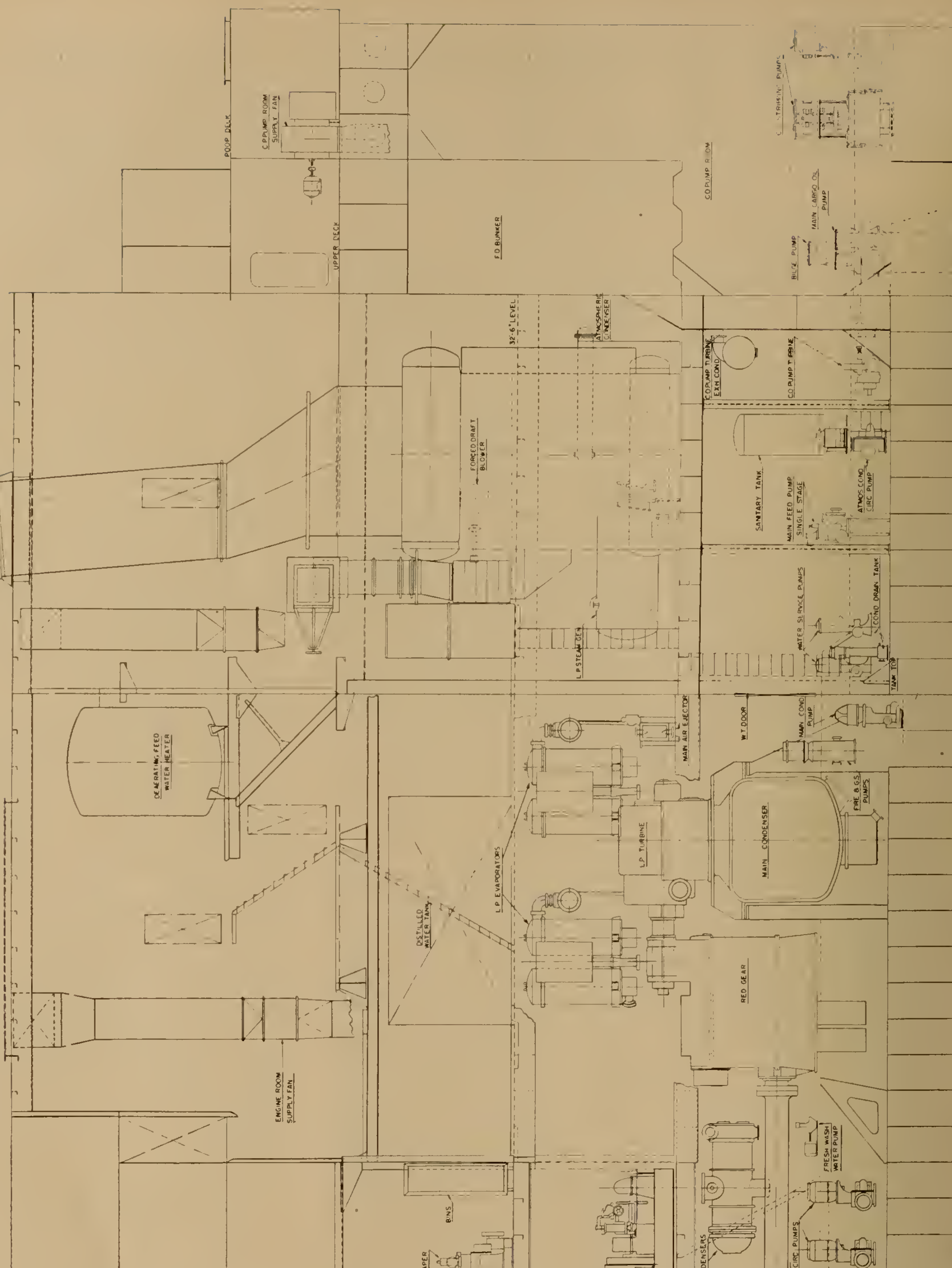



**Fig. 6. Machinery space port elevation.**

straight tube, reheating, surface type, with two passes of circulating water and an air cooling section and condensate hotwell. The shell is of welded steel construction, the water chests of cast iron, the tube sheets of rolled naval brass and the tubes of 70-30 copper nickel.

The effective outside tube surface is 12,500 sq. ft. Design conditions ensure the maintenance of an absolute condenser pressure of 1½ in. mercury, when, with a cleanliness factor of 85 per cent and a sea water temperature of 75°F., the rated normal ahead power is being developed.

The air ejector is a steam jet, twin element, two stage type, mounted on surface inter and after condensers. The operating steam is taken from the desuperheated steam range at a pressure of 275 psig. The inter and after condensers are circulated by the main condensate pump.

The main condenser is circulated by means of sea water from the main circulating pump which is a vertical, two-speed, motor-driven, single stage, centrifugal unit. Branches from the discharge line are led for circulation of the lubricating oil coolers and in an emergency, to cargo pump exhaust condensers.

The sea water enters the suction main from high and low injection valves. A connection is provided for emergency bilge pumping. In the event of failure of the main pump, circulating water is available from the cargo pump condenser circulating pump.

#### Auxiliary Condensing Equipment

Each turbo-generator has its own condenser, which is served by individual condensate pumps, circulating pumps and air ejectors. The pumps are cross connected so that either pump can be used on either condenser.

The cargo oil pumps exhaust to a single-pass, atmospheric condenser which is circulated by its own circulating pump. The shell is vented to atmosphere through a large vent pipe, designed to handle full steam flow, should the circulator fail.

Oily exhaust from reciprocating machinery, and pumps and drains from oil heating coils, are led to a combined atmospheric condenser, drain inspection tank and hotwell. Condensation takes place in the atmospheric condenser. The condensate flows by gravity to the inspection tank and to the hotwell which serves as storage for the feed pumps for the low-pressure steam generator. Circulation of the condenser is by the cargo pump turbine circulator in port and the water service system at sea.

#### Propulsion Shafting and Propeller

The propulsion shafting design created a problem because of the necessity of reducing the effect of torsional vibrations. The problem is of particular importance in vessels of this design, where the machinery is located aft and the ship has a large length-by-breadth ratio.

Critical conditions may occur which may induce excessive vibrations over the working shaft speeds. The object was to check the system inertias and their influence upon the location, in the speed range, of the one, two and three node critical frequencies.

The tailshaft was increased from 24-in. to 26-in. diameter, to suit standard shafts being fitted in other vessels operated by the shipowner. By adopting a five bladed propeller and using a smaller intermediate shaft of higher tensile steel than that normally considered, the two and three node criticals were found to be far above the maximum operating revolutions.

The one node critical was calculated to be at 58.9 r.p.m.; thus giving a theoretical absence of objectionable vibrations in the power range of approximately 3,000 s.hp. to the overload of 13,750 s.hp.

The shafting from the main gear to the propeller is in two lengths. The forward length, or intermediate shaft, has solid flanges and runs on a self-lubricated, steady bearing of cast iron. The bearing is lined with white metal on the lower bearing surface, and has white metal end bands on the cap.

The shaft has an electrical torsionmeter unit, mounted at the forward end for measurement of horse power. The propeller shaft has a solid inboard coupling and a centrifugally cast composition liner is fitted to extend throughout the sterntube bearing surfaces. The propeller end is tapered and fitted with a forged steel key and nut.

A spare tailshaft, complete with liner, is stowed in the aft end of the lower engine room. The propeller is five bladed, cast solid of manganese bronze with a diameter of 21 ft. 6 in and a pitch of 17 ft. 8 in.

#### Distilling Plants

The two salt water distilling plants are of the low-pressure, double-effect type with external distilling condenser, air ejector condenser and distillate cooler. For normal sea operation, steam is supplied to the first stage heating section from the low-pressure turbine bleeder at about 7 psia. Under this condition either plant can produce 6,000 gallons of fresh water per twenty-four hours.

When bled steam is not available, or when operating at reduced power, arrangements are provided to supply auxiliary steam at 5 psig., to the first stage heating section; the capacity of each plant then increases to 12,500 gallons per twenty-four hours.

The evaporator units of the first and second effects are identical and completely interchangeable. They comprise a deeply corrugated monel heating section, arranged in cylindrical form, and surrounded on the outside by sea water.

Above the evaporation section is a cyclonic separator where the major amount of entrained liquid particles are separated by centrifugal force. On top of the cyclonic separator is a steam dome, where final separation takes place by reversal of flow and impingement.

The vapour passes from the steam dome of the first effect shell to the basket heating section of the second effect evaporator, via a vapour feedwater heater. The drains from the second effect steam chest are led to a flash chamber in the bottom of the distillate condenser, where they mix with the condensate of the vapour from the second effect shell.

The vapour from the second effect shell passes to the distilling condenser. The condensed vapour combines with the second effect steam chest distillate at the bottom of the flash tank and is pumped by the distillate pump, through the distillate cooler, by way of a solenoid operated valve, designed to dump any contaminated water to bilge, and pass only pure distillate to the ship's service tanks.

The two-stage separation of the vapours, in each effect, results in fresh water with a salinity not exceeding 0.25 grains of sea water per gallon. The distillate cooler, distilling condenser and air ejector condenser are circulated with sea water from the ship's water service pump. About 25 per cent of the sea water passes through the supplementary heating sections in the distiller condenser and feeds the evaporator shells in parallel.

Automatic float valves control the rate of feedwater into the bottom of the cyclonic separator, where further heating drives off the carbon dioxide gases, with the vapour, before the degasified feed goes down the downtakes to the evaporator section.

Brine from the first effect shell is led to the second effect shell, the rate of flow being adjusted by a control valve. This gives a feed rate to the first effect equal to twice the amount of fresh water made from both effects. The bottom blow-off from the second effect shell is connected to the brine pump and discharges overboard. Salt concentrations of 1.5/32 NDS are maintained in the evaporator.

The vacuum in the system is maintained by a single pass steam jet air ejector. The non-condensable gases are taken from a specially baffled section in the distiller condenser. The vacuum is reflected throughout the entire evaporator plant via vent lines and interconnected vapour pipe, the degree of vacuum at all locations being dependent upon heat balances and ambient conditions.

#### Refrigeration Plant

A direct expansion type refrigeration plant, designed for use with freon-12 refrigerant and having a capacity of approximately 2.5 tons of refrigeration, is installed in the upper part of the engine room.

The plant is capable of maintaining the specified temperature in the refrigerated compartments and will freeze 300 pounds of ice per 24 hours. A cold water tank having a capacity of 26 gallons is provided for drinking water. Provision is made for the three 6 cubic feet domestic boxes to be cooled from the main refrigerating system.

The compartments are as follows:

(a) A poultry and meat room having a volume of 1,734 cubic feet, maintained at a temperature of zero degrees fahrenheit.

(b) A chill room having a volume of 1,901 cubic feet, maintained at 35 degrees fahrenheit.

The refrigeration machinery consists of two water-cooled compressor-condenser units, one being arranged to act as a standby. Automatic temperature control by means of thermostatically operated liquid line solenoid valves is provided for each compartment, domestic box, scuttle-butt and ice-maker.

An automatic condenser water regulating valve with a three valve by-pass is provided to control the flow through the condenser and maintain constant condensing or high-side pressures with fluctuating water temperature. For defrosting, hot gas connections are provided for the poultry and meat room. The usual safety devices and automatic shut-offs are provided.

#### Feed Cycle and System

The specification requirements for overall power plant efficiency called for a designed all-purpose fuel rate of 0.54 pounds of fuel per shaft horse power per hour (based on oil at 18,500 B.t.u. per lb.).

The feed cycle is arranged with two stages of heating on the low-pressure side of the feed pump. The sole heat gain on the high-pressure end of the cycle takes place in the economizer. A simplified flow diagram illustrating the cycle for normal sea operation is included with the drawings.

The basic design of the cycle follows the Bethlehem arrangement but the application of the turbines required a complete review of flows and temperatures. The turbine water rate for the Davie vessels is slightly in excess of that for the Bethlehem turbines but the use of the Maxim distilling plant offsets the slight loss of economy due to the main turbine change. The selection of the three extraction conditions was made on the basis of General Electric data and our own heat balance calculations, and the ultimate cycle proved to be within the specified economy.

The feed system is arranged on the closed principle with de-aerating feed heater. The main condensate pumps, one working and one for standby duty, take suction from the condenser hotwell and discharge through the air ejector condensers, drain cooler, gland exhauster condenser and first stage heater to the de-aerator.

The condensate pumps are vertical motor driven, two stage, centrifugal units. The pumps are designed on the submergence control principle, thereby eliminating the necessity of float gear, etc. A hand operated make-up valve makes recirculating water available in emergency or when manoeuvring.

Each turbo-generator exhausts to its own condenser. The two auxiliary condensate pumps are arranged so that each pump can service either condenser hotwell. As in the case of the main condensate pumps, the auxiliary pumps have similar design features. The pumps draw from the hotwell and discharge through the auxiliary condenser air ejectors to the main feed line ahead of the drain cooler. The low-pressure feed water heater combines with the drain cooler and gland exhaust condenser in a single combined unit.

The de-aerating feed heater is installed in the upper level of the engine room casing. It is of the direct contact type, with integral vent condenser and fixed orifice type steam atomizer. There is a large storage space of approximately 2,200 gallons. Float gear provides automatic regulation of water level by means of air operated spill and make-up valves. The spill valve opens on an increase in water level and by-passes excess condensate to the distilled water tank.

Should the water level fall, the make-up valve opens. This valve is fitted on a discharge line from the distilled water tank to the drain collecting tanks. In addition to the spill valve there is an air operated overflow valve which opens when the water level in the de-aerator reaches a high level. The heater outlet is led directly to the main feed pumps.

Automatic boiler feed control is provided by means of a two element type feed water regulator for each boiler and a feed pump governing system. A multi-cell electrical salinity indicator of the detector and alarm type is installed to measure concentrations of sea water salt from 0-10 grains per gallon, and to give visible and audible warning when the salinity in any one cell exceeds 0.25 grains per gallon.

There are three main feed pumps each capable of handling full boiler loads. They are horizontal, single stage, single suction units, driven by a single stage, axial flow, impulse turbine. The pumps deliver direct to the economiser inlet.

All clean drains are led to a steam and fresh water drain collecting system, which includes a drain collecting tank of 200 gallons capacity fitted in the fathometer space. Two drain transfer pumps are arranged to draw from the collecting tank and deliver to the condensate system. The pumps are automatically started by means of a float operated switch. One pump is in use while the other acts in a standby capacity.

The contaminated exhaust steam and condensate is led from such services as heating steam, cargo heating, boiler fuel heating, butterworth heater and drain cooler, lubricating oil heaters and tank coils, reciprocating pumps, etc., to a steam condenser and observation tank. Condensate from the observation tank is led through a drain cooler to the low-pressure steam generator.

#### Steam and Exhaust Systems

The distribution of steam is divided as follows:—

(a) High-pressure, superheated steam at 600 psig. and 850°F. total temperature drives the main propulsion turbines and the 400 kw. electric generator turbines.

(b) Main boiler desuperheated

steam is used for the following drives and services:—

*At full boiler pressure*

Main feed pump turbines.
Fire and butterworth pump turbine.
Cargo oil pump turbines.
Emergency steam to low-pressure propulsion turbine.

*At reduced pressures*

Main and auxiliary air ejectors.
Low-pressure steam generator tube nest.
Distilling plant air ejectors.
Make-up feed injector.
Turbine steam seal regulator.
Make-up steam for feed heating.
Whistle steam.
Soot blowing.

(c) Low-pressure steam generator steam is used, under normal conditions, as follows:—

Steam driven deck auxiliaries.
Stripping and bilge pumps in cargo room.
Oil heating services (heaters and coils).
Butterworth heater.
Comfort heating.
Low-pressure generator feed pumps.
Steam to fire smothering.
De-icing sea valves.
Fresh water heater—domestic uses.

(d) Bleeder steam from the main turbine system is led in three separate stages as follows:—

(i) *High-pressure Turbine 5th expansion bleeder (115 psig.).* This extraction supplies steam to the low-pressure steam generator tube nest during normal operating conditions.

(ii) *High-pressure Turbine 8th expansion bleeder (42 psig.).* Steam is supplied to the boiler air heaters and the de-aerating feed water heater.

(iii) *Low-pressure Turbine 5th expansion bleeder (7.9 psig.).* Steam to first stage feed heater and low pressure distilling plant.

The exhaust from the main turbines, generator turbines and main cargo pump turbines are led to their respective condensers. The main feed pump turbines and the turbine of the fire and butterworth pump exhaust at 15 psig. back pressure to the auxiliary exhaust range.

The exhaust range combines with the intermediate bleeder steam main and is used as the heating medium

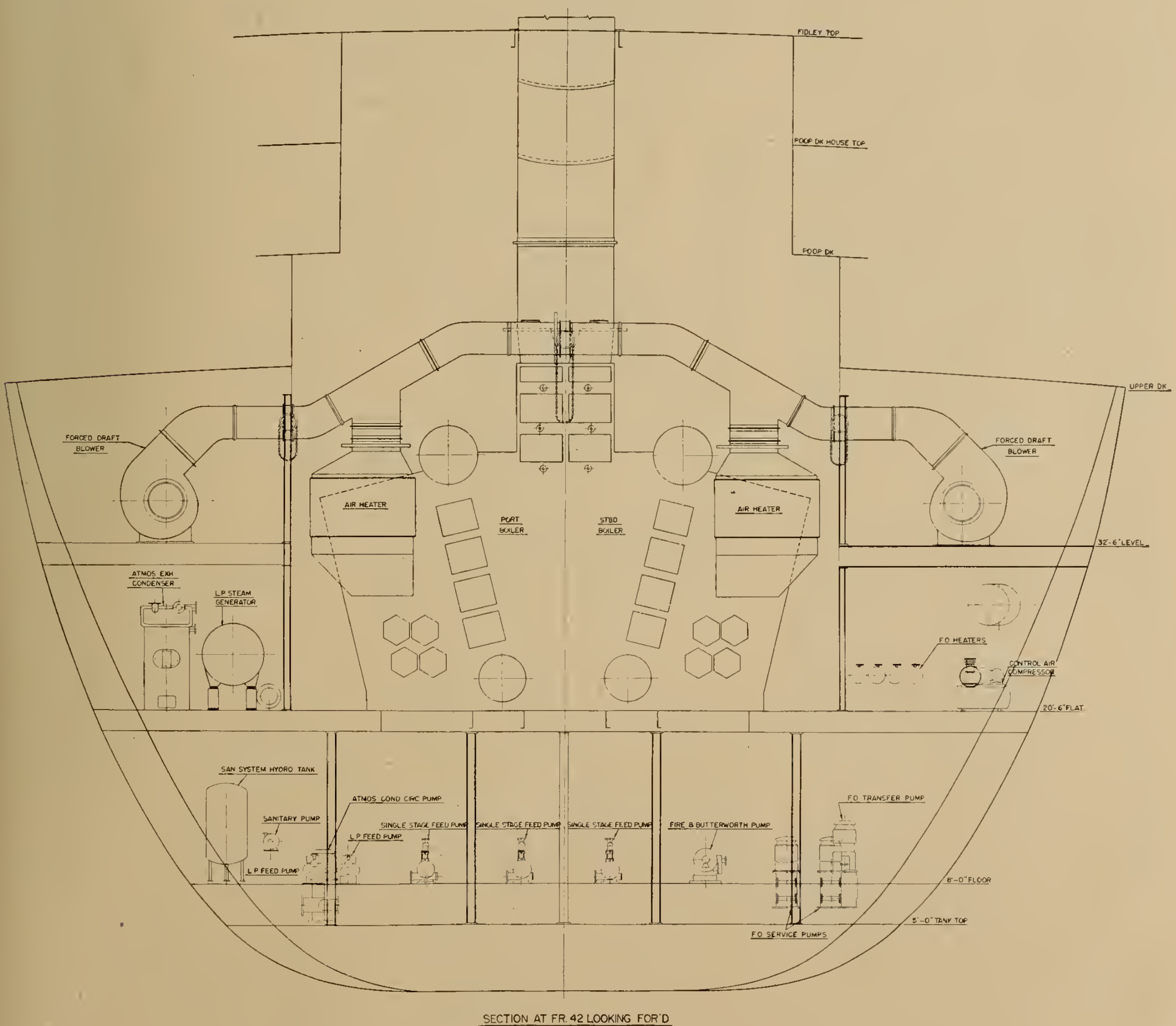



**Fig. 7. Machinery space section.**

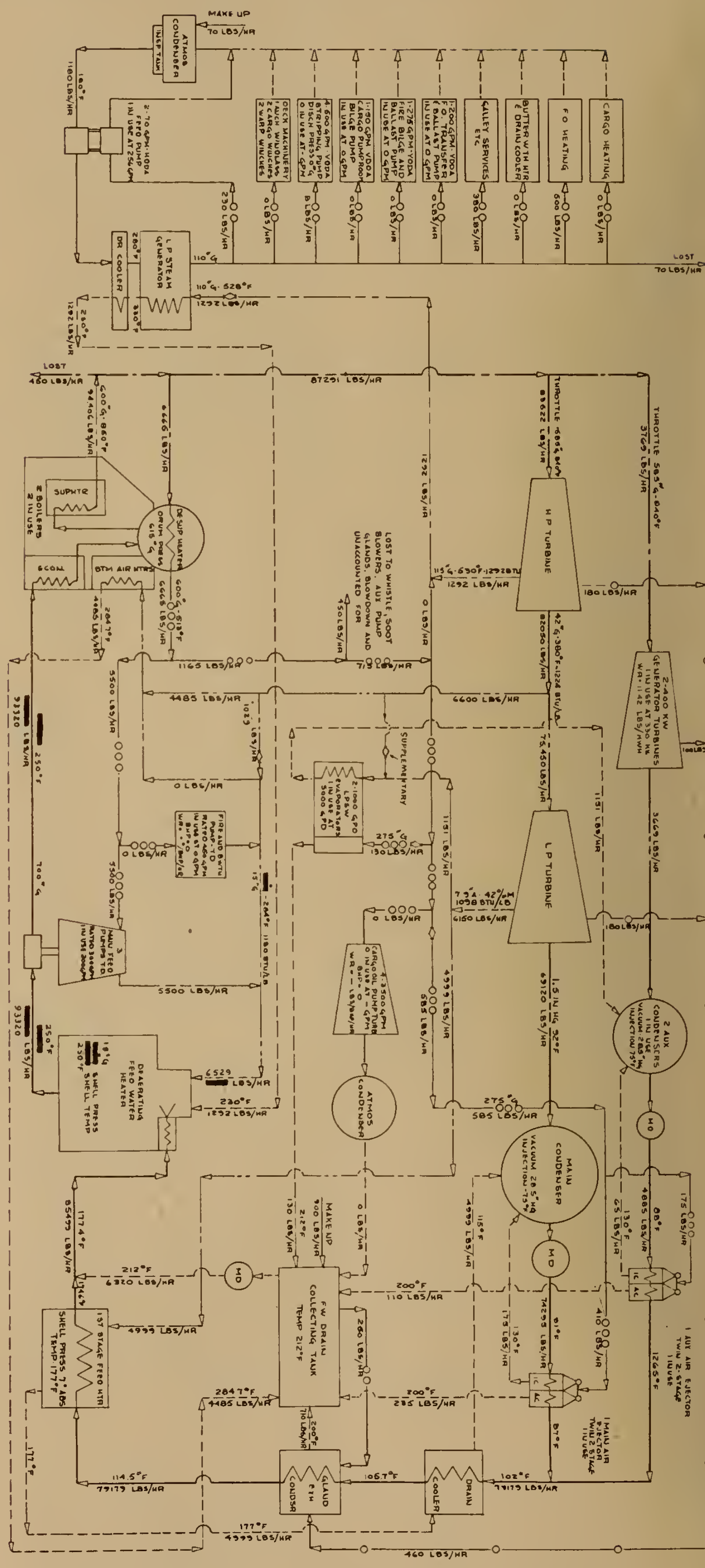
Fig. 8. Steam flow diagram, heat balance, normal power.

LEGEND

| | |
|---|---|
| ———— | FEED & CONDENSATE |
| — — — — | SUPHTD STEAM |
| —·—·—·— | BLEEDER & EXH. SYSTEM |
| —OOO— | DESUPH'TD STEAM |
| —OO— | SATURATED STEAM |
| —O— | GLAND LEAK OFF |
| - - - - - - | DRAINS |
| TD | TURBINE DRIVEN |
| MD | MOTOR DRIVEN |

Notes:

Shaft horsepower . . . . . . . . 12500
Full load displacement . . 36300 tons sw.
Revs per min . . . . . . . . . . 100
Oil/hr. . . . . . . . . . 6833 lbs./hr.
Oil/shp./hr. . . . . . .548 lbs./shp./hr.
Oil heat value . . . . . 18500 btu./lb.
Boiler efficiency . . . . . . . . . . 88%
Uptake temp. . . . . . . . . . . 305°F.
Mainturbine W. R. . . .622 lbs./shp./hr.
Generator load . . . . . . . . 330 kw.
Injection temp. . . . . . . . . . . 75°F.
Heating system secured.
L.P. evap. in use at 5,000 gpd.
Steam air heater temp. air in 100°F.




for the de-aerator and steam air heaters and for turbo-generator condensers when the pressure exceeds 20 psig. and to atmosphere when the pressure exceeds 25 psig. Exhaust from deck and engine room reciprocating machinery is led to the contaminated system.

### Lubricating Oil System

The main turbines and gearing are lubricated by a gravity type system. The equipment for the system includes two vertical, rotary, motor-driven service pumps which take suction from the double bottom sump tank, through a duplex magnetic strainer and discharge to gravity tanks through a duplex strainer and oil coolers. Each pump and cooler is capable of handling the maximum requirements of the system. Two gravity and settling tanks are installed in the engine room casing.

Each tank contains a six-minute supply of oil for the main units as a reserve in case of pump failure. Float-operated alarms are fitted to warn the engineer should the oil level drop. As the gravity tanks are used for settling the oil, they are fitted with heating coils to aid in the collection of sludge. The heating coils also serve to preheat the oil to its safe operating temperature before the propulsion unit is operated.

Two centrifugal lubricating oil purifiers, fitted with steam heaters and built-in suction and discharge pumps, are arranged for continuous and batch purification. The lubricating oil system also includes two oil storage tanks of 750 gallons capacity each, and one 3,000 gallon used oil tank.

Connections are provided for gravity filling of the reduction gear sump tank, turbo-generator sump tanks and the daily service tanks from the storage tanks. Used oil in the system can be pumped from the main sump tank and discharged into drums via the filling connections on the poop deck house top.

### Cargo Oil Pumping

Ten centre tanks and twenty wing tanks are provided for the carriage of cargo oil or ballast. Provision is made for boiler fuel oil to be carried in the after pair of wing tanks.

The thirty tanks are divided into four groups, each group being normally serviced by its own 14 inches filling and suction main and cargo oil pump. This arrangement permits four grades of cargo to be carried at the one time.

Provision is made for positive separation of the groups, by means of spectacle flanges provided in the pump room headers and two-valve protection provided at each group connection. When carrying one grade of cargo, arrangements are provided for connecting any group of tanks with any cargo pump.

Cargo oil suction and filling mains and a smaller stripping main run fore and aft through the cargo tanks, and are connected to the centre and wing tanks by athwart ship piping and valves. Two athwartship headers are located in the pump room, one connected across the suction and filling mains, and the other across the stripping main.

Each cargo main and stripping main is connected to corresponding deck mains by risers which permit either filling or discharging. The deck mains run forward from the pump room to individual headers located amidship.

For ballasting port and starboard sea chests and cross connecting piping are provided; this permits the cargo tanks to be ballasted or pumped out by means of either the cargo or stripping pumps. In addition to discharging directly overboard, the stripping pumps are arranged to discharge either to deck or to the after centreline cargo tank. The stripping process is thus consolidated, each pump discharging to this tank, which in turn is pumped out by one of the main cargo pumps.

A tank cleaning system is provided. Sea water is heated to approximately 180°F. in a steam heater, and is discharged to the deck fire main by a turbine-driven pump. A nozzle is connected to the fire main by means of a specially grounded hose, and lowered into the tanks through a deck manhole. The high-pressure jet of hot water is arranged to contact all parts of the tank and the oily water is then pumped by the stripping pump.

Each cargo oil tank is vented automatically to atmosphere whenever vapour pressure within the tank becomes excessive, or whenever a slight vacuum is caused in the tank due to falling liquid head. This is accomplished by leading individual lines from each tank to a common vent header, and installing a pressure-vacuum relief valve in each line, set at 2 psig. and 1 psi. vacuum.

The escape risers from the vent headers are led up the masts and are provided with flame arresters at the top. To prevent liquid from being discharged from the top of the mast, a relief valve set at 1 psig. is installed at the base of each riser.

Heating grids are fitted to all cargo oil tanks on a ratio of one square foot of heating surface per 100 cubic feet of cargo oil. The grids are formed from continuously welded pipe and fittings with flanged connections only as required for removal of sections. Some 34,000 feet of piping is fitted for cargo oil pumping and heating.

### Miscellaneous Pipe Systems

Boiler fuel is carried in forward and aft deep tanks and, in emergency, in No. 10 cargo oil wing tanks. Transfer of oil from tank to tank is possible by means of a motor-driven transfer pump, located in the machinery space and a steam-driven reciprocating pump located in the forward pump room. Filling connections are located on the main deck amidships.

The fuel oil service pumping equipment consists of two motor-driven, vertical rotary pumps, each of sufficient capacity to handle both boilers at maximum evaporation.

Heating takes place in four horizontal, extended surface type heaters, two of which have sufficient capacity to heat the oil required for normal operation from 90°F. to 250°F. Three heaters are required for maximum evaporation. Each pump takes suction through a simplex basket type strainer and discharges through duplex strainers. A fuel meter of the positive displacement type is provided. Diesel oil for the emergency generator and boiler lighting-up is stored in a 460 gallon tank.

Bilge pumping is divided into three separate systems, one for the forward spaces, one for the pump room aft and one for the machinery spaces. Steam-driven reciprocating pumps serve the forward space and the pump aft.

The machinery spaces are pumped by a motor-driven bilge and ballast pump located in the boiler room, and by a motor-driven fire and general service pump located in the engine room. The main circulator has a connection for emergency bilge pumping. The two motor-driven pumps are primed by means of two priming pumps, one a stand-by, mounted on a common sealing water tank and connected to a vacuum tank.

Hydro-pneumatic systems are provided for wash water, flushing water and drinking water. Hot water is available at all washbasins, etc., and cold drinking water is led to fountains throughout the accommodation and at the engine room control station.

Two separate systems of compressed air are installed, one to supply air to pneumatic tools, hydro-pneumatic tanks and ships' general service, the other to supply the air-operated controls. Each system includes a motor-driven compressor and receiver.

### Fire Extinguishing Systems

Fire alarm and extinguishing systems are provided consistent with the service involved, and complying with the requirements of the regulatory bodies. A complete carbon dioxide fire protection system is fitted, providing for alternative bilge flooding protection to the machinery spaces and total flooding protection of the cargo oil pump room.

The system is manually controlled from outside the protected spaces, and includes the necessary pressure-operated alarm sirens to warn personnel of an emergency. Pressure operated switches are installed to de-energize the mechanical ventilation system in any one space in the event of fire. A steam smothering system protects the following spaces (a) all fuel and cargo oil tanks, (b) lamp and paint rooms.

A salt water fire main, complete with the required branch lines and fixtures is installed. The system is served by the engine room motor-driven fire pump, the pumps in the boiler room and the forward pump room steam-driven fire pump.

The fire main is divided into three sections (aft, midship and forward) by suitable valves, so that, if any portion of the fire main is damaged, this section can be cut-out and the other sections connected by hose.

In addition, fire fighting equipment such as axes, portable extinguishers, sand boxes, hose and nozzles are fitted.

### Conclusion

The work entailed in engineering this large project was considerable. Machinery and equipment had to be ordered with the minimum of delay to co-ordinate with the severe delivery schedule. The main propulsion unit differed greatly from the type previously fitted in vessels of the class, with the result that the engine room machinery was almost completely rearranged. Space was at a premium, and a careful study of machinery and piping layouts was made.

The assistance rendered us by the engineering staff of the General Electric Co. was of much value, particularly so with respect to heat balance, foundations, shafting torsionals and the numerous problems related to piping systems. The early stages coincided with a period when materials were in short supply, due to defence projects having priority.

The problems associated with the installation of a turbine/gear set of this size commence with the arrival of the parts. The larger sections had to be stored outdoors, and elaborate precautions were taken to prevent corrosion damage to the working parts. The build up of the set from the lower gearcase through the turbine end calls for careful checking and alignment procedure. This work is carried out in circumstances which are far from ideal.

In the later stages all auxiliary machinery pipe systems, electrical apparatus, etc., are subjected to rigorous tests to prove their suitability prior to dock trials. The dock trials are full-dress rehearsals of the ultimate sea trials. It was found that running basin trials, at the light draft necessitated by dock conditions, presented many unexpected vibration problems.

The sea trials of the first tanker proved highly successful, a speed of 16.75 knots being attained at full power with the vessel ballasted down to the load water line, the designed efficiency of the entire plant being met and in some cases even surpassed. The successful operation of the "Andros Venture" over six months is looked upon with great pride by the builders. It is felt that the prestige of shipbuilding in Canada has been boosted in the eyes of all maritime nations by this achievement. √

## MANUFACTURING PROCESSES FOR A NEW CEMENT PLANT

(*Continued from page 687*)

Each new plant may present an excellent opportunity for an engineer to do creative work. This creative work will be a product of his experience, his industry and his imagination. Every new plant brings problems and new solutions, and no one is the same as another. That is why the work of an engineer and his profession may be considered so fulfilling.

### Acknowledgments

The author desires to pay tribute to the efficiency and drive of all the contractors concerned for the difficult part they have played in keeping within an extremely tight construction schedule. √

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# British Aviation Interests in Canada Expand

This information made available to *The Engineering Journal* by The Society of British Aircraft Construction

Recent months have seen a considerable expansion in the capacity of the Canadian aircraft industry and in particular of those companies which are associated with the British industry.

Two new factories have recently been formally opened (Bristol and Dowty), work is well ahead in two more (Rolls-Royce and Lucas-Rotax) and a third, Avro Canada, has invested 17½ million dollars in acquiring an existing factory from the Canadian Government. A big extension to another factory (Faireys) is nearly complete, and a further expansion is planned. De Havillands of Canada are also expanding.

Altogether there are about 40 companies closely associated with parent companies in Great Britain. Five of the Canadian companies are Members of the Society of British Aircraft Constructors, which has eleven Commonwealth Members altogether.

The expansion of these aviation companies in Canada goes hand in hand with Canada's policy of procuring strategic defence material from her own continent—as well as the ordinary day-to-day after sales service given to all aircraft overseas by British manufacturers.

### Aircraft Companies Expand

In detail, the expansion of these various companies is as follows:—

The de Havilland Aircraft Company of Canada, long-established as aircraft designers and producers, will be moving soon from their old Downsview plant to a new 600,000 sq. ft. factory nearby.

The Fairey Aviation Company of Canada, a comparative newcomer, are building an extension to their factory near Halifax, Nova Scotia, of some 208,000 sq. ft. and a further possible 160,000 sq. ft. is also planned.

Avro Canada, now in full production with the *CF 100* all-weather fighter and the *Orenda* jet engine, have bought up the Government factory near Toronto, plus tools and equipment, where the *Orenda* is produced.

### New Engine Factories

Rolls-Royce is the latest British company to expand its Canadian interests—with a new large factory near Montreal for the servicing and, eventually, the production of jet engines. The first stage in this program will be the servicing of *Nene* jet engines built in Britain for a Canadair-built trainer, next the assembly of components and testing in Canada, and the final stage the complete manufacture of engines on the spot, using local materials and sub-contractors throughout.

A large new factory for the overhaul and repair of engines has also been built by Bristol Aeroplane Engines to supplement their existing factory at Vancouver. The new factory of 85,000 sq. ft. near Montreal handles about 75 engines a month, giving the Bristol organization in Canada a total capacity of some 130-140 engines a month.

### Equipment Makers Expand Too

Dowty Equipment of Canada recently formally opened a 60,000 sq. ft. factory at Ajax, Ontario, 20 miles east of Toronto, and another important new accessory factory is also in action at Scarborough, near Toronto—the Lucas-Rotax plant. This has a floor space of some 120,000 sq. ft. and is to employ

(*Continued on page 709*)

# FROM MONTH TO MONTH

**Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers**

## Confederation

Herewith is the report of the special committee appointed by Council to study the proposals for cooperation between the provincial professional bodies and the Institute. The report is a comment on the proposals, a recommendation as to the personnel of a national committee of the Institute to carry out further studies, and terms of reference for the committee.

This report was presented by J. B. Stirling at the meeting of Council held in Kingston on April 30, and was approved unanimously. It has been discussed further at the annual meeting by the branch officers, at the business meeting and by Council. As well the members of the committee and certain alternates who were at the annual meeting in Quebec, were called to the first meeting of the committee by R. E. Heartz, the chairman, on Friday, May 14.

In addition to those named in the report, the following have been added by the committee in order to widen the representation—Eric Hinton, Newfoundland, and Ronald B. Smith, Prince Edward Island. A representative is to be appointed in Trail, British Columbia.

Copies of the report have been mailed to all members of the committee, to branch secretaries and to councillors. With its appearance in the *Journal* it will now be in the hands of every member.

Correspondence on the report may be mailed to R. E. Heartz, 2050 Mansfield Street, Montreal.

### The Engineering Institute of Canada

#### Co-operation Within the Profession

***Report from the Nominating Committee***

The proposal of J. Herbert Smith to study the relationship between The Engineering Institute of Cannada and the provincial professional organizations, and their functions, with the idea of developing a better set-up for the profession, must be accepted as a challenge and an opportunity. The development of complete co-operation and the elimination of overlapping and duplication is an objective that should be approved universally throughout the profession.

It must be recognized that some engineers will not approve (at least in the beginning) any fundamental change in the existing organizations. They may be prompted by loyalty to one organization or by a prejudice against another. They must be convinced eventually that proposals for co-operation deserve their support. Above all they must not be aggravated into active opposition against the proposals.

Profiting by the mistakes of the past, we must handle this opportunity with every consideration. Care must be taken to think out a practical and sensible set-up. Each step must be made firm before the next one is attempted, so that when we come to the end of our deliberations we will be on undeniably solid ground.

It is important to bring about improved conditions as soon as possible, but the passing of time is of less importance than ultimate success. Let us not waste time, but let us weigh well every consideration.

Before negotiating with other bodies, the Institute should have a clear understanding of all the circumstances, which should lead to definite proposals as to how this much desired co-operation can best be brought to pass. Progress will be more rapid if all the problems are considered and their solutions determined, before joint negotiations are started. This same procedure would appear to be best for other organizations as well.

In examining the proposal there appear to be a few clearly defined angles from which it must be regarded. First consideration should be to determine how it would affect the public interest. What are the advantages and the disadvantages?

The next consideration should be the interests of the members of the Institute. What are the advantages

## Cover Picture

The cover picture shows Imperial Oil's Ioco refinery, opened on September 16, 1953 after an 18-month reconstruction program, which raised the plant's capacity to 22,500 barrels a day. New installations included atmospheric and vacuum distillation units and the first fluid catalytic cracking unit in British Columbia.

and disadvantages from their point of view?

When all these aspects have been studied and the results put together in a report, they should be submitted to Council for approval. At that point Council should arrange to discuss the whole matter with the provincial professional associations.

### *Terms of Reference*

In studying procedures to bring about the desired co-operation or unity of effort, there are certain questions which must be answered. The answers should be the basis of the report to Council—the terms of reference.

The list of questions is as follows:

1. (a) Should the federation be integral (corporate unity) or (b) joint. (Each organization a separate entity but operating together under a joint undertaking), or (c) combination of both?
2. Should the Council of the Institute be controlled (a) solely through the association or (b) by a council composed of appointed representatives of each association and a corresponding number elected at large or (c) as at present?
3. *Membership*—Should the Institute receive members (a) by direct application or (b) exclusively through the associations or (c) a combination of both? What will happen to Honorary Members, Life Members, paid up Members, Affiliates and Students?
4. Should there be any compulsion, i.e., should all members of associations be required to belong to the Institute, and vice versa, or should these second memberships be optional?
5. *Branches*—Will they be (a) branches of the associations or (b) branches of the Institute?
6. *Financing*—Should the Institute receive a fee (a) direct from each member or (b) indirectly through the associations?
7. *Money, funds and reserves*—It seems logical if not essential, that all provincial associations retain their own funds as at present, but what will happen to ownership and control of Institute assets such as Headquarters premises, education fund, prize funds, reserves and cash balances?
8. *Publications*—Should the Institute (a) control the *Journal* and retain the revenue from it? or (b) should it be directed by the associations and the profit dispensed by the associations perhaps to reduce the joint fee?
9. *Headquarters Services—Employment*—Will this continue to be operated (a) through H.Q. or (b) through the associations or (c) both?

   (b) *Library*—Presumably this will operate as before, but the point should be covered in the report.

   (c) *Accounting*—This will be answered when the previous questions are answered.

   (d) *Records*—Will the Institute (a) maintain its own membership records and stencils or (b) will mailing be done through associations?

The committee recommend that a national committee be established and propose the following persons for it:

Nova Scotia: J. R. Kaye, Halifax.

New Brunswick: E. O. Turner, Fredericton.

Quebec: Hector Cimon, Quebec; I. R. Tait, Montreal; R. E. Heartz, Montreal; L. J. Hammerschmidt, Montreal; H. Gaudefroy, Montreal; R. L. Dunsmore, Montreal; G. M. Dick, Sherbrooke.

Ontario: D. Ross-Ross, Cornwall; T. Foulkes, Ottawa; J. J. Green, Ottawa; H. R. Sills, Peterborough; S. Sillitoe, Belleville; R. Harvey Self, Toronto; E. R. Graydon, Toronto; J. F. MacLaren, Toronto; C. D. Carruthers, Toronto; J. G. Hall, Toronto; W. S. Wilson, Toronto; W. E. Brown, Hamilton; J. S. Ellis, Niagara Falls; J. A. Vance, Woodstock; B. B. Hillary, Sarnia.

Manitoba: C. L. Fisher, Winnipeg.

Saskatchewan: Allan Tubby, Saskatoon.

Alberta: T. D. Stanley, Calgary.

British Columbia: H. T. Libby, Vancouver; M. L. Wade, Kamloops.

**Executive**

Quebec: R. E. Heartz—Chairman, Montreal; I. R. Tait, Montreal; R. L. Dunsmore, Montreal; Hector Cimon, Quebec; G. M. Dick, Sherbrooke.

Ontario: W. S. Wilson, Vice-Chairman, Toronto; D. Ross-Ross, Cornwall; S. Sillitoe, Belleville; J. J. Green, Ottawa; E. R. Graydon, Toronto; J. F. MacLaren, Toronto; C. D. Carruthers, Toronto; W. E. Brown, Hamilton.

The foregoing does not preclude consideration of any other relevant matters, or other members being added to the committee.

Respectfully submitted,

R. L. Dobbin,
I. R. Tait,
J. B. Stirling.

Note: (a) This report was approved and accepted by the Council of the Institute at Kingston, on April 30th, 1954.

(b) The committee will be known as The National Committee on Confederation of the Profession of Engineering in Canada (Short title "Committee on Confederation").

Montreal, May 4th, 1954.

# The Senior of All Engineering Institutions Loses Its Secretary

Members of the Institution of Civil Engineers in Canada and many members of the Engineering Institute as well will be shocked to hear of the sudden death of E. Graham Clark who for the last seventeen years has been secretary of that great Institution.

Mr. Clark has been in the service of the Institution for forty years, and in that period has done a tremendous work for the Institution and for the profession. His services and his pleasant disposition have won for him the warm esteem of all with whom he came into contact in the course of his work.

Many Canadians will recall having met Mr. Clark in the fall of 1952 when he along with the president of his society and the presidents and the secretaries of the other great British Institutions, were guests of the Engineering Institute of Canada for a short tour in this country.

Mr. Clark was a great friend to the Engineering Institute. His knowledge of conditions in Great Britain and in other parts of the world as well, was of great assistance to the Institute through the secretariat and through certain committees as well.

Mr. Clark was due to retire from his post on May the first, but he had been asked to remain a few months longer until his successor would be able to take over the full burden. As well Mr. Clark was an important part of the organization of the Conference of Commonwealth Engineering Institutions which is to meet in London, England, on May 24th of this year. He will be sadly missed around the conference table.

The Council of the Institute has sent to the president of the Institution their deepest sympathy and it is certain that the members of the Institute who have had the opportunity of knowing this great man will join with the Council not only in expressing their sympathy to the Institution itself but also to Mr. Clark's family.

## How Foolish Can We Be?

In today's world where everyone is overburdened with controls, regulations and legislation, there are a lot of iniquities brought about by attempts to set up regulations that cover every (well almost every) possible condition or combination of events. Over the years legislation is cut, patched, stretched and shrunk, until finally one end of a sentence may well contradict the other end.

Recently a member of the Institute has called the attention of Headquarters to the working of a tariff regulation which comes into that category. The situation is this. This student went to the United States to get a Ph.D. degree in electrical engineering. It was his intention to return to Canada to teach. As the end of the two years study approached he made inquiries at Ottawa as to the conditions which would apply to his return.

He was stunned to be told that he would be allowed a customs exemption of only $100 per adult person—the same as is allowed any Canadian who has been in the United States forty-eight hours. Now the serious part of all this is that the student is married and has a child. Naturally he had to set up house while he was there and acquire all the gear that goes with such a project. And now he has to pay full customs duty on every single thing he owns (except for the two allowances of $100 each).

When he reported this situation to the Institute it seemed so fantastic that the general secretary was certain there had been a mistake. However an exchange of letters with various officers in the Department of National Revenue—including the minister himself—brought out all too clearly the fact that that was the law and no one was prepared to do anything about it.

Now here is a pretty situation. We have a brilliant young Canadian who has spent two precious years of his life (and a lot of money) preparing himself for high level service in Canada. He has had tempting offers to stay in the United States but he wants to spend his life in Canada. The customs regulations require him to pay at one time as customs duties so much money, that it is likely he cannot finance it. Not many students have cash on hand for such purposes.

Now what is likely to happen? Canada will lose this man who would be worth almost his weight in gold, to Canada. The government regulations will force him to become a foreigner—will deny him the right to live and practice his profession in Canada. The need for such men here is one of the most urgent that Canada has ever known.

The irony of it is that if he were a foreigner, coming here for the first time, even without his valuable education, he would be allowed to bring in all his belongings free, as settlers' effects or as a landed immigrant.

Surely some place along the line, someone can do something to prevent this completely silly thing from happening, but who he is or where he is the Institute does not know. It is evident that this piece of legislation is completely wrong for a case like this. Surely in the beginning no one even intended it to work such a hardship on anyone, and without any sign of compensating values for anyone elsewhere.

How foolish can we be!

## Dominion Council Elects President

Professor William Lister Sagar, M.E.I.C., was elected president of the Dominion Council of Professional Engineers, at the 17th annual meeting of the Council, held in Toronto, May 26-28, 1954.

William L. Sagar, M.E.I.C.

The president of the Association of Professional Engineers of Ontario, and professor of civil engineering at the University of Toronto, Professor Sagar succeeds, as president of the Council, another well-known engineer and educator, Dean R. M. Hardy, of the University of Alberta.

Executive officers of the nine provincial associations of professional engineers attended the meeting, which dealt with a wide diversity of legislative topics, primarily designed to establish uniformity of registration and legislation for professional engineers across Canada. Representatives of various professional organizations attended, also, with I. R. Tait, M.E.I.C., Montreal, and B. G. Ballard, M.E.I.C., Ottawa, representing the Engineering Institute of Canada.

The Dominion Council concluded its 3-day meeting by "strongly opposing any trend towards unionization of engineers in both Canada and the United States". The opinion was voiced that professional bodies should be able to effectively represent their members.

The council was advised that a uniform syllabus of examinations for the registering of professional engineers now was in force across Canada, and that a free movement of engineers across the country was possible in most cases, without the payment of additional provincial fees in order to practice.

With a view to bringing about unity within the engineering profession in Canada, the council appointed a special committee to discuss a plan for confederation with the Chemical Institute of Canada, the Engineering Institute of Canada and the Canadian Institute of Mining and Metallurgy.

The incoming president of the Dominion Council also expressed his confidence in the value of a liaison program, recommended by T. Carr Forrest, whereby information would be exchanged by United States and Canadian engineering bodies. Mr. Forrest is president of the U.S. National Society of Professional Engineers.

It was announced that the next annual meeting of the Dominion Council will be held in St. John's, Newfoundland, in May, 1955.

## A New Wrapper

Starting with the June issue members may have noticed that the appearance of the envelope which each month brings *The Engineering Journal* to them has been changed considerably. The staff of the

*Journal* hope that it finds favour with all members.

The change was made for two reasons—the first and perhaps the more important being that the former envelope had turned out to be too light for the work it had to do. It is not considered good business to spend a lot of money and take a lot of time preparing a well-printed and well-turned out publication only to have it delivered in a tattered and shabby envelope.

While the weight of the paper was being changed it was decided to change the colour also. Judging from the samples the new envelope should be a great improvement on the old one.

Incidentally, certain changes in the *Journal* itself are planned in the near future. Some new departments will be added, and there will be changes in the typography. However, none of these proposals has gone far enough yet to give the membership details. But the story will be written in these columns in the not too distant future.

# Correspondence

### So You Would Like to Be an M.P.?

This correspondent asks for anonymity behind some initials. This is granted, but it is believed many members will not agree with this sentiment. The ***Journal*** will be glad to print comments, either for or against.—Ed.

The Editor:

Every now and then somebody arises to blast engineers for their lack of interest in public affairs, specifically for their reluctance to run for elective office. I do not believe that engineers deserve this criticism any more than a good many other citizens, as I shall try to show. It is only because our critics are generally engineers themselves that we hear so much from them. Perhaps plumbers and plasterers, bakers and bus drivers are just as much taken to task, but few of us are in touch with such people and so we are ignorant of what is going on in their collective minds.

The biggest stumbling block to one with an impulse to enter politics is economic. Look at the make up of the House of Commons and what do you find? Most of its members are self-employed — lawyers, doctors, owners of businesses and the like. Some of them may have to accept a cut in their ordinary incomes when they enter the House, but they are assured of an occupation to which to return when they retire from political life or when their constituents decide to replace them with others of more appealing political philosophies.

The plight of the salaried man is quite different. A candidate for major political office is — perhaps I should say "ought to be" — drawn from the highest bracket of character, education and good sense which the population affords. Any such person is bound to be an important cog in his organization and no employer is going complacently to let him drop out or partly drop out of his place for an indefinite period. The recent increase in parliamentary stipends may stimulate some of the younger and more adventurous to exchange their business positions for those of elected office, in the hope they will last long enough in the political arena to qualify for parliamentary pensions, but it is not likely to change the outlook of older men. Security has become too much of a fetish to be lightly forsaken and political life in a democracy such as ours is notoriously insecure.

This economic condition is not peculiar to engineers. It affects every salaried man in the same way and there is no prospect that it is going to change. So long as it continues, there will be no great rush to public life, of the people affected by it.

It has been said many times that the qualities instilled into one by engineering training and experience are those that are needed badly by our legislators. No doubt the engineer's habit of thought could well be more freely applied to public questions to advantage, but it must also be recognized that some of these selfsame habits are handicaps in government as we know it.

For example, engineers are impatient with delay; they want to get on with the job. They marshal the facts, study them, arrive at a decision and then act at once. The whole process, though it may involve commitments of millions of dollars, takes a relatively short time as compared to the long drawn out palaver which precedes so much political action. The engineer is vocal enough when he has something worth saying, but he has scant patience with talk for its own sake and a good deal of political oratory seems to be of this sort.

He is still less patient with cranks. He cannot bring himself willingly to listen to those who expound lunatic theories, whatever they may be. He will listen respectfully enough until he is convinced of the absurdity of the theory advanced, after that he wants none of it. But in politics he will have to listen to a good deal of such talk, ranging from the promotion of schemes that are completely impossible to those which are merely impracticable, perhaps because they cannot be put into effect in a democracy, perhaps because they are quite beyond the country's means.

Of necessity more and more engineers are becoming interested in people as well as in things, but still their interest is generally limited to certain classes of people — their co-workers of all grades, their clients, those from whom they buy — in short, to those with whom they come into close and regular contact. Not many have any great interest in the fisherman and the farmer at one end of the scale and of the princes of the church, let us say, at the other. But the interest of the occupant of a political niche must be all embracing; it must be a lively and personal interest in each of his constituents, and also *ought* to cover the country.

No engineer worthy of the title believes in reaching major political ends by the distribution of patronage. Thanks to an excellent and well administered civil service system, petty patronage has been pretty well done away with in Canada, but there seems little doubt that governments at every level, no matter what their political stripe, still placate their followers by the judicious use of patronage, whether it be by the construction of public works, some of it unneeded, or by the appointment to public office sometimes of other than the best qualified candidates. This may be and perhaps is one of the prices we have to pay for the privilege of living under conditions that suit us best, but such things irk the engineer. He objects to it not only on moral grounds but because it is generally inefficient and he hates inefficiency.

In spite of valiant attempts on the part of the universities and on his own, to overcome the handicap, the engineer is still a rather dumb individual. He will talk to another engineer freely enough, or perhaps turn out a top-hole report for his boss or his client, but he is quite unenthusiastic about addressing an ordinary audience on an ordinary topic. He seldom feels strongly enough on any non-technical matter to produce an article about it worth reading. Yet, if he gets into political life, he will find that most of the questions he will have to consider are outside his usual sphere, and that he must have convictions about them and express those convictions.

And a good many years of observation have convinced me — it may be heresy — that engineers are not familiar enough with what, for lack of a better term, are often called "cultural subjects". How many, without necessarily being themselves musicians, know anything about music ? How many have any coherent idea of world history ? For that matter, how many here have a really good knowledge of Canadian history ? How many have ever learned a foreign language just for the pleasure of reading its literature ? In the bilingual province of Quebec, how many English-speaking engineers have even a passable knowledge of French ? I could fill a page with questions like these. I am afraid that we must own up that we do not have the backgrounds we should have for public life.

Of course, there are exceptions. Some engineers have shed lustre on the profession in the political field. Names that will occur to us at once are those of the Hon. C. D. Howe and the Hon. Robert H. Winters. Notwithstanding their conspicuous successes, I am forced to conclude that the chances of engineers making any great reputations for themselves in the political field are slim, so long as economic conditions are as they are and so long as they themselves remain without substantial changes in temperament and training. Sorry!

FDR

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**Ottawa Branch Expresses Gratitude**

February 18, 1954.

Mr. W. K. Brasher, C.B.E.,
Secretary,
Institution of Electrical Engineers,
London, England.

At the annual meeting of the Ottawa Branch of the Engineering Institute of Canada held on January 21, 1954, the members of the Branch were informed of the action being taken by the three British Institutions to maintain Colonel By's grave in good condition and appropriate to its surroundings in the churchyard at Frant. The members were most touched by this generous undertaking and a motion was passed that, as the retiring chairman of the Branch, I should write formally to the three Institutions to thank them on behalf of the membership of the Branch for the action they are taking in this matter.

I know from Dr. Austin Wright that we are particularly indebted to you personally because you made all the detailed arrangements, including transportation, for Mayor Whitton and Mr. Dobbin to visit Colonel By's last resting place. I know, too, that this involved a preliminary trip on your part in order to interview the vicar and make sure that everything went well.

You may know that the Ottawa Branch is anxious to see some permanent memorial to Colonel By in the City of Ottawa. We have a subcommittee, of which I am the chairman, that is presently looking into ways and means of honouring Colonel By's memory. At the same time we have taken an interest in the possibility of raising funds in Ottawa to help the restoration work which is urgently required in the old church at Frant. The question has been referred to the Colonel By Chapter of the Imperial Order Daughters of the Empire and to Bishop Jefferson of the Ottawa Diocese.

J. J. Green, M.E.I.C.
Ottawa, Ont.

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# H.E.P.C. and Concrete Reseach

One can hardly pick up a newspaper today without finding in it something about research, usually medical, and sometimes highly embellished or inaccurate. It is natural that medical research should attract the public eye, but there is much other research of importance going on that does not find its way into the press; often it is little known except by workers in the field that it covers. Nevertheless, it is calculated to give the citizen more for his money, either in improvements in existing materials and procedures, or by substituting better ones for them.

The researches in concrete which were started many years ago by the Hydro-Electric Power Commission of Ontario are designed to save Ontario people money by enabling the Commission to give them better, more dependable and cheaper service. The Commission's program along these lines was well described in a recent address of Dr. W. P. Dobson, M.E.I.C., to the National Concrete Products Association; Dr. Dobson is research consultant to the Commission.

Perhaps his address can best be summarized by devoting a paragraph or two to each of the principal topics he discussed:

1. An electronic device, the "Sonoscope", developed by the Commission's technicians, detects minute cracks in concrete and is of great value in studying the deterioration of concrete structures.

2. Tests of aggregates for chemical reactivity are regularly made; so far not even a moderately reactive material has been found.

3. Freezing and thawing tests are carried out with completely automatic equipment.

4. Wetting and drying effects and the effect of sulphate ground water are being studied.

5. Fly ash as a partial replacement for cement in mass concrete has been studied with successful results, largely because it may result in the saving of money and because the Commission will have a large supply of it from its steam stations in Toronto and Windsor.

6. Tests of cements from Canadian mills are made at regular intervals to check their quality; there are differences in the cements at early ages, but after six months there is little to choose among them.

7. Test methods are being improved; a better sulphur capping material for concrete compressive specimens has been developed.

8. The newer types of deformed steel reinforcing bars have been tested. Other studies seem to show that much of the reinforcing in certain areas in gravity dams may safely be omitted.

9. Much work has been done on precast concrete; precast wall panels have been used to some extent and an investigation of precast poles is under way.

10. Prestressed concrete is coming in for much attention. Precast, prestressed concrete floor slabs have been used with good results and beams made of an assembly of concrete blocks mortared together and prestressed by cables lying in grooves in the blocks have been used for 17-foot roof beams. Many questions have had to be answered — the effect of cable lay on bond, the kind of mortar

to be used between the blocks and around the cables, etc.

11. The thermal and elastic behaviour of concrete is under study.

12. Ice pressures are being investigated; the maximum observed to date is about 7,000 lb. per lin. ft.

13. Pressures on concrete forms have received attention, as influenced by rate of filling, slump, temperature and character of mix.

We understand that the results of some of the completed projects may be obtained by applying to the Commission.

# C.C.A. Tells Government

One of the virtues of our democratic form of government is that any organization may present its views to Parliament and to the Cabinet with assurance that at least it will receive a courteous hearing, but, of course, no guarantee of action. Ministers and Members must have to listen to so many crackpot suggestions that it should be something of a pleasure for them to receive a brief such as the one presented on February 22, 1954, by the Canadian Construction Association, representing a thousand firms and thirty affiliated organizations right across the country.

We have never made a count of our members who are connected, directly or indirectly, with the construction industry, but we are sure that it is large enough to warrant our publishing a fairly extensive abstract of the C.C.A. brief.

### Construction is Big Business

Last year it is estimated that the value of construction in Canada exceeded $4½ billions and that it gave direct employment on the average to some 468,000 and indirectly to an even larger number employed in manufacturing, selling and transporting an extremely wide variety of construction materials and other items used on the job-sites. In terms of money, the operations of the Federal Government and of the construction industry are on about the same level.

Much of today's construction program consists of large projects connected with our transportation, steel, aluminum, hydro-electric power, oil, gas, chemical and other basic industries. With the supply situation now in balance, with construction costs relatively stable and with competition keen throughout the industry, conditions are distinctly in the owners' favour.

### Housing

The brief made reference to the fact that the Association had been invited to testify before the Banking and Commerce Committee of the House of Commons concerning the proposed amendments to the National Housing Act. Advantage was taken of this invitation and a brief was presented on February 25.

This dealt with a number of matters, mainly of a non-engineering nature, which for this reason will not be discussed in detail in this report.

### Highways

The subject of Canada's road system received a good deal of attention at the C.C.A.'s recent 36th annual meeting and the statement adopted at its 1953 convention was re-endorsed. While the roads programs undertaken by provincial governments in recent years have reached record proportions, the backlog of road requirements both present and potential is steadily increasing. Experience with the Trans-Canada Highway has proved conclusively that Federal-Provincial joint action in the execution of highway projects may take place in cooperative fashion and still maintain provincial rights.

The Trans-Canada Highway Act provides for the availability of federal funds until 1956; as yet there has been no commitment on the part of the Federal Government either to the extension of existing agreements or to federal investment in other roads of national importance.

The vital importance of interprovincial and international highways and of roads designed to develop our natural resources, especially in the north, to enlarge our tourist trade and to meet strategic requirements is apparent. Failure to meet needs for road facilities will seriously restrict the scope of our national development. It is therefore recommended that:

1. Federal appropriations be made available to the provinces for use in the improvement of Canada's main highway network, following a procedure similar to the Trans-Canada Highway dollar-for-dollar arrangement.
2. A joint program be carried out with respect to international connections, access roads to undeveloped areas, approaches to national parks, railway-highway grade separations, etc., in accordance with regional needs.
3. All provinces receiving federal aid conform to minimum standards, in keeping with traffic volumes and geographic needs.
4. The use of federal aid continue to be optional to the provinces and that authority over the administration of road projects remain under provincial highway departments.

It is also recommended that a National Highways Commission be established to coordinate the planning, financing and construction of roads of national importance, to administer federal funds aiding such projects, to facilitate the exchange of roadbuilding and traffic control knowledge and to promote highway safety activities.

### Tendering Practices

The Association once again endorses a policy of coordination and centralization of responsibility and control of construction projects under a general contractor to eliminate delays caused by divided responsiblity and to save time and money. The General Contractors' Section and the Trade Contractors' Section of the C.C.A. have established a joint committee to discuss relationships between the two groups. This joint committee expects to produce a *Guide To Better Bidding Practices*, which it is hoped, will be endorsed by the Royal Architectural Institute of Canada and by the Engineering Institute.

Endorsation was also given to the policy of calling for competitive tenders on all construction work involving public funds and of the public opening of these tenders, except when work falls in the secret or emergency categories. The privilege of attending such tender openings is much appreciated by contractors, as there bidders are quickly advised as to their standing. This is most helpful, for it enables decisions to be made without delay concerning equipment movements and whether to tender on other projects. It also is an indication to future bidders that their tenders will be fairly considered. From the owner's standpoint, public tender openings constitute , good public relations and tend to encourage greater competition and better prices.

A problem that was the subject of

a special resolution adopted at the 36th convention is one of long standing. While it is the practice of federal agencies, when calling for tenders on construction projects, to furnish certain information concerning subsoil conditions, there is always a clause in the specifications stating that none of this information is guaranteed. Getting accurate subsoil information by each tenderer is impracticable, because this would cause unnecessary expense and because it is usually impossible to make the necessary tests and borings in the time allowed for the preparation of tenders. It is urged that an amendment be made to Federal Government specifications and contracts to provide that the necessary subsoil information shall be furnished and that, in the event that the actual conditions vary from the conditions described in the specifications, an equitable adjustment with the contractor will be made.

### Public Works Program

Labour organizations and others participating in recent discussions on unemployment have advocated that the Federal Government inaugurate an increased public works program as an emergency measure. While the fact that there were twenty tenders submitted recently for a $1.2 million project testifies to the degree of competition existing in the construction industry and to the eagerness of contractors to bid, it is not felt that a large-scale program over and above that contemplated in the present estimates should be undertaken for the prime purpose of solving the present unemployment problem.

Construction activity brings about even more off-site employment in a wide range of supporting industries than on-site employment in actual construction operations. This fact makes investment in construction desirable in times of a general decline in business activity. With a high volume of construction anticipated this year, it is doubtful that a substantial increase in the public works program would affect the present seasonal unemployment factor or help the textile, marine, agricultural equipment and other industries currently beset with unemployment problems.

### Labour Relations

The Association has for a number of years advocated that the Federal Government amend its labour relations legislation to require the use of secret ballots, under the supervision of electoral officers or other public officials of a similar status, when trade unions vote on strike action. Work stoppages may affect the wellbeing of large sections of our population, so it is important that votes concerning strike action do, in fact, represent the voters' personal feelings and considered thinking. The protection afforded to voters by secret ballot on important issues is, of course, fundamental to democratic principles and is also contained in the labour relations legislation of the Federal Government and of all provincial governments dealing with the certification of trade unions as collective bargaining agents, the acceptance of arbitration awards or the authorization of payroll deductions. In addition, four provinces have legislation providing for the use of the secret ballot when trade unions vote on strike action. It is strongly urged that similar action be taken by the Federal Government. It might be added that, while lockouts are relatively uncommon, employers are more than willing to follow secret ballotting practices in cases where group agreements exist with trade unions. Indeed, contractors requested this procedure in connection with a lockout on the West Coast in 1952.

The Association takes this opportunity of reiterating its stand opposing any amendments to the Industrial Relations and Disputes Investigation Act which would provide for the voluntary revocable check-off of union dues as a legal right. The Association is also strongly of the opinion that the Unemployment Insurance Fund should not be used for the payment of benefits to those unemployed due to illness or injury, as this would constitute a health insurance scheme quite foreign to the purpose of unemployment insurance legislation.

### St. Lawrence Seaway

The leadership displayed by the Federal Government with regard to the St. Lawrence Seaway is to be highly commended and it is to be hoped that the prospect of a start on the Seaway this year will be realized. In view of the many delays that have been encountered because of the hesitancy of the United States to participate in a joint project, and because of the contribution that the project will make in the development of Canada, this project is especially Canadian in nature. It is strongly urged that the resources of the Canadian construction industry, including engineering, manpower, materials and contracting facilities, shall be used to the full in its execution.

### Special Tariff Arrangements Concerning Construction Equipment

The Department of National Revenue permits the importation of construction equipment on a temporary basis, when suitable equipment is not available in this country, upon payment of 1/60th of the normal tariff and sales tax for each month that the equipment is in Canada. Similarly, permission may be given to import used vehicles in cases where it is claimed that suitable units are not available in Canada, notwithstanding Tariff Item 1215. These concessions are available to both Canadian and foreign construction companies, but because the latter may obtain and dispose of specialized equipment more readily and because they may purchase equipment and borrow money more cheaply, the tariff concessions are, on balance, detrimental to Canadian contractors and to manufacturers and distributors of construction equipment. The practice of the Department of National Revenue in referring applications for tariff concessions of this nature to the C.C.A. office to check on the availability of the equipment in question is appreciated; the number of applications has decreased considerably recently, as the supply of construction equipment in Canada has increased substantially. A resolution adopted by the Association at its 36th convention urges the Federal Government to refrain from granting tariff concessions of this nature, unless required as war or emergency measures.

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## BRITISH AVIATION INTERESTS IN CANADA EXPAND

*(Continued from page 702)*

about 1,500 people in the production of items such as turbo-starters, electric starters, magneto parts, etc.

There is also the small but well-equipped factory of Godfrey Engineering Company Limited in Quebec, producing pressurization equipment for the latest Canadian-built aircraft.

Finally, there is Field Aviation at Oshawa, Ontario, an associate of the Hunting Group of Companies. This organization is responsible for extensive servicing work on RCAF aircraft, and also for sheet-metal and other sub-contracted detail work. √

# *Thirty-five Years Ago*

## Comment on the *JOURNAL* of June 1919

It is not possible to introduce much variety into these excursions into the past of the *Journal*; the contents of the old issues simply do not provide any material for it. Month after month the central topics are the licensing of engineers and their salaries, and the *Journal* for June, 1919, is no exception. True, there are papers of varying degrees of excellence, but it is quite obvious that the thoughts of the members of the Institute were then concentrated on matters other than technical.

It is hard for today's readers, most of them of a younger generation, to realize how important some control of the engineering profession and better salaries seemed to members of that period. Now that nine out of the ten provinces have regulated the practice of engineering for so long that it might well be from the beginning of time, and also now that, if not so high as some think they should be, the incomes of engineers have increased to figures astronomical by 1919 standards, we are prone to forget that this condition of things was not brought about without much hard work in which the Institute was the leader.

Reactions to the publication in May, 1919, of the model act began to appear in this *Journal*. The personal opinions of some of the prominent members of the day—R. W. Leonard (president), H. E. T. Haultain (vice-president), William Pearce, G. H. Duggan, F. H. Peters, H. H. Vaughan, L. B. Elliott, A. Gray, James H. Kennedy, J. G. Sullivan and L. A. Thornton—ranged from enthusiastic to somewhat qualified approval of the model act.

Only two of the branches had got around to reporting their attitudes on the matter. The Toronto Branch "heartily approved of the proposed act." The Montreal Branch reported the results of a questionnaire which it had sent to its members. The replies to some of its questions are interesting enough to warrant giving them here. (See table on this page.)

Present regulations of the provincial associations conform pretty closely to the opinions expressed in this questionnaire.

Some 70 M.P.'s were reported as willing to support any movement for better salaries in the Civil Service. The Civil Service Commission, hitherto regarded as the stumbling block in the campaign, was now said to be guiltless of any wish to keep salaries down, as it had to accept the recommendations of department heads in such matters. Several branches reported committees at work on fair salary schedules. A "Superintendent of a Government Department" wrote in to add his to the complaint of low Civil Service salaries, but thought it would be a long and tough job to get them improved.

Council finally decided that it would not send out individual "letters of advice" with the letter ballot on the model act, but that the letter of transmittal from the model act committee should be published in the *Journal* and that a pro-and-con circular should be sent to all members with the ballot. For this purpose, it appointed a committee consisting of Walter J. Francis, Arthur Surveyer, H. H. Vaughan, G. H. Duggan and R. A. Ross.

This letter of transmittal is almost as important as the draft of the act itself. It said, "It may be assumed that there is no opposition . . . on the part of any engineer in Canada to the basic principle . . . Every branch has expressed itself . . . as . . . desirous of obtaining legislation . . . The engineer has as good . . . a claim to recognized status . . . as the doctor (or) lawyer . . . it must be made apparent . . . to the public that the (act) . . . would redound . . . to the benefit of the community at large . . . (It should) be uniform for all provinces, so far as reasonably possible; . . . it should be acceptable to every individual engineer and to every engineering and technical organization . . . The outstanding feature of the draft is . . . the incorporation in each province of an entirely new body to be called "The Association of Professional Engineers of . . ." (This) offers the only . . . solution of the problem . . . Its object is to forestall adverse criticism and . . . to eliminate jealousy and opposition that might reasonably exist by the apparent . . . assumption . . . of control of the machinery . . . on the part of the . . . Institute . . . or by any other . . . organization."

For the first time the issue of unionization appears. A copy of a circular letter advocating the formation of a draftsmen's union was presented to Council and information of a similar notice was received from a Toronto member. Council "received" these; perhaps later we shall find that it took some action.

The Institute's relations with the Canadian Engineering Standards Association were made still closer by the acceptance by the latter of our two specifications for steel railways and highway bridges. The C.E.S.A. secretary at that time was R. J. Durley, later to become secretary of the Institute and to serve it faithfully for many years.

The *Journal* "fillers" ranged over a wide field as they do now. A translation from the *Electrotechnische Zeitschrift* predicted that the voltage of electrical transmission lines would not increase much beyond the then level of about 100,000 volts and says that 200,000 volts is the "further limit". It was sure that high-tension, direct-current transmission was just around the corner.

The *Journal's* masthead in 1919 carried the names of the Board of

**Montreal Branch Study of Opinion of Engineering Legislation**
from *The Engineering Journal*, June 1919

| | Yes | No | No reply |
|---|---|---|---|
| Are you in favour of a closed corporation? | 146 | 18 | 3 |
| Are you in favour of legislation embracing: | | | |
| All engineering works? | 140 | — | — |
| Public works only? | 17 | — | 10 |
| Are you in favour of entrance through college only? | 53 | 114 | — |
| Should examinations for admission to study be required | 140 | 27 | — |
| Should examinations for admision to practice be required? | 133 | 32 | 2 |
| Should a period of apprenticeship be required? | 129 | 20 | 8 |
| Should there be exemptions from examinations? | 110 | 46 | 10 |
| Should graduates be exempted from | | | |
| All examinations? | 78 | — | — |
| Some examinations? | 33 | — | — |
| No examinations? | 44 | — | 12 |
| Should graduates have some experience before taking charge of work? | 140 | 18 | 8 |

Management—the president, the vice-president and five councillors—the editor (the secretary) and sixteen "associate editors".

As one result of the fuel shortages during the war, referred to in the May 1919 *Journal*, considerable interest had been aroused in the utilization of peat. As usual with any new development, this project had enthusiastic proponents, among whom was Ernest V. Moore. His paper in this *Journal*, "The Production of Peat Fuel", is a good summary of the situation in Canada in 1919. With over 37,000 square miles of peat bogs, many close to centres of population, it is no wonder that there was much interest in peat for the fuel purposes for which it was fitted—autumn and spring usage in furnaces, in cooking, in fire places and in some types of stoves, such as the Quebec heater.

According to Mr. Moore, it was hopeless to try to dry peat artificially or to squeeze the moisture out of it; air drying was the only economically possible method. The problem, then, boiled down to one of materials handling—excavation, spreading on the drying ground, recovery from this ground, storage and the loading of railway cars.

This paper was based largely on Mr. Moore's experiences with the peat plant at Alfred, Ont., Mechanically, this plant seems to have been successful; its troubles were mostly financial. However, it did produce a considerable tonnage of dry peat, which was sold in Ottawa and in Montreal and the quality was good. The writer burned some of it during the war years.

"Peat, Oil and Gas Fuel", by B. J. Forrest, also appeared in the June, 1919, *Journal*. This paper argued that the use of peat as a gas producer fuel or its processing by destructive distillation were promising. A ton of peat would yield 20,000 to 80,000 cubic feet of gas, according to the calorific power desired, and a long list of byproducts including coke, ammonium sulphate, tars and acids, useful as chemical bases. Most of Mr. Forrest's material was drawn from European sources and he quoted copiously from various reports and magazine articles. In short, his paper was a compilation, a type at which the *Journal* is today inclined to look askance.

Hanbury A. Budden in "Patents and Engineering" found a good deal to complain of: ". . . an Englishman cannot get a copy of a Canadian patent without sending to Canada, and even then only a typewritten one . . . In indices, the proof reading should be accurately done, but this is far from being the case . . . The revenue of the Canadian Patent Office . . . for . . . 1918 . . . (showed a credit) balance of $101,051.93 which was . . . merged in the Consolidated Fund . . . This brings me to another point . . . the injustice . . . of the present system, whereby the Patent Office makes a large annual profit out of the fees paid by inventors. It is merged in the ordinary returns of the country and (is) . . . a . . . tax on the cerebral activity of . . . men who are usually by no means overburdened by wealth . . . Reconstruction is now the important question and our patent system is one that calls for immediate action if we are to take our place among up-to-date nations."

The position of petroleum engineer, a graduate with three years' experience in the geology of Alberta and Saskatchewan, was advertised at $2,700 and the governors of the University of Manitoba were looking for a professor of civil engineering at $3,500. Somebody wanted an electrical engineer at "$3.00—$3,600"—quite a range!

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# Canadian Engineers Unexcelled Anywhere In World

*Recently while visiting the Adam Beck Generating Station No. 2 at Niagara Falls with Dr. Sydney Smith president of the University of Toronto, the Ontario Hydro chairman made some remarks that will warm the cockles of the heart of all Canadian engineers. It is too bad these comments, coming as they do from a man who has every reason to know what he is talking about, cannot be brought to the attention of a lot of people in Canada who seem to believe that engineering services must be imported if they are to be good. The* Journal *has in mind specifically several individuals and organizations that might benefit materially by heeding to Mr. Saunders (Ed.)*

Canada's remarkable progress within recent years, and her present status as one of the world's greatest and most progressive nations, can be attributed in large measure to her highly developed engineering profession, Ontario Hydro Chairman Robert H. Saunders stated recently.

Paying wholehearted tribute to Canadian engineers, whom he described as "one of our most valuable and least publicized resources", Mr. Saunders referred to the phenomenal development of the country from coast to coast. The ambitious programs of new construction now being undertaken right across the country were referred to as dynamic examples of the skill and ingenuity of engineers, helping to build a still greater nation.

"Our Niagara project is prodigious in every sense of the word", the Chairman commented, "and it is being carried forward with such high efficiency that it should be a source of pride to all Canadians. It was planned, designed and undertaken by Canadian engineers, and it leaves no doubt of the standing they have attained in their field—second to none!" Mr. Saunders had warm praise for Hydro's technical staff, who have pioneered in the fields of engineering, construction and research. "We have approximately 900 professional engineers and assistants on our staff," the Chairman stated, "and all of them are making a vital contribution to our progress. I could refer specifically to many who are regarded as pre-eminent in their particular spheres and whose advice and guidance are sought by outside organizations. At this time, I would like to single out three University of Toronto alumni who are carrying a tremendous share of responsibility: Dr. Richard L. Hearn, our General Manager and Chief Engineer; Dr. Otto Holden, Assistant General Manager-Engineering; and Gordon Mitchell, Project Manager at Sir Adam Beck-Niagara No. 2. They are, in my opinion, making an outstanding contribution to the life and welfare of all those who live in this Province."

"We at Hydro are convinced that we could not have made such remarkable progress with our power development, frequency standardization and other major programs without the direction and advice of our own engineers," Mr. Saunders added. "We like to draw to the attention of our people the reputation and standing of Hydro engineers—men who are dedicating themselves to the service of a publicly-owned enterprise. We believe that they should be recognized and that is why we have established a policy of naming many of our great projects in their honour." The Chairman referred to large

Hydro installations which already bear the names of outstanding Canadian engineers and builders:

*Sir Adam Beck*-Niagara Generation Station No. 1 and No. 2. (Sir Adam was the first Chairman of Ontario Hydro, serving from 1906 to 1925).

*Detweiler* Transformer Station, near Kitchener. (Daniel N. Detweiler was the "Committee of One" who did much to sponsor the Hydro movement."

*Richard L. Hearn* Generating Station, Toronto (Canada's largest steam generating station—named in honour of the Commission's General Manager and Chief Engineer).

*Otto Holden* Generating Station, Ottawa River (named in honour of Hydro's Assistant General Manager-Engineering).

*A. W. Manby* Transformer Station and Service Centre, at Islington (named in honour of Hydro's Assistant General Manager-Administration).

*E. V. Buchanan* Transformer Station, near London (named as a tribute to the former General Manager of the London Public Utilities Commission).

*J. Clark Keith* Generating Station, Windsor (Canada's second largest steam plant—named in honour of Mr. Keith who has served for many years as General Manager of the Windsor Utilities Commission).

*R. H. Martindale* Transformer Station, Sudbury (named in tribute to the former Manager and Secretary of the Sudbury Hydro-Electric Commission).

*Ross L. Dobbin* Transformer Station, Peterborough (named in tribute to the former General Manager of the Peterborough Public Utilities Commission).

*George W. Rayner* Generating Station, Mississagi River—named in honour of the President of Rayner Construction Limited).

Mr. Saunders emphasized that these are but a few of the names that should go down in Canadian history as an inspiration to future generations. "Their contribution to Canadian achievement and expansion will be more fully realized with the passing of time," he stated. "Knowing that we have at our service the finest minds in the engineering field, we may rest assured that no job will be beyond our reach if it will serve our people. We have full confidence in our ability to carry forward almost staggering programs of development, and that is why we are anxious to get ahead with the St. Lawrence project. I cannot express too often, and too strongly, my high personal esteem and admiration for Canadian engineers and, in particular, those on the staff of Ontario Hydro," he emphasized. "They represent still greater progress for our Province and our country."

# The ASME Boiler Code

### Interpretations

The Boiler Code Committee meets monthly to consider "Cases" where users have found difficulty in interpreting the Code. These pass through the following procedure (1) Inquiries are submitted by letter to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.; (2) Copies are distributed to Committee members for study; (3) At the next Committee meeting interpretations are formulated to be submitted to the ASME Board on Codes and Standards, authorized by the Council of the Society to pass upon them; (4) They are submitted to the Board for action; (5) Those which are approved are sent to the inquirers and are published in Mechanical Engineering.

The following Case Interpretations were formulated at the Committee meeting March 5, 1954.

**Case No. 1116-3**
(Reopened)
Special Ruling

The Boiler Code Committee is considering annulling Case No. 1116-3 (Reopened) (Special Ruling); and comments are welcome.

**Case No. 1181**
Interpretation of Par. P-112(c)

***Inquiry:*** Paragraph P-112(c) makes stress-relief of carbon and carbon-molybdenum steel mandatory in thicknesses appreciably less than those currently permitted under other sections of theCode. May these thicknesses be increased?

***Reply:*** It is the opinion of the Committee that under Par. P-112(c) the following need not be stress-relieved:

(1) Carbon steel in thicknesses less than ¾ in.

(2) Carbon-molybdenum steel with carbon not exceeding 0.20% in thicknesses less than ½ in.

**Case No. 1183**
Special Ruling

***Inquiry:*** When copper, copper silicon alloy, 90-10 copper nickel alloy and 70-30 copper nickel alloy plates, sheets, pipes, tubes and shapes conforming to an approved specification are used for the construction of vessels to be used for external pressure, under what rules shall they be designed and fabricated?

***Reply:*** It is the opinion of the Committee that copper, copper silicon alloy, 90-10 cupro nickel and 70-30 cupro nickel plates sheets, pipes, tubes and shapes that conform to an approved specification may be used for the construction of external pressure vessels and the vessels may be stamped with the Code symbol providing the following requirements are complied with:

(1) The applicable rules in the 1952 edition of Section VIII of the Code covering vessels under external pressure when constructed of nonferrous materials shall be adhered to.

(2) The thickness of shells and heads and the required moment of inertia for stiffening rings shall be determined from the charts in Fig. UNF-28.9 for Annealed Copper Type DHP; Fig. UNF-28.10 for Annealed Copper Silicon Alloys Type A and C: Fig. UNF-28.11 for Annealed 90-10 Copper Nickel Alloy; and Fig. UNF-28.12 for Annealed 70-30 Copper Nickel Alloy and Par. UNF-30. The above mentioned figures are available from the Committee.

**Case No. 1184**
Special Ruling

***Inquiry:*** May annealed aluminum bronze Alloy D seamless condenser tubing with chemical analysis and mechanical properties in accordance with SB-169-52 (plate material) and otherwise conforming to requirements for condenser tubing as given in SB-111-52 be used in the construction of unfired pressure vessels to Section VIII of the 1952 ASME Code?

***Reply:*** It is the opinion of the Committee that annealed aluminum bronze Alloy D, seamless condenser tubing conforming to chemical analysis and mechanical properties of SB-169-52 and otherwise conforming to requirements for condenser tubing as given in SB-111-52 may be used in the construction of unfired pressure vessels to the 1952 Section VIII.

The design stresses for aluminum bronze SB-169, Alloy D plate as shown in Table UNF-23 may be used for aluminum bronze Alloy D condenser tubing.

### Proposed Revisions and Addenda to Boiler and Pressure Vessel Code

As need arises, the Boiler Code Committee entertains suggestions for revising its Codes. Revisions approved by the Committee are published here as proposed addenda to the Code to invite criticism.

In the following the paragraph numbers indicate where the proposed revisions would apply in the various sections of the Code.

Comments should be addressed to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.

**Unfired Pressure Vessels, 1952**

***Par. UG-80.*** Revise to read:

UG-80 Permissible Out-of-Roundness of Cylindrical Shells.

(a) Internal Pressure. The shell of a completed vessel shall be substantially round. The difference between the maximum and minimum inside diameters at any cross section shall not exceed one per cent of the nominal diameter at the cross-section under consideration. The diameters may be measured on the inside or outside of the vessel. If measured on the outside the diameters shall be corrected for the plate thickness at the cross-section under consideration (see Fig. UG-80.2).

When the cross-section passes through an opening the permissible difference in inside diameters given above may be increased by two per cent of the inside diameter of the opening.

For vessels with longitudinal lap joints the permissible difference in inside diameters may be increased by the nominal plate thickness.

(b) External Pressure. The shell of a complete vessel to operate under external pressure shall meet the following requirements at any cross section:

(1) The out-of-roundness limitations prescribed in (a).

(2) The maximum plus-or-minus deviation from the true circular form, measured radially on the outside or inside of the vessel, shall not exceed the maximum permissible deviation "$e$" obtained from Fig. UG-80.1. Measurements shall be made from a segmental circular template having the design inside or outside radius (depending upon where the measurements are taken) and a chord length equal to twice the arc length obtained from Fig. UG-29.2. The value of $t$ shall be determined as follows:

(a) For vessels with butt joints, $t$ is the nominal plate thickness, less corrosion allowance;

(b) For vessels with longitudinal lap joints the permissible deviation $e$ may be increased by the nominal plate thickness.

(e) Where the shell at any cross-section is made of plates having different thicknesses, $t$ is the nominal thickness of the thinnest plate, less corrosion allowance.

(c) Delete (c) as these rules now apply to completed vessels.

(d) New (c). No change.

(e) New (d). The dimensions of a completed vessel may be brought within the requirements of this paragraph by any process that will not impair the strength of the material.

(f) New (e). No change.

(g) New (f). No change.

(h) New (g). An example illustrating the application of these rules for a vessel under external pressure is given in Appendix L (Par. UA-271).

***Fig. UG-80.1.*** Revise the title to read: Maximum Permissible Deviation from a Circular Form "$e$", for Vessels under External Pressure.

***Figs. UG-29.2 and UG-80.1.*** Revise figures to show ordinate values of $D_o/t$ instead of $t/D_o$.

***Fig. UG-80.2.*** Revise the title to read: Examples of Differences between Maximum and Minimum Diameters in Cylindrical Shells.

***Par. UA-6(b)(2).*** Revise the introductory phrase to read:

(2) Heads of the type shown in Fig. UA-6(b), (No joint efficiency factor is required).

Delete $E$ in formula (a) making it read:

(a) Head thickness, $t = \frac{5PL}{6S}$

***Par. UA-6(b)(3).*** Revise the introductory phrase to read:

(3) Heads of the type shown in Fig. UA-6(c), (No joint efficiency factor is required).

Delete $E$ in formula (a), making it read:

(a) Head thickness, $t = \frac{5PL}{6S}$

***Par. UA-6(b)(4).*** Revise the introductory phrase to:

(4) Heads of the type shown in Fig. UA-6-(d), (No joint efficiency factor is required).

Delete $E$ in formula (a) making it read:

(a) Head thickness, $t = \frac{5PL}{6S}$

# 1953 E.I.C. Membership Directory

## Errata

*(Continued from May issue)*

With the completion and distribution of our 1953 Membership Directory, a small number of errors have come to light. Naturally, these are very much regretted, but since the work had to be done under pressure against time, a certain number of mistakes were almost inevitable.

For the convenience of all members we are printing below a further list of names as they should have appeared in the Alphabetical Section. For errors in the Geographical Section the necessary correction is simply noted. — EDITOR.

### Honorary Members—Page IX:

**ALLAN, J. A.**, M. 1941, Hon. M. 1952.

**DOANE, F. W. W.**, S. 1887, A.M. 1889, M. 1892, Hon. M. 1952.

**KERRY, J. G. G.**, S. 1888, A.M. 1894, M. 1904, Hon. M. 1952.

### Alphabetical List:

**BARBOUR, Ronald G.**, N.B. '24 and '27. Gen. Mgr., T. Pringle & Son Ltd., 485 McGill St., Montreal. M.'51.

**CAMPBELL, J. A.**, Tor. '35. Distbn. Engrg. Supt., Northern Electric Co. Ltd., 759 Victoria Sq. (Rm. 40), Montreal. M.'52.

**CLARKE, R. E.**, Queen's '35. Div. Engr., Dept. of Hwys., North Bay, Ont. Mail: 847 Main St. W. M'45.

**COOPER, J. S.**, Tor. '34. Asst. Chf. Engr., Ont. Northland Rly., North Bay, Ont. Mail: 777 Browning St. J'36. AM'40. M'40.

**DEMARQUE, G. M.**, Ecole Nat. des Ponts et Chaussées '29. Chf. Engr., T. O. Lazarides, Lount & Partners, 2005 McGill College Ave., Montreal. Mail: 190 Blvd. Edouard Laurin, Ville St. Laurent, Que. M'47.

**DIBBLEE, John**, Tor. '15. Mgr. of Personnel, H.E.P.C. of Ont., 620 University Ave., Toronto. M'39.

**HAMMOND, E. R.**, Man. '34. R.M.C. '38. M.I.T. '39. Sr. Engr., C. D. Howe Co. Ltd., 1421 Atwater Ave., Montreal. Mail: 598 Curzon Ave., St. Lambert, Que. S '36. J'40. M'46.

**KENNEY, S. W.**, Vice-Pres., Kenney Constrn. Co. Ltd., P.O. Box 380, Yarmouth, N.S. M'48.

**KLIMOVICH, John**, B.C.'50. Proj. Engr., Sandwell & Co., 1500 W. Georgia St., Vancouver. Mail: 1476 Gravely St. S'48, J'52.

**MORSSEN, C. M.**, Ecole Nat. des Ponts et Chaussées '97. Consltg. Engr., Rm. 70, 417 St. Peter St., Montreal. AM'09. M'14.

**NEUFELD, Cornelius**, Sask. '35 and '37. Asst. Engr. of Bridges, C.P.R., Rm. 401, Windsor Stn., Montreal. S'36. M'40.

**ROBERTON, J. J. P.**, McGill '51. Asst. to Factory Mgr., Cdn. Pratt & Whitney Aircraft Co., P.O. Box 39, Longueuil, Que. S'48. J'53.

**TEMPLEMAN, G. E.**, Commissioner, Elec. Commn., City of Mtl., Rm. 717, 159 Craig St. W., Montreal. Mail: 147 Strathearn Ave., Montreal West. AM'19. M'27.

### Geographical List:

Correct under **Winnipeg Branch.** Page 179: Norwood, MEMBER, H. S. Beetham.

Add under **England,** page 195: Heaton, JUNIOR, J. K. Belyea.

Delete above name under **Amherst Branch,** page 193 from Sackville, N.B.

# News of Other Societies

The third convention of UPADI, **The Panamerican Federation of Engineering Associations,** will take place in Sao Paulo, Brazil, August 2 to 6, 1954.

The program will allow discussion of the administration of the Federation, as well as sessions on legislation, relationships, and technical matters coming under the attention of UPADI. Some of the questions to be reported upon are: highlights on professional ethics; trends regarding a World Engineering Council; interchange of teachers; co-ordination of technical congresses; interchange of technical information on engineering education.

The Institute, as a member of UPADI will be represented, and the Journal will carry a report of this important international meeting.

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A three-day semi-annual meeting of the **American Society of Heating and Ventilating Engineers** (62 Worth Street, New York 13) will start on June 28, 1954. Headquarters will be the New Ocean House, Swampscott, Mass.

The second western regional conference of the **Chemical Institute of Canada** (18 Rideau Street, Ottawa 2), will be held in Vancouver, B.C., September 10-11, 1954.

There will be a Summer Institute on Nuclear Physics in Engineering Education at the Northwestern University, September 7-11, 1954. Open to physics and engineering educators, and with attendance limited to 150 persons, the conference is sponsored by the American Society for Engineering Education, the American Institute of Physics, the National Science Foundation, and Columbia and Northwestern Universities. For information write to Professor Robert L. Young, Technological Institute, Northwestern University, Evanston, Illinois.

The **Institute of the Aeronautical Sciences** (2 East 64th Street, New York 21) will sponsor a meeting in Seattle, Washington, August 9-11, 1954, on the subject of turbine-powered air transportation.

The **Town Planning Institute of Canada**, at the annual meeting on May 7, 1954, elected the following officers: president, Dr. E. G. Faludi, M.E.I.C., vice-presidents, P. Alan Deacon; and T. D. LeMay; secretary-treasurer, R. Norman Dryden.

C. A. Wright, of the Canadian General Electric Company was elected chairman of the Montreal Branch of **The American Institute of Electrical Engineers**, in June, at the annual meeting of the group.

**The American Society of Refrigerating Engineers** will hold a semi-annual meeting at Seattle, Washington, July 11-14, 1954.

The fall meeting of the **American Society of Mechanical Engineers** (29 West 39th St., New York 18) is scheduled for September 8-10, at the Hotel Schroeder, Milwaukee, Wis.

The next congress of the **International Federation for Housing and Town Planning** will take place in Edinburgh, Scotland, September 20-26, 1954. Information can be obtained from the secretary-general of the Federation, Paleisstraat, The Hague, Holland.

*The Pines, Digby, N.S.*

# *Maritime Professional Meeting*

*of*

The Engineering Institute of Canada

*and*

The Associations of Professional Engineers

*of*

Newfoundland, New Brunswick and Nova Scotia

The professional engineers of the Maritimes will meet together again this year at Digby, N.S. The committee extends an invitation to all engineers and their wives to attend this popular meeting.

On Thursday and Friday morning, September 9 and 10, professional sessions will be held, with papers being presented on subjects of interest to Canadian engineers.

The remainder of the time will be spent in sports, recreation, entertainment and any other holiday fare that suits the individual taste.

Guest luncheon and dinner speakers will include Premier Smallwood of Newfoundland; D. M. Stephens, president, E.I.C., Prof. W. L. Sagar, president of Dominion Council of Professional Engineers.

Watch for complete program and details of registration and reservation in the July issue of the *Journal* but plan now to attend the Maritime Professional Meeting.

## *The Pines, Digby, N.S.*

## *September 8-11, 1954*

# NEWS OF THE ASSOCIATIONS & CORPORATION

**Information received through co-operation with the provincial organizations**

## Quebec

### 1953 Salary Survey

The Corporation conducts an annual survey of salaries among its members primarily to obtain an indication of the general trend of engineers' salaries from year to year and to gather valuable information which may help us in rendering assistance to engineers and employers in the determination of fair remuneration.

We reproduce herewith a chart prepared by Dr. Huet Massue from the analysis of returns to our questionnaire.

The large number of returns (50 per cent of members residing in Quebec) and other observations indicate without doubt that the figures obtained are truly representative of the remuneration of professional engineers of Quebec.

According to the 2,250 answers to the salary survey questionnaire sent to the 5.000 members of the Corporation in 1953, the remuneration of Quebec engineers fluctuate within wide limits. Not only do salaries fluctuate according to years of experience, but they also vary considerably among engineers with comparable years of practice.

The accompanying chart shows, for example, that the median salary of Quebec engineers starts at $3,730 after one year of practice and reaches about $9,000 after 30 years and more. As years of experience increase, the spread between the lower and upper 10 per cent range of salaries increases from about $1,200 after one year of experience to about $10.000 after 20 years. After 20 years of experience, there are still 10 per cent of the engineers earning less than $5,200, the middle 50 per cent earning between $6,200 and $11,500, and the upper 10 per cent more than $15.000.

### Corporation's Annual Meeting

The Corporation held its annual meeting in Montreal on April 24th. The highlight of this year's meeting was the inauguration of an art exhibit consisting exclusively of paintings by professional engineers of Quebec; among the 90 paintings assembled for this show were portraits, landscapes, seascapes and others and the general quality of the work astonished all those who viewed the exhibit. The Montreal Star commented that "Not only is the Corporation of Professional Engineers of Quebec serving the nation through its engineer members, the theme of its annual meeting, but it is contributing to the nation culturally".

### Georges Demers Elected President

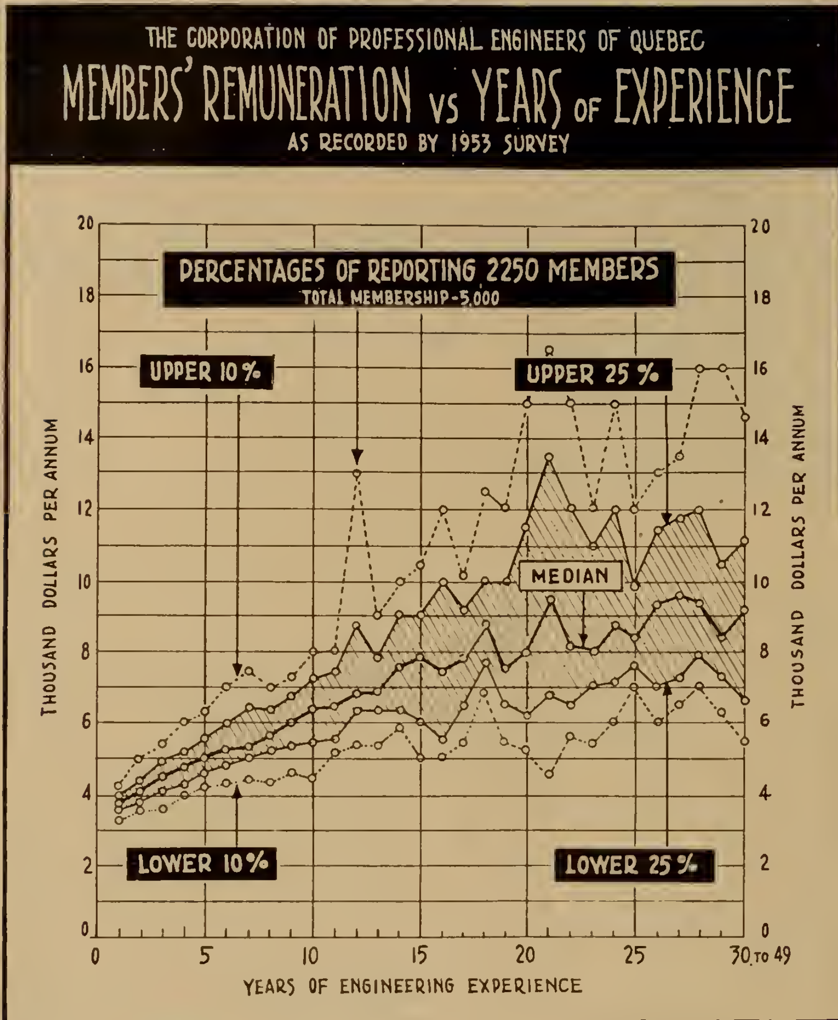
During the business meeting Mr. Georges Demers was elected President for the year 1954-55. Born in Montreal in 1912, Mr. Demers graduated as Civil Engineer from the Ecole Polytechnique of Montreal in 1935 and followed postgraduate courses at l'Ecole des Ponts et Chaussées in Paris in 1937.

After a few years with the Roads Department of the Province of Quebec as resident engineer and district engineer, he joined the office of Zachée Langlais, Consulting Engineer in 1939 and finally set up his own consulting practice in Quebec City in 1942, specializing in municipal and other civil engineering works of all types.

In addition to a very successful practice, Mr. Demers has managed to be active in many engineering and other groups and has served his profession well through his numerous activities. He is a member of Council of the Engineering Institute of Canada and of the Society of Industrial and Cost Accountants of Quebec, and a member of the Board of Trade, the Association of Civil Engineers of France, the American Water Works Association and many others. He is married and has six children.

Other officers elected are G. Lorne Wiggs, vice-president; T. A. Monti, honorary secretary-treasurer; D. C. MacCallum, R. A. Phillips, R. F. Shaw, D. Wermenlinger and R. Painchaud, councillors.

**Georges Demers (left), of Quebec City, is greeted as new president of the Corporation of Professional Engineers of Quebec by retiring president R. F. Shaw of Montreal. Seated, left to right: Mrs. Shaw, J. D. Coleman, past president of the National Society of Professional Engineers and guest speaker, Mrs. Demers.**




# Ontario

## Salary Survey

A sub-committee of the Professional Status Committee was appointed in January 1953 to investigate and report on matters affecting the remuneration of salaried engineers. Included within the scope of the sub-committee's activities are surveys of members' salaries, along the lines of those which have been conducted annually by the Association since 1945. The results of the December 1953 survey, reflect the guidance during its first year in operation of the Sub-Committee on Remuneration of Salaried Engineers.

Six meetings of the Sub-Committee were held between its inception and the time questionnaire forms were sent out last November.

Believing that the Association can perform a major service to engineers and their employers by providing accurate and up-to-date statistical information, concerning the current market for engineering services, the Sub-Committee concluded that the most practical and useful form in which such information can be supplied, initially, is a series of curves relating the salaries of professional engineers to years of experience.

The Sub-Committee then gave consideration to the sort of information that should be collected in the surveys. Noting certain factors having a bearing on remuneration to be of much greater significance than others, it designed a questionnaire form which sought to obtain information pertaining to:

(a) Field of employment—

(1) Industrial — including mining, consulting, crown companies.

(2) Utility — privately and publicly owned.

(3) Civil Service, Municipal, and Educational.

(b) Type of Work—

(1) Executive — administrative.

(2) Supervisory.

(3) Non-supervisory.

(4) Non-supervisory — Sales.

A final count reveals that 6,641 replies were received to questionnaires mailed in November. This represents a return from 70.8 per cent of the Association's membership resident in Ontario at the beginning of the year.

Chart I is a graphical presentation of the annual earnings of Association members at the time the survey was taken, in December 1953.

Certain trends are also discernible from the chart. The slope of the median line during the first 7 years after graduation shows a steeper rise than during any similar succession of ensuing years. This may be indicative of a general improvement with regard to engineering salaries during the post-war years. Note the "flat" between classes with 7, 8, and 9 years of experience, indicating the situation that existed between 1944 and 1946 when salaries were "pegged". Note also the "hollow", reflected at all levels, indicating the situation with respect to the classes that graduated into the Depression of 1929. Now, after the passage of a quarter of a century, the earnings of those men still reflect the economic chaos of the time.

### Serving Canada

Accompanying the April issue of "The Professional Engineer" all members received a copy of a booklet entitled "Serving Canada".

Conceived and produced by the Association's Public Relations Committee late in 1953, the purpose of the booklet is to provide vocational guidance counsellors and interested secondary school students with a brief and attractive story of the professional engineer. It refers to the early days of the profession, the present-day needs and the challenge of the future. It also tells of the education that is required to become an engineer and why, as a profession, engineering provides both a challenge and an opportunity of "Serving Canada".

The booklet has been submitted to the Minister and officials of Ontario's Department of Education, who signified their approval of its contents and purpose by arranging for its distribution among the Principals and Guidance Officers in all secondary schools in the province. Since that distribution was made the Association has received numerous requests from schools and individuals for extra copies. We feel that its purpose is being achieved to a highly satisfactory degree.

### New Regulations

It sometimes takes several years to accomplish changes in government regulations. For at least four years regulations made under The Theatres Act, have been under fire because the manner in which the regulations were worded made it impossible for professional engineers to design theatres.

The new regulations state:-

"Subject to subregulation 4, the plans shall be prepared and certified by a registered member of—

(a) the Ontario Association of Architects,

or

(b) the Association of Professional Engineers of the Province of Ontario".

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# British Columbia

## Public Relations

Announcement is expected to be made soon of the appointment of a new public relations consultant to succeed Margaret Ecker Francis who was public relations consultant for the Society until April 30 of this year.

The Public Relations Committee has recently interviewed a number of prospects and hopes that the new consultant will be closer to a full time employee of the Society. It is intended to place more emphasis on the program of personal approach to members and to those employing professional engineers. It is also hoped that the new consultant will be able to keep up the excellent job which Mrs. Francis did in obtaining favourable newspaper releases.

As soon as the new consultant is appointed arrangements will be made for him to visit various parts of the province and meet as many members as possible.

### New Assistant Registrar Appointed

Douglas W. Russell, has been appointed assistant registrar of the Association to succeed Hugh M. McManus. He is 29 years of age and is married. He was born in Russell, Manitoba where he received his high school education. During the last war he served in the R.C.A.F. and entered the Faculty of Applied Science at the University of B.C. in 1946 graduating in 1950.

From 1950 until 1952 Mr. Russell was employed by Swan, Rhodes and Wooster, consulting engineers of Vancouver. Since June of 1952 he has been with the B.C. International Engineering Company Limited in Vancouver engaged in hydro-electric design work.

Mr. Russell will assume his new duties on June 1 and it is hoped that he will soon have an opportunity to meet many of the members of the Association.

### Employment of Foreign Engineers

Council recently instructed the registrar to write to the premier of the province of British Columbia asking that consideration be given in the future to natural resources of the province being exploited by firms from outside the province and that local professional engineers be employed on the projects. The following letter was sent to the premier:-

"Dear Sir:

For some time this Association has been concerned regarding the number of engineers from outside the province and outside Canada who have been coming into the province to supervise the development of our natural resources. This situation is not as serious now as it was two or three years ago, when there were several large projects under way, all under the direction of American engineers, but it is a problem which may come up again in the future. This letter is intended to bring the matter to your mind in the event that further developments are being considered.

Many of the members of the Association felt in the past that our own engineers, who did so much work in earlier years to make some of these recent large scale developments possible, were being overlooked. It was felt that many of them are as well, or better, qualified to participate in this development work as those who are imported from outside Canada.

Further, past experience has proved that when the design of these projects is carried out by outside engineers, who are not familiar with our provincial or Canadian manufacturing and supply facilities, there is a natural tendency for them to specify equipment and products from their own country, the equivalent of which is often available locally, but is unknown to the designer.

Thus not only do our local engineers not participate to the extent desired, but many business firms and individuals are overlooked which might otherwise successfully contribute to the development of these projects.

For this reason, we wish to request that in the future, when the Government enters into agreements with companies which will be developing the natural resources of the province, provision should be made that these companies give first preference to the use of local professional engineers."

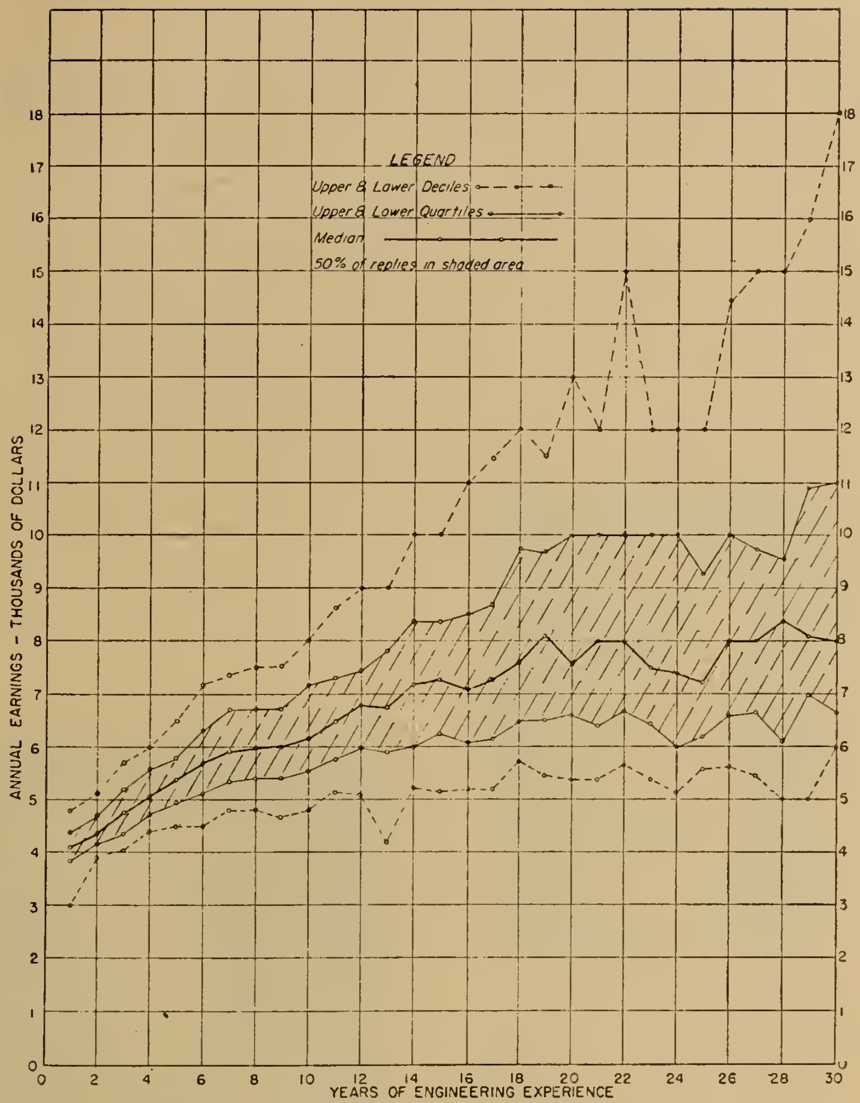


**Chart 1. The Association of Professional Engineers of the Province of Ontario. Remuneration vs. years of experience.**

### New Members

The following have recently complied with all requirements for registration as professional engineers in British Columbia, and are duly registered as members of the Association of Professional Engineers of B.C.

**Baker, George J. W.,** civil, chief engineer, overseas department, John Laing & Son Limited, Vancouver, B.C.

**Christoffersen, Per T.,** civil, design engineer, J. H. Read & Associates, Consulting Engineers, Vancouver, B.C.

**Forrester, Andrew G.,** forest, resident engineer, B.C. Forest Products, Shawnigan Lake, B.C.

**Goff, Harford S. H.,** electrical, B.C. Electric Co. Limited, Vancouver, B.C.

**Hamersley, Hugh L. S.,** civil, assistant hydraulic engineer, Water Rights Branch, Victoria, B.C.

**Hunt, Hugh M.,** civil, designer, Phillips, Barratt & Partners, Consulting Engineers, Vancouver, B.C.

**Jack, Peter S.,** mining, research metallurgist, Britannia Mining & Smelting Co., Britannia Beach, B.C.

**Menzies, Morris M.,** geological, field geologist, Noranda Exploration, Limited, Vancouver, B.C.

**Newbury, Edward Wm.,** electrical, field electrical engineer, B.C. Power Commission, Nanaimo, B.C.

**Patterson, John Wm.,** mining, inspector of mines and resident engineer, Prince Rupert, B.C.

**Rolston, William H.,** civil, manager, Vancouver branch, Associated Engineering Services Limited, Vancouver, B.C.

**Spence, Robert A.,** civil, assistant professor in civil engineering, University of B.C., Vancouver, B.C.

**Tupper, Victor M.,** mechanical, liaison engineer, Galbraith & Sulley, Vancouver, B.C.

**Webber, Eugene D.,** civil, assistant municipal engineer, District of North Vancouver, B.C.

### New Temporary Licences

The following were recently granted Temporary Licences to the dates indicated:-

**Blair, S. M.,** mechanical, president, Canadian Bechtel Limited, Toronto, Ontario. Expires: Mach 3, 1955.

**Hunt, Albin D.,** geological, geologist, Canada Southern Oils Limited, Calgary, Alberta. Expires: May 4, 1955.

**Park, John D., Jr.,** mechanical, construction engineer, Standard Oil Company of British Columbia Limited. Expires: September 3, 1954.

### Temporary Licence Renewals

The following were recently granted renewals of their Temporary Licences to the dates indicated:-

**Alliger, Jerald,** geological (Petroleum), manager, Geophoto Services Limited, Calgary, Alberta. Expires: May 4, 1955.

**Beach, Hugh H.,** geological, chief geologist, Texaco Exploration Co., Calgary, Alberta. Expires: April 26, 1955.

**Charles, William W., Jr.,** geological (petroleum), chief geologist, Central Leduc Oils Limited, Calgary, Alberta. Expires: April 22, 1955.

**McLaren, George R.,** mining, consulting engineer, Toronto. Expires: April 12, 1955.

**Nauss, Arthur Wm.,** geologist (petroleum), partner, Link and Nauss Limited, Calgary, Alberta. Expires: October 16, 1954.

### Engineers In The News

**J. H. Toms** has been transferred by Stone & Webster Canada Limited to Toronto where the firm is supervising construction of a new brewery for Molson's Brewery (Ontario) Limited. He was formerly located at Waneta where this firm was constructing the Waneta Power Plant for the Consolidated Mining & Smelting Co. of Canada Limited.

**R. F. Pearce** is now with Sherritt Gordon Mines Limited at Fort Saskatchewan, Alberta. He was formerly with the South African Cyanamid (Pty.) Limited at Johannesburg, South Africa.

**R. W. Robertson** is now with Smith Bros. and Wilson of Vancouver. He was formerly with Silver Standard Mines.

**B. D. Bohna** is at present in Cairo attending the bid evaluation of a proposed crude oil pipeline to be built from the Suez to Cairo to supply fuel for the Egyptian railways. Mr. Bohna is a partner of the firm B. D. Bohna, J. L. Miller, and Company.

**A. G. Westaway** has been promoted to the position of plant engineer with the Clayburn Company Limited at Abbotsford, B.C.

**W. R. Smith** is now with the Radar Pneumatics and Engineering Co. Limited in Vancouver. He was formerly with Conveyair Company Limited of North Vancouver.

**A. H. Whistler** is now on the engineering staff of the Shell Oil Company at the refinery in Vancouver. He was formerly with Heat and Power Engineering Services Limited of Vancouver.

**A. Walisser** is now working with the Provincial Department of Public Works on the Pattullo bridge approach in New Westminster. He was formerly with Phillips, Barrat and Partners, Consulting Engineers of Vancouver.

**S. J. Hunter** has joined the staff of Geco Mines Limited in Ontario. He was formerly with Reeves MacDonald Mines Limited, at Remac, B.C.

**E. Muna** has accepted a position with the B.C. Power Commission as assistant civil engineer. He was formerly with the B.C. International Engineering Co. at Kemano, B.C.

**F. J. Bennett** has recently accepted a position with the B.C. Power Commission in their transmission and distribution section. He was formerly with the Powell River Comapny at Powell River, B.C.

**A. G. Nicholls** is now with the Bramwell Construction Company. He was formerly with H. A. Simons Limited, consulting engineers in Vancouver.

**H. P. Pfeifer** is now with Gibbs and Hill, at Bogota, Columbia where he is working on a team of experts evaluating the utility systems in that country. He was formerly with B.C. International Engineering Co. at Kemano.

**S. C. Maplethorp** is now with the Canadian Pacific Railway Co. at Nanaimo. He was formerly with the planning department of the City of Vancouver.

**W. Parkinson** is now resident engineer with the Water Resources Division of the Department of Northern Affairs and Natural Resources at Nelson, B.C.

**H. M. Anderson** is now with the B.C. Forest Service at Horseshoe Bay where he is assistant engineer on the right of way clearing of the P.G.E. Railway between Horseshoe Bay and Squamish. He was formerly with the B.C. Forest Products at Port Renfrew, B.C.

**S. Hogg,** president of Western Bridge and Steel Fabricators Limited, Vancouver, has been appointed director White Pass and Yukon Corporation.

**A. H. W. Busby** has accepted a position with the Anglo-American Corporation of South Africa as assistant consulting mechanical and electrical engineer. He was formerly superintendent of engineering and research development of the Consolidated Mining and Smelting Co. of Canada Ltd. at Trail. Before his departure from Trail, Mr. Busby was commended by the City Council for the time and energy he devoted to community service during his stay in that city. He recently resigned as president of the Trail and Rossland District Boy Scout's Association. He was a member of the Chamber of Commerce Council, Rotary Club, the Canadian Legion and Vice-President of the Trail Arts and Crafts Society.

**J. A. Walker** has been appointed British Columbia representative on the Federal District Commission responsible for carrying out the development of Ottawa as the national capital.

**T. A. G. Beeching** has accepted a position with B. C. International Engineering Company at Kemano. He was formerly with A. E. Simpson, consulting engineer, Vancouver.

**D. S. Rae** has accepted a position with the Howe Sound Pulp Company at Port Mellon, B.C.

**Dr. Joseph Burr Tyrrell, 95 (right), is awarded the Engineer's Medal by Prof. G. B. Langford of the University of Toronto, on behalf of the Association of Professional Engineers of Ontario at its Annual Meeting in Toronto. One of the country's eminent geologists, Dr. Tyrrell's explorations of the west before the turn of the century led to the discovery of the vast coal and oil resources of that area. He is the fourth man to receive the medal since it was struck in 1945.**

# Institute Awards

At the banquet which concluded the sixty-eighth annual general and professional meeting of the Institute, the award of honorary memberships and of prizes and awards of the Institute was announced. Presentations were made to those honorary members and award winners who were present on this occasion, and remaining presentations will be made on other appropriate occasions.

## Honorary Members

The Institute has awarded honorary memberships this year to three distinguished engineers. They are, **LeRoy Fraser Grant,** formerly associate professor of engineering, Queen's University, Kingston; and field secretary of the Engineering Institute of Canada; **Lewis Ketcham Sillcox,** vice-chairman of the board of directors, New York Air Brake Company, and president of the American Society of Mechanical Engineers; and **Omond McKillop Solandt,** chairman of the Defence Research Board, Ottawa, Ontario. The citations which accompany the awards are as follows:

### *LeRoy Fraser Grant, Hon, M.E.I.C.*

The young engineers of Canada have good reason to know the name of LeRoy Fraser Grant. His consistent dedication to

Lt.-Col. L. F. Grant, Hon.M.E.I.C.

their welfare is well known to those who in recent years enthusiastically followed the professional development courses which he introduced in Canada. Originating, of course, in his association with students at Royal Military College and Queen's University as a professor, his interest became a most profitable service to the Institute when he assumed the duty of chairman of the Committee on the Training and Welfare of the Young Engineer. He was long one of the Institute's representatives on the Engineers' Council for Professional Development, and as the present chairman of this international body, he brings a still wider vision to his work for young people.

Colonel Grant—widely and affectionately known as Leary—was born in Toronto. He was educated at St. Alban's School and Royal Military College from which he graduated with honours in 1905. In 1926 while teaching at R.M.C. he received the degree of B.Sc. with honours from Queen's University. The honorary degree of D. és Sc. was conferred on him at Quebec by Laval University.

The first of many military posts which he filled with distinction was an appointment with the Royal Canadian Artillery in Halifax in 1905. Here he was one of two officers to take over the defences of Halifax from the Imperial forces. Resigning from the Army in 1907 he worked in British Columbia for seven years, first with the Grand Trunk Pacific Railway at Prince Rupert, and later with the consulting firm, Ducane, Dutcher and Company in Vancouver. At the outbreak of war in 1914 he was granted a commission as captain and adjutant in the Canadian Overseas Railway Construction Corps. Two years later he transferred to the 5th Battalion Canadian Railway Troops as second in command with the rank of major. He was three times mentioned in despatches.

After the war, Major Grant returned to British Columbia and worked until 1921 for the provincial Department of Lands and Surveys on the Southern Okanagan Irrigation Project. Then he returned to Royal Military College as an instructor in engineering. Two years later he became associate professor, an appointment he retained until 1940 when he re-entered the Canadian Army. While at R.M.C. he commanded the 32nd Field Battery, and later the 9th Brigade, Canadian Field Artillery. He was promoted to lieutenant-colonel in 1937. In 1940 he was appointed general staff officer, first grade, for Military District No. 3, Kingston, remaining in that post until retired in 1944. He then went to Queen's University as a special lecturer and was appointed associate professor engineering in 1946.

Colonel Grant became the field secretary of the Engineering Institute on retiring from Queen's in 1949. He has since crossed Canada several times, renewing acquaintances, making friends for the Institute and helping in the organization of new branches and sections.

A special feature of his work has been meeting with engineers in locations where there is no branch. These he calls his "orphans".

Colonel Grant was chairman of the Kingston Branch in 1925, and its secretary-treasurer from 1928 to 1937. He was a councillor in 1938, 1939 and 1940, and one of Ontario's vice-presidents in 1943 and 1944. His term as president in 1947 was one of the most constructive in the Institute's history.

Colonel Grant is one of our "senior engineers" who has made an enviable name for himself in many fields—as an engineer, a teacher, an administrator, a yachtsman, a military officer and perhaps greatest of all as a gentleman. The Institute has had few members as lovable and loyal as he.

### *Lewis Ketcham Sillcox, Hon.M.E.I.C.*

Lewis Ketcham Sillcox of Watertown, N.Y. is the president of the American Society of Mechanical Engineers—an American engineer of distinction who retains an interest in Canada, aroused years ago when he was associated for a time with our railway industry. He has been for thirty years a summer resident of Canada at his home in the Georgian Bay area. And he has been a member of the Institute almost thirty years.

Dr. Sillcox, honorary vice-chairman of the board of the New York Air Brake Company, has spent his entire career in the railroad industry. He has been one of the active but unassumingly influential engineers who have contributed immensely to the development of improved methods of railway-power application, and the

Dr. L. K. Sillcox, Hon.M.E.I.C.

control of railway trains. During the past twenty-five years Dr. Sillcox has been responsible for developing the brake-cylinder release valve which eliminates hand bleeding of retained air in standing frieght cars; improved sanding methods for rail conditioning; the brake-pipe flowmeter which registers brake-pipe pressure in freight and passenger trains irrespective of main supply head pressure; and basic brake types. He also sponsored the designing of several types of aircraft hydraulic pumps now found on practically all current military aircraft and the latest commercial aircraft.

Dr. Sillcox was born in Germantown, Pa. He graduated from Trinity School in New York, attended L'Ecole Polytechnique in Brussels for a year, and started as an apprentice in the shops of the New York Central Railroad. Two years later he came to Canada. Here he was a shop engineer for Canadian Car and Foundry Company in Montreal, and a mechanical engineer for Canadian Northern Railway in Toronto.

Returning to the United States in 1916, he was a mechanical engineer with the Illinois Central Railroad, and in 1918 became general superintendent of motive power with the Chicago, Milwaukee and St. Paul Railway. Since 1927 he has been first vice-president of the New York Air Brake Company. In 1947 he was made a director of the Company, the following year was elected executive vice-president, and in 1953, honorary vice-chairman of the board. He also serves in the capacity of an executive officer of the board of several large companies.

Many American universities have called upon Dr. Sillcox to lecture on subjects relating to railway practice and applied mechanics. His teaching and his extensive writings have been of great value to the railroad-transportation field. He is honorary curator of transportation of the Baker Library of Harvard University, and a trustee of Clarkson College. He has received honorary degrees in science from Clarkson College, in engineering from Cumberland and Purdue Universities, and in laws from Syracuse University.

An honorary member of A.S.M.E., Dr. Sillcox holds various grades of membership in the leading professional and technical societies in the United States and abroad; he takes an active part on the advisory councils of numerous educational and cultural institutions, and honorary societies; and maintains memberships in many social clubs and fraternal associations.

The A.S.M.E., when awarding him the gold medal for distinguished service in engineering and science in 1943, justly described him as a "pre-eminent learned technologist—lover of wisdom—inspirer of men", and now it is the privilege of Canadian engineers to add their mark of recognition to the achievements of this great man.

### *Omond McKillop Solandt, Hon.M.E.I.C.*

Omond McKillop Solandt is a Canadian whose stature in the international scientific world is well known and well documented. Early in World War II, Canada was able to provide a young scientist whose abilities could direct themselves into the new fields of research made urgent by a serious situation we all remember vividly.

**Dr. O. M. Solandt, Hon.M.E.I.C.**

Dr. Solandt was born in Winnipeg. He obtained his B.A. degree in biological and medical sciences in 1931 from the University of Toronto. Then, after two years in post-graduate research under Dr. C. H. Best in the Department of Physiology, he received his M.A. degree. He took his doctorate from the faculty of medicine in 1936 "with honours not exceeded by any other student in the history of this school", according to Dr. Best.

Dr. Solandt went to England for a year to do research on experimental pathology at Cambridge. This was followed by a year of internship at the Toronto General Hospital, and post-graduate work at the London Hospital. The M.C.R.P. was conferred on him in London in 1939, and he took a position in the Department of Physiology at Cambridge as a member of the teaching staff, and was subsequently named a Fellow of Trinity Hall.

Remaining in England at the outbreak of World War II, Dr. Solandt directed the South-West London Blood Supply Depot until 1941. He founded the Medical Research Council's Physiological Laboratory at the Armoured Fighting Vehicle School at Bovington, and became actively engaged in research concerned with tank design and the physiological problems peculiar to tank personnel.

This work led to the investigation of important tank gunnery problems by Operational Research Group, established by Dr. Solandt in 1942. In May, 1944 he became superintendent of the Army Operational Research Group.

Dr. Solandt joined the Canadian Army in February, 1944 as a lieutenant-colonel and was appointed acting colonel in May, 1944. He continued as director of the Army Operational Research Group until 1945, when he was chosen to direct the Operational Research Division of the South East Asia Command. His appointment was that of scientific advisor to Admiral Lord Louis Mountbatten, then commander-in-chief, S.E.A.C. The cessation of hostilities made it unnecessary for him to assume this post, and Dr. Solandt returned to England. He was later sent to Japan by the War Office as a member of the Joint Military Mission evaluating the effects of the atomic bomb.

Returning in 1946 to the Department of National Defence in Ottawa, Dr. Solandt undertook the planning of a permanent defence research organization in Canada. The result was the formation of the Defence Research Board in 1947. He became the first chairman, and the scientific member of the Chiefs of Staff Committee and Defence Council. He accompanied Sir W. G. Penney, chief scientist in charge of the United Kingdom's first atomic explosion test, to Australia in the autumn of 1952, and participated in the trial at the Monte Bello Islands.

Dr. Solandt has received a number of honours for his outstanding service. Among them are the Order of the British Empire, the U.S. Medal of Freedom, with Bronze Palm, the honorary degree of D.Sc. from the University of British Columbia, Laval University, the University of Manitoba, McGill University, and the honorary degree of LL.D. from Dalhousie University. To these the Engineering Institute of Canada is pleased to add its highest honour.

## Julian C. Smith Medals

Established by a group of friends of Julian C. Smith, president of the Institute in 1928, to commemorate his memory within the Institute, it is awarded for achievement in the development of Canada, an objective always close to the heart of Mr. Smith.

This year two awards have been made—to **Richard Ellard Carden Chadwick,** M.E.I.C., chairman of board of the Foundation Company Limited, and president of the Foundation of Canada Engineering Corporation Limited; and to **Douglas Stewart Ellis,** M.E.I.C., dean of the faculty of applied science, and professor of civil engineering, Queen's University, Kingston. The citations which accompany these awards, as given by the general secretary, are as follows:

### *Richard Ellard Carden Chadwick, M.E.I.C.*

Richard Ellard Carden Chadwick is chairman of the board and director of the Foundation Company of Canada Limited, and president and director of Foundation

**R. E. Chadwick, M.E.I.C.**

of Canada Engineering Corporation Limited.

Mr. Chadwick was born in Toronto, and was educated at Upper Canada College and graduated from the School of Practical Science of the University of Toronto in 1906.

After teaching at the University for two years, he worked with the city engineer's department in Toronto until 1911. Speaking parenthetically I would like to confess that I was one of the students into whose thick heads he tried to drive some elementary knowledge of design and draughting. Shortly thereafter, when he was bridge engineer for the City of Toronto, I was his entire office and field staff, a second ordeal to which no man should have been subjected. Shortly thereafter he commenced his long and distinguished career with the Foundation Company.

He started in Montreal as superintendent and engineer. Subsequently he became superintendent of the Winnipeg District; eastern district manager, and manager and acting chief engineer in Montreal. He also served as chief engineer of the Foundation Company of New York. In 1924 he organized the Foundation Company of Canada Limited as a subsidiary of the United States company. He was its vice-president and general manager and later its president. In 1929 he obtained control of the company for Canadian interests and ever since, under his presidency, it has been a wholly Canadian-owned and operated company.

He retired in 1952 from the presidency but in 1953 became the first president of Foundation of Canada Engineering Corporation Limited.

In his forty-three years with the Foundation Company, and particularly in the twenty-five since he severed its connection with the American company, Mr. Chadwick has built an organization which has completed over $500,000,000 worth of construction contracts from St. John's to Victoria and from the American border to Resolute Bay. He has organized a group of subsidiaries all of which are leaders in their fields. They have offices in six Canadian cities, and it is worthy of special note that the Foundation Company is one of the few Canadian companies with an American subsidiary.

Mr. Chadwick joined the Institute as an Associate Member in 1913, transferring to Member in 1921. He was treasurer of the Institute in 1944 and 1945.

Surely here is a man worthy of recognition for his "achievement in the development of Canada."

D. S. Ellis, M.E.I.C.

***Douglas Stewart Ellis, M.E.I.C.***

The dean of the Faculty of Applied Science of Queen's University, Douglas Stewart Ellis, first became associated with Queen's in 1903 as a student. Now we have the opportunity to recognize, by the award of this medal, the contribution of a distinguished educator and engineer to Queen's, and to Canada.

"Doug" Ellis was born at Cobourg, Ontario, and moved to Kingston in 1893 when his father was appointed principal of the Kingston Collegiate Institute.

He won a B.A. degree in mathematics at Queen's in 1907, an M.A. degree in 1908, and a B.Sc. in civil engineering in 1910. He was one of the original members of the 5th Field Company established at Queen's in 1909 for undergraduates.

After graduation he worked for the International Waterways Commission, and during 1913-1914 was an engineer for the Commission of the St. Lawrence Ship Channel.

During the First World War he served with the 6th Field Company, Royal Canadian Engineers. In February 1917 he received his majority and was first in command of the company. He was mentioned in despatches and in 1918 was awarded the D.S.O. For a year after the war he remained in England as brigade major attached to headquarters units, and as chief instructor of the Canadian School of Military Engineering. During this time he was promoted to the rank of lieutenant-colonel.

Returning to Queen's in 1919, he applied for leave to attend Cornell University where he obtained the degree of M.C.E. Back again at Queen's University, he remained on the teaching staff, being appointed head of the civil engineering department in 1941. He was appointed dean of the Faculty of Applied Science in 1943.

As a consulting engineer Dean Ellis worked for a number of years for the Hydro-Electric Power Commission of Ontario and for the Ontario Government. He was for two years chairman of a board of three engineers appointed by the Federal Government to study the most effective means of crossing the Straits of Canso.

This Queen's student whose support was to be of such great help to the Institute joined this organization in 1909. He was a councillor in 1929, 1941 and 1942, and he has served on numerous committees.

Today in every nook and cranny of this broad Dominion and in numerous other places around the world, there are engineers who with great profit to themselves have passed through the hands of this man whom we honour tonight. They will join with us in the happiness which is ours in publicly acknowledging Doug Ellis' great "achievements in the development of Canada."

## Gzowski Medal

***Presented each year for the best paper on a civil engineering subject***

***Egil Mikkelsen Rensaa, M.E.I.C.***

Egil Mikkelsen Rensaa of Edmonton, Alberta, was awarded the Gzowski Medal for his paper "The Cracking Problem in Reinforced Concrete Buildings". This paper was published in the November 1953 issue of the *Journal*.

Mr. Rensaa is a partner in the Edmonton consulting engineering firm of Main, Rensaa and Minsos.

He was born in Astafjord, North-Norway. After completing his elementary education, he entered Bergen Technical School from which he graduated in 1925 as a civil engineer. While in Norway he gained experience in railway surveying and ship building draughting before coming to Canada in 1926 where he entered the employ of Canadian National Railways as a designer of dams and water supplies, and subsequently as resident engineer. He studied at the University of Manitoba, receiving B.Sc. and M.Sc. degrees in 1933 and 1937. From 1934 to 1936 he worked with the Department of Public Works of Canada as a designer of bridges and wharfs, and as a resident engineer.

He then returned to Norway where he became associated with the Norwegian State Railways. During this period he was occupied with the structural design of bridges, buildings, dams, power plants, wharfs, paper mills and civil defence structures.

He returned to Canada in 1947 and opened a private practice as consulting engineer in Edmonton, Alberta. In 1948 he entered into partnership with T. C. Main, M.E.I.C., to form a general consulting engineering firm under the name of Main and Rensaa, and a year later Messrs. Rensaa and Main formed a new company with a third associate, A. O. Minsos, an architectural consultant. The firm has developed a system of precast reinforced concrete framework which has been used for several large buildings.

E. M. Rensaa, M.E.I.C.

Mr. Rensaa has written a number of articles for Canadian and Norwegian engineering publications dealing with structural theory and practice.

He is a member of the Association of Consulting Engineers of Canada, the American Concrete Institute, and the Associations of Professional Engineers of both Alberta and Ontario.

Mr. Rensaa joined the Engineering Institute of Canada as an Associate Member in 1932, transferring to Member in 1940.

## Duggan Medal and Prize

***Awarded for papers dealing with the use of metals for structural or mechanical purposes***

***Leo Schenker, M.E.I.C.***

Leo Schenker, until recently a research associate at the University of Michigan, was awarded the Duggan Medal and

Leo Schenker, M.E.I.C.

Prize for his paper, "Analysis of Building Frames by Limit Design", which appeared in the March 1953 issue of the *Journal*.

Mr. Schenker was born in Vienna, Austria. Upon completion of his general studies at the Kilburn Grammar School in London, England, he entered the University of London (Battersea Polytechnic) from which he graduated with first class honours in civil engineering in 1942. He was awarded the Wells Gold Medal, given annually to the top ranking engineering graduate.

After graduation, until early 1946, he served as engineer officer in the Royal Air Force and was discharged with the rank of flight lieutenant.

For the next two years he was in charge of a small London machine shop engaged in turning and pressing metal components.

Mr. Schenker then came to Canada where he joined the Hydro Electric Power Commission of Ontario in Toronto as assistant research engineer. During a period in 1949-1950 he studied toward his M.A.Sc. degree at the University of Toronto, having been granted a fellowship by the Canadian Institute of Steel Construction.

In the summer of 1952 he was invited to the University of Michigan to take part in a research project on building connections, a subject with which he had become familiar while working on his master's thesis. He worked at the same time toward his Ph.D. degree, specializing in the effects of shockloading on tall structures. His research is now completed and he is to receive his degree this year. He has returned meanwhile to Toronto.

Mr. Schenker is a member of the Association of Professional Engineers of Ontario. He joined the Engineering Institute of Canada as a Member in 1950.

## Ross Medal

***Awarded for papers on electrical engineering subjects.***

***Milton Eaton, M.E.I.C.***

Milton Eaton, electrical engineer for Shawinigan Chemicals Limited and consultant on electric boilers for the Shawinigan Water and Power Company, was awarded the Ross Medal for his paper, "Improvements in Electrode Boilers", published in the May, 1953 issue of the *Journal*.

Mr. Eaton was born at Whitewater, Manitoba. After receiving his general education he proceeded to McGill University where he graduated with a B.Sc. degree in electrical engineering in 1921.

Upon graduation he joined the Shawinigan Engineering Company, at Shawinigan Falls. In October, 1922 he was placed in charge of the electrical department of Canadian Electro Products Company Limited which in 1927 was incorporated under the name of Shawinigan Chemicals Limited.

This is the second time that Mr. Eaton has received an Institute award. In 1933 he won the Gzowski Medal for his paper, "Automatic Operation of Electric Boilers".

He has been active in the work of the Engineering Institute, has been chairman (1948-49) and councillor (1951-52) for the St. Maurice Valley Branch. He joined the Institute as a Student in 1920, transferring to Associate Member in 1925, and to Member in 1940. He has also been chairman of the St. Maurice Valley Section of the American Institute of Electrical Engineers.

**Milton Eaton, M.E.I.C.**

## Plummer Medal

***Awarded for the best paper on a metallurgical subject***

***John S. Moloney***

John S. Moloney, design engineer with Polymer Corporation Limited in Sarnia, Ontario, was awarded the Plummer Medal for his paper, "Fluid-born Solid Particles with Particular Reference to Solid Fuel for Internal Combustion Engines". The paper was published in the April, 1953 issue of the *Journal*.

**J. S. Moloney**

Mr. Moloney received his B.A.Sc. degree in mechanical engineering from the University of Toronto in 1945. The paper which received the Plummer award was the thesis submitted as partial requirement for his M.E. degree which he obtained from the National University of Ireland in 1949.

He worked for two years, 1945-47, in the laboratory, Mechanical Engineering Division, National Research Council, Ottawa. An interest in philosophy led him to take night classes in Ottawa, and also to undertaking the study of philosophy for a year in Dublin, Ireland. He stayed in Dublin for a second year to take advantage of an opportunity to do research for a master's degree in engineering. The subject of his research was the possibility of a practical efficient heat engine using cheap solid fuel-coal. During his stay in Europe, he made two trips to the continent, visiting England, France, Spain, Switzerland and Italy. Mr. Moloney returned to Canada in 1950 and worked in Brantford, Ont., with the Cockshutt Plow Company. He worked for about 1½ years in the Gas Dynamics Laboratory of McGill University at St. Anne de Bellevue, Que., going to Polymer Corporation, at Sarnia, early in 1953 to do engineering design work.

## Leonard Medal

***Awarded for papers on mining subjects.***

Leonard Medals have been awarded to **Clement Matthew Anson**, M.E.I.C., and to the late **Charles Blair Archibald**, M.E.I.C., for their paper, "Treasure under the Atlantic" which described in the August 1953 issue of the *Journal* the Wabana Mines in Newfoundland which are the world's only iron ore mines under the sea.

***Clement Matthew Anson, M.E.I.C.***

Clement Matthew Anson, vice-president and general manager of Dominion Iron and Steel Limited in Sydney, Nova Scotia, was born in England and moved to Australia at an early age. He received his preliminary schooling there and at the age of fifteen began his career in the steel industry. After four years' work he came to Canada in 1920 to enter McGill University. While at McGill he was elected president of the Students' Branch of the Canadian Institute of Mining and Metallurgy and president of the Science Undergraduates' Society. He received his B.Sc. degree in metallurgy in 1925.

The same year he joined the Dominion Steel and Coal Corporation as a labourer in the blast furnaces. Within two years he became assistant blast furnace superintendent, and then successively assistant mills superintendent, and assistant general superintendent. In 1931 he was appointed assistant general manager. He was named general manager of steel operations in 1940 and vice-president and general manager in 1952.

Mr. Anson is a director of Dominion Iron and Steel Limited, Dominion Wabana Ore, Limited, James Pender & Company Limited, and the Sydney and Louisburg Railway Company.

His valuable support has been given to professional and educational activities. He joined the Engineering Institute as an Associate Member in 1931, transferring to Member in 1940. In 1946 and 1947 he served as vice-president of the Institute for the Maritime Region. The Julian C. Smith Medal of the Institute, for achievement in the development of Canada, was awarded to him in 1951.

He is a member of the British Iron and Steel Institute and of the American Iron and Steel Institute. He is on the boards of governors of Nova Scotia Technical College, and of the Nova Scotia Research Foundation.

**C. M. Anson, M.E.I.C.**

***The late Charles Blair Archibald, M.E.I.C.***

Charles Blair Archibald, who died at Sydney, Nova Scotia on March 14, 1954, was born in Pictou, Nova Scotia on October 25, 1889.

He received his early education at Truro schools and Colchester Academy, after which he entered the Royal Military College in Kingston, Ontario from which he graduated in 1910.

One year previous to graduation he was employed on track construction by the Intercolonial Railway, and after graduation he joined the Nova Scotia Steel and Coal Company, Limited at New Glasgow where he worked on the design of conveying machinery, ore pockets and buildings. In November of 1910 he was engineer in charge of the company's construction at Wabana, Newfoundland. The following year he returned to New Glasgow where he was engaged in designing and erecting conveying machinery and running a survey. He was subsequently transferred to Wabana as engineer in charge of construction and machinery erection.

In May, 1912, Mr. Archibald was appointed mechanical superintendent for the company at Wabana and assumed the responsibility of all mechanical and electrical installation and construction. Three years later he was named chief engineer at Wabana and was placed in charge of the civil, mechanical and electrical departments as well as mine surveying.

Mr. Archibald was appointed general manager of the company's iron ore operations at Wabana in 1918, and in 1922 he became manager of both the Nova Scotia Steel and Coal Company, Limited and Dominion Steel and Coal Corporation Limited iron ore operations, with headquarters in Wabana.

In December, 1948 he retired from the post of manager at Wabana and became chief mining engineer for Dominion Iron and Steel Limited in Sydney, Nova Scotia.

Mr. Archibald joined the Engineering Institute as a Student in 1910, transferring to Associate Member in 1917 and to Member in 1940.

## John Galbraith Prize

***Awarded for the best paper presented by a Junior in the Ontario vice-presidential zone.***

***Frank Stanley Gue, Jr. E.I.C.***

Frank Stanley Gue, manufacturing engineer in the Power Products Division of Canadian Westinghouse Company Limited in Hamilton, Ontario, was awarded the John Galbraith Prize for his paper, "Moral Responsibilities of the Engineer".

Mr. Gue was born in Edmonton, Alberta. After receiving his pre-matriculation education there, he served for one year as control operator with Radio Station CJCA in Edmonton, after which he joined the Royal Canadian Air Force as a wireless mechanic.

At the close of the war he served as radio counterman for a year with Radio Supply Company. The following year he obtained his matriculation and entered the University of Alberta, graduating with distinction in electrical engineering in 1951. During the summers of his university course he was employed as telephone-telegraph technician with Canadian National Telegraphs.

F. S. Gue, Jr.E.I.C.

Mr. Gue joined Canadian Westinghouse Company Limited as an engineering apprentice, and in 1953 was appointed to his present position in the manufacturing methods department of the Power Products Division.

Mr. Gue joined the Engineering Institute of Canada as a Student in 1950, transferring to Junior Member in 1951.

# Personals

## News of the Personal Activities of Members of the Institute

**William L. Sagar,** M.E.I.C., was elected president of the Dominion Council of Professional Engineers, at the 17th annual meeting in Toronto, May 26-28, 1954.

Professor Sagar is also serving this year as president of the Association of Professional Engineers of Ontario. He is professor of civil engineering at the University of Toronto, where he has been a member of the faculty since 1937; and previously had served there as a sessional lecturer. He also does private consulting work dealing with the building of large industrial plants, bridges and other structures. He is an authority on soil mechanics and construction materials.

He worked in the construction field, in the earlier years of his career, as a contractor, and on testing and inspection of general construction materials. Later he was employed on the construction of several of Toronto's well-known buildings, taking part also in the building of the Humber River bridge. He served as foundation consultant on various projects for the Imperial Oil Company refinery at Sarnia.

A veteran of both World Wars, and holding the rank of lieutenant-colonel in the R.C.E.M.E., he is one of the oldest members in point of service of the Association of Professional Engineers of Ontario, his membership dating back to 1923, the year after the Association was formed. He became an Associate Member of the E.I.C., in 1926, transferring to Member in 1940.

**B. G. Ballard,** O.B.E., M.E.I.C., director of the Radio and Electrical Engineering Division of the National Research Council of Canada, has also been named vice-president (scientific). He fills the position left vacant when Dr. E. W. R. Steacie became president.

In 1930 Mr. Ballard was appointed to the National Research Council staff in the Division of Physics, and during the following ten years he gradually built up the electrical engineering section.

This work became extremely important during the war when Mr. Ballard's efforts included the development of mine sweepers and other means of protecting ships against enemy magnetic mines. The resulting equipment was used on both coasts as well as on the high seas, and this work was recognized in 1946 by the award of the Order of the British Empire.

The electrical engineering section was amalgamated with the radio branch of the Division of Physics and Electrical Engineering, and Mr. Ballard was named as assistant director of that division in 1946. This research expanded rapidly and a full division on radio and electrical engineering was established in 1948, with Mr. Ballard as director. It is now one of the largest divisions of the National Research Council.

Mr. Ballard was elected a vice-president of the Engineering Institute this year. His biography was included in the April issue.

### Treasurer of E.I.C. for 1954

**Charles H. Jackson,** M.E.I.C., president of Atlas Asbestos Co. Ltd., of Montreal, has been appointed treasurer of the Engineering Institute for 1954.

Mr. Jackson graduated from the University of Toronto in 1923, and after a wide experience in the construction field, joined the engineering department of Canadian Industries Limited in 1929. In 1934 he was transferred to the ammunition division at Brownsburg, Que., where he was made production manager, and in 1938, manager of the ammunition division with headquarters in Montreal

In 1946 he joined the Atlas Asbestos Co. Ltd., of Montreal, and he was vice-president in charge of manufacturing prior to his appointment as president in 1953.

Charles H. Jackson, M.E.I.C.

Mr. Jackson joined the Institute in 1928 as a Junior, transferring to Associate Member in 1935, and to Member in 1940.

**S. G. Bennett,** M.E.I.C., president of Beardmore and Company, and a vice-president of Canada Packers Limited, was recently re-elected president of the Royal Agricultural Winter Fair.

After receiving his B.A.Sc. degree from the University of Toronto in 1914, Mr. Bennett studied political economy at Oxford, after which he joined the Royal Engineers with whom he served with distinction from 1914 until 1918.

At the close of the war he joined the engineering staff of the University of Toronto, where he served for six years before entering business.

Mr. Bennett is one of Canada's leading Scotch Shorthorn cattle breeders.

**H. E. Cunningham,** M.E.I.C., has been appointed a vice-president and manager of the paper division of Dominion Engineering Company Limited in Montreal.

A graduate of McGill University, Mr. Cunningham has been with the company since 1934, and has occupied successively the positions of assistant chief engineer, and chief engineer and manager of the company's paper division.

**Col. Ibbotson Leonard, D.S.O., V.D.,** M.E.I.C., director of E. Leonard and Sons, Ltd. of London, Ont., and chairman of the board of the Canada Trust Company and the Huron and Erie Mortgage Corporation, has resigned as president of the London Health Association, a position he has filled for 29 years.

After announcing his resignation at a recent meeting, Col. Leonard was immediately elected honorary president —the first honorary president the association has had.

Lt.-Col. Gordon J. Ingram, O.B.E., V.D., was elected president by acclamation to succeed Col. Leonard.

**Air Commodore C. F. Johns, M.B.E.,** M.E.I.C., has been appointed as special assistant on construction engineering to the Minister of National Defence for a two-year term.

Air Commodore Johns is president and general manager of Tribune Press Limited in Sackville, N.B.

**W. G. Sharp,** M.E.I.C., manager of Sharp's Theatre Supplies Limited in Calgary, Alta., has been elected chairman of the Calgary Branch of the Engineering Institute.

Mr. Sharp was born at Indian Head. Sask. He attended public schools in Vancouver, B.C., and high school in Didsbury, Alta., after which he received his B.Sc. degree in electrical engineering from the University of Alberta in 1933

During the summer months of his university training he was associated with W. H. B. Sharp in the operation of a number of theatres and a theatre supply business in Calgary, and he was employed in general theatrical management and maintenance of equipment.

After graduation he was placed in charge of installation of equipment, including arc lamps, rectifiers, projectors and sound equipment for theatres supplied by Sharp's Theatre Supplies in Alberta, eastern British Columbia, and western Saskatchewan.

In May, 1944, when the company disposed of its theatres, Mr. Sharp took over the operation of the supply business.

He is a member of the Association of Professional Engineers of Alberta, and a member of the Calgary Chamber of Commerce.

**Jules Armand Beauchemin,** M.E.I.C., has announced the formation of a new Montreal firm of consulting engineers specializing in the field of municipal engineering and public utilities under the name of J. A. Beauchemin & Associates.

**J. A. Beauchemin, M.E.I.C.**

Mr. Beauchemin was previously a partner in the firm of Beauchemin & Hurter which has recently been dissolved.

He received his degree in civil engineering from Ecole Polytechnique in 1911, and began his career as assistant resident engineer with Richelieu River Improvements. He was subsequently appointed engineer with the Department of Public Works in Ottawa, and with Riordon Co. Ltd. which is now the Gatineau Power Company.

In 1921 he became chief engineer with the Donnacona Paper Company and six years later he founded and became the first manager of the Town of Dolbeau, Lake St. John, Que.

Mr. Beauchemin was appointed personnel manager of Consolidated Paper Corporation in Port Alfred, Que., and was later named resident engineer on the construction of the Wellington Street Tunnel in Montreal, and the Honore Mercier Bridge.

Previous to his association with the firm of Beauchemin & Hurter, Mr. Beauchemin was chief engineer with the Provincial Electricity Board of Quebec.

He is a past-chairman of the Montreal Branch of the Engineering Institute and a past-councillor representing the Montreal Branch. He is also a past-president of the Alumni Association of Ecole Polytechnique.

**W. H. Beaton,** M.E.I.C., is now an associate in the consulting engineering firm of J. A. Beauchemin & Associates of Montreal. He was until recently a project engineer on public utilities with Stadler Hurter & Company attached to the affiliated firm of Beauchemin & Hurter.

He was previously resident engineer on the construction of an extension to James MacLaren Co. Ltd. at Masson. Que., and he also served as a field engineer with Columbia Cellulose Co. Ltd. in Prince Rupert, B.C.

Mr. Beaton is a graduate in civil engineering of McGill University, class of 1947.

**W. H. Beaton, M.E.I.C.**

**H. Lapointe,** Jr.E.I.C., has become an associate in the new consulting engineering firm of J. A. Beauchemin & Associates of Montreal.

Until recently he was a project engineer on municipal works for the firm of Beauchemin & Hurter. He was previously associated with the Aluminum Company of Canada, and he also worked as a field engineer for the City of Verdun, Que., for the construction firm of Dufresne Engineering, and for the Quebec Roads Department.

Mr. Lapointe graduated in civil engineering from McGill University in 1951.

**H. Lapointe, Jr.M.E.I.C.**

**J. I. Carmichael,** M.E.I.C., has been appointed manager of Fort Erie Construction Limited in Fort Erie, Ont.

He was formerly executive assistant to the president and plant manager of Fleet Manufacturing Limited in Fort Erie.

Mr. Carmichael is a 1936 mechanical engineering graduate of Queen's University.

**A. M. Thurston,** M.E.I.C., has been appointed chief engineer of the engineering division of Canadian Aviation Electronics Limited in Montreal.

Previous to his new appointment, Mr. Thurston served as development engineer with the Shawinigan Water and Power Company, as research and consulting engineer with the Canadian

A. M. Thurston, M.E.I.C.

Marconi Company, as manager of a refrigeration, heating, ventilating and air conditioning firm, and as plant manager of the Dominion Electrical Protection Company.

Mr. Thurston received his degree in electrical engineering from McGill University in 1936 and his master's degree in physics from the same university in 1948.

During the war he served with the R.C.A.F. as signals officer and navigator.

Mr. Thurston is a member of the Corporation of Professional Engineers of Quebec, the Sigma Xi (Research) of McGill University, and the Canadian Association of Physicists.

**Harry E. Miller,** M.E.I.C., district engineer for the Department of Public Works in Charlottetown, P.E.I., retired in December, 1953, after almost fifty years of service with the Department.

Mr. Miller received his early education in Charlottetown and was appointed to the staff of the Department in 1907. He was named assistant engineer following the first war, and in September, 1937, he was appointed district engineer, and served in that capacity for 16 years.

**J. Antonisen,** M.E.I.C., of the Lakehead Branch was present at the meeting of March 15 when President Ross L. Dobbin visited the Branch.

Mr. Antonisen gave a vote of thanks to the president. This has been his customary contribution to the program of the presidents' visits for the past 15 years.

Active for his 85 years, Mr. Antonisen is a former city engineer of Port Arthur, Ont.

**V. K. Mason,** M.E.I.C., has been appointed chief engineer with B. Perini & Sons Canada Limited in Toronto, Ont.

He is a graduate of McGill University in civil engineering, class of 1942.

**Lt. Cmdr. R. A. Grosskurth, R.C.N.,** M.E.I.C., has been appointed deputy manager of the electrical engineering department of the H.M.C. Dockyard at Esquimalt, B.C.

He was formerly assistant command electrical officer on the Atlantic Coast, and electronics instructor at the H.M.C. Electrical School, H.M.C.S. *Stadacona* in Halifax, N.S.

**L. G. Chavignaud,** M.E.I.C., has been named general manager of Bryan Mountain Coal Co. Ltd. in Robb, Alta.

He was formerly general manager of mining operations for the North Western Coal and Oil Limited in Robb.

Mr. Chavignaud has been in the coal mining business for the past 33 years and has held executive positions with Luscar Coals Limited, Cadomin Coal Company and McLeod River Hard Coal Company (1941) Limited.

**Harvey Carruthers,** M.E.I.C., has opened offices under the firm name of Harvey Carruthers Limited, sales engineers, in Vancouver, B.C.

He was formerly district manager of Bingham Pump Co. Ltd. in Vancouver.

Mr. Carruthers is a graduate of the University of British Columbia, class of 1940.

**P. W. Bishop,** M.E.I.C., is engineer with Cementation Company (Canada) Limited in Vancouver, B.C., and is in charge of all engineering for the company in the territory from Winnipeg to the Pacific coast.

He was previously marine terminal engineer with Canadian Pacific Railways in Victoria, B.C.

Mr. Bishop is a civil engineering graduate of the University of New Brunswick, class of 1942.

**W. B. Jackson,** M.E.I.C., has been appointed division engineer for Canadian National Railways in London, Ont.

Born in Vancouver, B.C., Mr. Jackson was educated at Vancouver schools and at the University of British Columbia and the University of Alberta, where he received his degree in civil engineering in 1945.

He joined the Canadian National Railways as an instrumentman on the St. Lawrence Division at Montreal in 1945, becoming assistant engineer there in 1946. He then served in this same capacity at the Montreal terminals, the St. Jerome Division, and at the Laurentide and Levis divisions. In 1948 he was appointed assistant division engineer in the Levis Division, and two years later, division engineer at Cochrane, Ont.

Mr. Jackson saw service in World War II, rising from sapper to lieutenant with the R.C.E.

He is a member of the Corporation of Professional Engineers of Quebec and of the American Railway Engineering Association.

**R. E. McMillan,** M.E.I.C., has joined Canadian Comstock Company Limited as electrical engineer in St. Catharines, Ont.

A graduate of McGill University in electrical engineering, class of 1926, Mr. McMillan has been associated with the Saguenay Power Co. Ltd., the Aluminum Company of Canada Ltd., the Canadian International Paper Company, R. A. Hanright of St. Catharines, and H. G. Acres and Company of Niagara Falls.

**C. D. Dies,** M.E.I.C., has been transferred by the Canada Cement Company from Belleville, Ont., to Fort Whyte, Man., as construction engineer.

Mr. Dies graduated with a B.Sc. degree in metallurgy from Queen's University in 1943.

**H. J. Petursson,** M.E.I.C., is now regional construction engineer with Central Mortgage and Housing Corporation in Winnipeg, Man.

Mr. Petursson graduated with a B.Sc. degree from the University of Manitoba in 1930.

**W. J. Dyne,** M.E.I.C., has recently joined the Atomic Energy of Canada Ltd.

He was formerly on the staff of Canadian Western Natural Gas Company.

Mr. Dyne graduated in mechanical engineering from Lughborough University in 1946.

**Leopold Tessier,** M.E.I.C., is now associated with Paul Pelletier, Montreal construction engineer.

He was formerly a designer with the Quebec Streams Commission in Montreal.

**John B. Newman,** M.E.I.C., has joined Anglo Electromatic Elevator Co. (Canada) Ltd. in Toronto, Ont.

He was formerly associated with the Roelofson Elevator Company in Toronto.

**E. G. deWolf,** M.E.I.C., has been transferred as works manager from the Prairie Salt Company in Unity, Sask., to Dominion Salt Company Limited in Sarnia, Ont.

Mr. deWolf is a graduate of the Nova Scotia Technical College in mining engineering, class of 1944.

**Cecil G. Mills,** M.E.I.C., recently joined the engineering staff of the Winnipeg Electric Company in Winnipeg, Man.

He was previously associated with the B.C. Electric Railway Company. Mr. Mills graduated from McGill University in electrical engineering in 1926.

A. O. Drysdale, M.E.I.C.

**A. O. Drysdale,** M.E.I.C., assistant superintendent of Canada Cement Company Limited, has been elected chairman of the Belleville Branch of the Engineering Institute.

Mr. Drysdale was born in Ottawa, and received his schooling at the Glebe Collegiate there. In 1941 he obtained his B.Eng. degree in mining engineering from McGill University. While attending McGill, he was employed during the summer months by Dome Mines Ltd., with Dr. G. W. H. Norman on a Dominion geological survey, and by Omega Gold Mines Ltd.

Upon graduation Mr. Drysdale entered Canada Cement Co. Ltd. as a plant engineer. Five months later he joined the Army, serving overseas with the First Canadian Army, and as officer commanding of R.C.E.M.E. Third Canadian Infantry Brigade Workshop, the First Canadian Army Troops Workshop and the Fourth Canadian Armoured Troops Workshop. While overseas he also attended during 1943 the Royal College of Military Science in England. He was discharged in 1946 with the rank of major.

He then returned to Canada Cement Co. Ltd. as assistant superintendent of the company's Montreal East No. 1 plant. Four years later he was transferred to the company's No. 5 plant in Belleville, Ont.

Mr. Drysdale is a member of the Association of Professional Engineers of Ontario and of the Royal Canadian Electrical Mechanical Engineer Corps Association.

**F. R. Denham,** M.E.I.C., has joined the staff of the production tool standards section of Ford Motor Company of Canada Ltd. in Windsor, Ont.

He was previously defence scientific service officer with Canadian Armament Research and Development Establishment at Valcartier, Que.

Mr. Denham received his B.Sc. degree in mechanical engineering from the University of Durham in 1950, and his Ph.D. degree from the same university in 1953.

**J. O. Hulbert,** M.E.I.C., has been appointed zone engineer with Canadian Oil Refineries Ltd. at Corunna, Ont.

He was formerly associated with Foundation Company of Canada Ltd. in Toronto, Ont.

Mr. Hulbert holds the higher national certificate in mechanical engineering.

**D. K. Partington,** M.E.I.C., is now construction superintendent with Wells Construction Company in Saskatoon, Sask.

He was previously resident engineer with Underwood & McLellan in Saskatoon.

Mr. Partington graduated from the University of Saskatchewan in civil engineering in 1949.

**Wm. I. Phemister,** M.E.I.C., was recently named assistant to the executive vice-president of Electric Tamper & Equipment Co. Ltd. in Lachine, Que.

He was formerly chief of draughting and lofting with A. V. Roe (Canada) Ltd. in Toronto.

Mr. Phemister graduated with a B.Sc. degree in mechanical engineering from Queen's University in 1940.

**L. V. Roberts,** M.E.I.C., has been appointed Canadian manager of Brookhirst Switchgear Limited in Toronto, Ont.

Mr. Roberts was formerly on the staff of Canadian Controllers Ltd. in Toronto.

**J. W. Southin,** M.E.I.C., has been appointed resident engineer for H. A. Simons Ltd. of East Texas Pulp and Paper in Silsbee, Texas.

He was previously chief engineer with the Frobisher Company at Kampala, Uganda, British East Africa.

**R. W. Stephenson,** M.E.I.C., has joined the staff of Racey, MacCallum and Associates, Ltd. in Montreal.

He was previously associated with the Hydro-Electric Power Commission of Ontario in Niagara Falls, Ont.

Mr. Stephenson graduated in mining geology from the University of Toronto in 1949.

**G. R. Pritchard,** M.E.I.C., has been transferred recently by John Inglis Company Limited from Calgary, Alta., to Toronto, Ont., where he will occupy the position of manager of Worthington products sales for the company's general engineering division.

Mr. Pritchard received his electrical engineering degree from the university of Manitoba in 1937.

**J. F. McInnis,** M.E.I.C., has joined the Bowaters Shoutherns Paper Company in Calhoun, Tenn.

He was previously associated with the Quebec North Shore Paper Company in Baie Comeau, Que.

Mr. McInnis graduated from the Nova Scotia Technical College in mechanical engineering in 1941.

**D. W. Laird,** M.E.I.C., has been named branch manager of Defence Construction (1951) Limited in Winnipeg, Man.

He is a 1942 civil engineering graduate of the University of Manitoba.

**George A. Bird,** M.E.I.C., is now associated with Defence Construction (1951) Ltd. in Moncton, N.B.

He was formerly in the employ of Central Mortgage and Housing Corporation.

Mr. Bird is a graduate in civil engineering of the University of New Brunswick, class of 1949.

**A. A. Kenwood,** M.E.I.C., has joined Oland Construction Limited as estimator in Lethbridge, Alta.

He was previously in the employ of Meech, Mitchell & Associates in Lethbridge.

Mr. Kenwood is a graduate in civil engineering of McGill University, class of 1949.

**Donald D. Dick,** M.E.I.C., is now with the Harmac Pulp Division of MacMillan & Bloedel Company Limited in Nanaimo, B.C.

He was previously associated with the H. A. Simons Company in Vancouver, B.C.

Mr. Dick is a 1949 civil engineering graduate of the University of Alberta.

**L. B. Rose,** Jr.E.I.C., is now woodlands development engineer with Abitibi Power and Paper Co. Ltd. in Toronto, Ont. He was previously attached to the company's woods department in Iroquois Falls, Ont.

Mr. Rose received his B.A.Sc. degree in civil engineering from the University of Toronto in 1947.

**Harvey M. Kolesar,** Jr.E.I.C., has joined the staff of the general engineering department of the Mountain States Telephone and Telegraph Company in Denver, Colorado.

He was previously with the Bell Telephone Co. of Canada, Ltd. in Toronto, Ont.

Mr. Kolesar graduated in civil engineering from the University of Toronto in 1947.

He is the former secretary-treasurer of the Toronto Branch of the Institute.

**John S. Flavelle,** Jr.E.I.C., has joined the pulp and paper machinery division of John Inglis Co. Ltd., as a sales engineer in Toronto, Ont.

He was previously associated with the Canadian International Paper Company in Hawkesbury, Ont.

Mr. Flavelle graduated in mechanical engineering from the University of Toronto in 1948.

**G. N. McLellan,** Jr.E.I.C., is now an engineer in the design section of the engineering division of Imperial Oil Limited in Sarnia, Ont. He was previously an assistant resident engineer.

Mr. McLellan graduated in chemical engineering from the University of British Columbia in 1948.

**Donald J. Bird,** Jr.E.I.C., has joined MacDonald Construction Ltd. in Halifax, N.S. He was previously associated with Cameron Contracting Limited in Halifax.

Mr. Bird graduated in civil engineering from the Nova Scotia Technical College in 1948.

**R. W. McNeill,** Jr.E.I.C., has been appointed power equipment supervisor with the Alberta Government Telephones in Edmonton.

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Mr. McNeill graduated in electrical engineering from the University of Alberta in 1948.

**J. L. McGregor,** Jr.E.I.C., is now assistant project engineer with the Hydro-Electric Power Commission of Ontario in Toronto, Ont.

He was previously electrical supervisor for the company's eastern central region in Belleville, Ont.

Mr. McGregor graduated in electrical engineering from the University of Alberta in 1948.

**Michael Price,** Jr.E.I.C., has been appointed project engineer with Foundation Company of Canada Limited in Toronto, Ont.

He is a civil engineering graduate of the University of Birmingham, class of 1948.

**J. A. Pettis,** Jr.E.I.C., has been appointed parks engineer with Yoho, Glacier and Mt. Revelstoke National Parks at Field, B.C., by the Department of Northern Affairs and National Resources.

Mr. Pettis graduated in civil engineering from the University of Alberta in 1948.

**R. T. Crawford,** Jr.E.I.C., has recently accepted the position as engineer in the home office construction department of Burns and Company Limited in Calgary, Alta.

He was previously connected with the Hudson Bay Mining and Smelting Company in Flin Flon, Man.

**A. W. Rae,** Jr.E.I.C., is presently employed as project engineer with General Foods Limited in Toronto, Ont.

Before joining this company he was industrial and sales engineer for Engineering Industries Co. Ltd.

Mr. Rae is a mechanical engineering graduate of the Nova Scotia Technical College, class of 1949.

**James Eric Cullen,** Jr.E.I.C., has been promoted from chemist to general superintendent of Davis Leather Co. in Newmarket Ont.

Mr. Cullen is a graduate in chemical engineering of Queen's University, class of 1949.

**L. W. Anderson,** Jr.E.I.C., has been appointed supervisor of the amplitude modulation group for the engineering products service and installation division of the engineering products department of R.C.A. Victor Co. Ltd. in Montreal.

Mr. Anderson graduated in electrical engineering from the University of Alberta in 1949.

**George Nagel,** Jr.E.I.C., is D. and C. group supervisor of the Canadian Comstock Company in Windsor, Ont.

Mr. Nagel graduated in mechanical engineering from the University of Saskatchewan in 1949.

**S. A. Germaniuk,** Jr.E.I.C., is now construction engineer with Brown and Root Limited in South Edmonton, Alta.

Mr. Germaniuk is a graduate in mechanical engineering of the University of British Columbia, class of 1949.

**P. A. Inglis,** Jr.E.I.C., is now a structural engineer with Stock, Ramsay and Associates in Regina, Sask.

He was formerly associated with H. G. Acres and Company in Niagara Falls, Ont.

Mr. Inglis received his B.Sc. degree from the University of Toronto in 1949.

**John A. Sample,** Jr.E.I.C., is presently employed as a computer with Texaco Exploration Co. Ltd. in Innisfail, Alta.

Mr. Sample graduated in electrical engineering from the University of Saskatchewan in 1949.

**D. Chmara,** Jr.E.I.C., has joined the staff of the University of Toronto as an instructor in mining engineering.

He was formerly a supervisor with Fleet Manufacturing Co. Ltd. in Fort Erie, Ont.

Mr. Chmara graduated in mining engineering from the University of Toronto in 1949.

**J. P. Kot,** Jr.E.I.C., has joined Giffels and Vallet of Canada Ltd. in Windsor, Ont.

He was previously associated as hydro engineer with Price Brothers and Company at Kenogami, Que.

Mr. Kot is a graduate in electrical engineering of the University of Saskatchewan, class of 1949.

**H. L. Bachman,** Jr.E.I.C., has joined the staff of the transmission department of the B.C. Electric Commission in Vancouver, B.C.

He was previously associated with the Manitoba Telephone System in Winnipeg, and Canadian Westinghouse Co. Ltd. in Hamilton, Ont.

Mr. Bachman graduated in electrical engineering from the University of Manitoba in 1949.

**F. B. Matthews,** Jr.E.I.C., has been transferred by Maloney-Crawford Tank and Service Co. Ltd. from Tulsa, Oklahoma, to Calgary, Alta.

Mr. Matthews graduated in chemical engineering from the University of Alberta in 1949.

**Allan A. Park,** Jr.E.I.C., has joined Dominion Bridge Co. Ltd. in Winnipeg, Man., as structural designer.

He was previously associated with Standard Iron and Engineering Works Ltd. in Edmonton, Alta., as an estimator.

Mr. Park received his B.Eng. degree in mechanical engineering from McGill University in 1949.

**T. W. Kitchen,** Jr.E.I.C., is now a pulp inspector in the employ of McMillan & Bloedel (Alberni) Ltd. in Port Alberni, B.C.

Mr. Kitchen graduated in chemical engineering from the University of Alberta in 1949.

**C. G. Saunders,** Jr.E.I.C., has been appointed assistant superintendent of garages and equipment for the Ontario Department of Highways in Toronto, Ont.

Mr. Saunders received his B.Sc. degree in mechanical engineering from Queen's University in 1951.

**Maurice Lavallee,** Jr.E.I.C., has been recently appointed industrial commissioner of the Gatineau Power Company in Ottawa.

Mr. Lavallee received his B.A.Sc. degree in electrical engineering from Laval University in 1948. He joined the company the same year.

**K. J. Newbert,** Jr.E.I.C., is now project engineer for Saskatoon and Dundurn

Maurice Lavallee, Jr.E.I.C.

with Defence Construction (1951) Ltd.

He was previously associated with Central Mortgage and Housing Corporation in Saskatoon, Sask.

Mr. Newbert received his B.Sc. degree from the University of Saskatchewan in 1950.

**J. Milner,** Jr.E.I.C., is managing director of his own business, Oilfield Engineering Services Ltd. in Edmonton, Alta.

Mr. Milner graduated in chemical engineering from the University of Alberta in 1950.

**Kenneth D. Stephenson,** Jr.E.I.C., has joined the staff of Canadian Potteries in St. John, Quebec.

He was previously ceramic engineer and assistant plant superintendent with Hamilton Porcelains Ltd. in Brantford, Ont.

Mr. Stephenson is a graduate in ceramic engineering of the University of Toronto, class of 1950.

**V. K. Jameson,** Jr.E.I.C., has been appointed works manager of the Dominion Tar and Chemical Company in Vancouver, B.C. He was previously assistant works manager for the company in Trenton, Ont.

Mr. Jameson graduated in mechanical engineering from the University of Saskatchewan in 1950.

**C. R. Langer,** Jr.E.I.C., is now design engineer with Cowin & Co. Ltd. in Winnipeg, Man.

Mr. Langer graduated in civil engineering from the University of Manitoba in 1950.

**A. F. Roberts,** Jr.E.I.C., is now mine engineer with Cochenour Willans Gold Mines Ltd. at Cochenour, Ont.

He was previously associated with Giant Mascot Mines Limited at Spillimacheen, B.C.

Mr. Roberts received his B.A.Sc. degree in mining engineering from the University of British Columbia in 1951.

**F/Lt. Victor Swanberg, R.C.A.F.,** Jr.E.I.C., has been promoted from the rank of flying officer, and is now located with the First Air Division R.C.A.F. Headquarters, at Metz, France.

He was previously with the Second C.M.U. Unit at Calgary, Alta.

Mr. Swanberg is a graduate in civil engineering of the University of Alberta, class of 1951.

**R. Noel,** Jr.E.I.C., is a designer and development engineer in acoustics with the R.C.A. Victor Division in Camden, N.J.

He was formerly a research scientist in the electronics laboratory of Defence Research Telecommunication Establishment in Ottawa.

Mr. Noel graduated in civil engineering from Ecole Polytechnique in 1951.

**D. Murray,** Jr.E.I.C., has joined the engineering department of the City of Edmonton.

He was formerly connected with Peale Construction Co. Ltd. in Edmonton.

Mr. Murray graduated in mechanical engineering from the University of Manitoba in 1951.

**A. Gordon Shugg,** Jr.E.I.C., has been appointed district engineer for General Motors Diesel Limited in Calgary, Alta. He has served as service repair engineer in London, Ont., since 1952.

A. Gordon Shugg, Jr.E.I.C.

Mr. Shugg graduated from the University of British Columbia in mechanical engineering in 1950.

**Wm. T. Haggert,** Jr.E.I.C., has joined the staff of Engineering Associates (Western) Ltd. in Vancouver, B.C., as director.

He was previously with International Engineering Co. Ltd. in Vancouver.

Mr. Haggert graduated in electrical engineering from the University of British Columbia in 1951.

**H. L. Knappett,** Jr.E.I.C., is now an engineer in the production engineering department of the Ford Motor Company of Canada in Windsor, Ont.

He was formerly a manufacturing engineer with Canadian Westinghouse Co. Ltd. in Hamilton, Ont.

Mr. Knappett graduated with a B.A.Sc. degree in mechanical engineering from the University of British Columbia in 1951.

**J. C. D. Mallet-Paret,** Jr.E.I.C., has joined the Alberta Government Telephone system in Edmonton, Alta. He was formerly associated with Picker X-Ray of Canada Ltd. in Montreal, Que.

Mr. Mallet-Paret is a graduate of the University of British Columbia in electrical enginering, class of 1951.

**F. H. Papke,** Jr.E.I.C., is now with the production control department of Wm. E. Coutts Company in Toronto, Ont.

He was formerly with the planning department of E. S. & A. Robinson (Canada) Ltd. at Leaside, Ont.

Mr. Papke graduated with a B.A.Sc. degree in engineering and business from the University of Toronto in 1951.

**H. B. McLenaghan,** Jr.E.I.C., has joined Structural Engineering Services as structural engineer in Calgary, Alta.

He was previously associated with J. A. Lamb, an engineer and Alberta land surveyor in Calgary.

Mr. McLenaghan received his B.Sc. degree in civil engineering from the University of Manitoba in 1952.

**F/O J. M. Lepage, R.C.A.F.,** Jr.E.I.C., has been posted to No. 1 Air Division Headquarters at Metz, France.

F/O Lepage is a graduate in civil engineering of Laval University, class of 1952.

**G. A. Gorman,** Jr.E.I.C., is now assistant engineer in the soils section of the Hydro-Electric Power Commission of Ontario in Toronto.

He was formerly soils engineer with Construction Borings Ltd. in Toronto.

Mr. Gorman graduated in civil engineering from the University of Toronto in 1951.

**J. R. Finlay,** Jr.E.I.C., has joined General Steel Wares Limited in London, Ont., as industrial engineer.

He was formerly associated with Dominion Bridge Company in Winnipeg, Man.

Mr. Finlay graduated in mechanical engineering in 1951 from the University of Manitoba.

**Andrew Frame,** Jr.E.I.C., is now sales engineer with English Electric Company of Canada.

He was formerly associated with the Canadian Westinghouse Company on the graduate student training course for engineers in Hamilton, Ont.

Mr. Frame graduated in electrical engineering from the University of Toronto in 1951.

**Ronald T. McLaughlin,** Jr.E.I.C., is now junior design engineer in the department of planning and works of the City of Ottawa.

He was formerly assistant research officer with the National Research Council in Ottawa.

Mr. McLaughlin graduated in civil engineering from Queen's University in 1951, and undertook post-graduate work at the California Institute of Technology in Pasadena, Cal.

**Thos. B. Macauley,** Jr.E.I.C., has joined the staff of C. D. Howe Company Limited in Montreal, Que.

He was previously associated with the McGill University Gas Dynamics Laboratory in Ste. Anne de Bellevue, Que.

Mr. Macaulay graduated from McGill University in mechanical engineering in 1951.

**Douglas H. Keen,** Jr.E.I.C., has recently joined the Steel Company of Canada Limited in Hamilton, Ont.

Mr. Keen graduated in mechanical engineering and business from the University of Toronto in 1951.

**Clifford F. Jardim,** Jr.E.I.C., has joined Phillips Electrical Works Ltd. in Toronto, Ont.

He was formerly with Canadian Industries Ltd. in Maitland, Ont.

Mr. Jardim graduated in electrical engineering from McGill University in 1952.

**M. B. Ferman,** Jr.E.I.C., has joined the staff of Superior Masonry Products Ltd. in Lethbridge, Alta.

He was previously associated with Burns and Dutton Concrete and Construction Co. Ltd. in Calgary, Alta.

Mr. Ferman graduated in civil engineering from the University of Alberta in 1952.

**E. H. Gilliatt,** Jr.E.I.C., is now instrumentman in the division engineer's office of Canadian National Railways in Campbellton, N.B.

He was previously an engineer in training with the company in Montreal.

Mr. Gilliatt graduated in civil engineering from the Nova Scotia Technical College in 1952.

**Chas. T. Wale,** S.E.I.C., has been promoted to the position of district manager of the B.C. Power Commission at Merritt, B.C. He previously held the position of assistant district manager in Port Alberni, B.C.

Mr. Wale is a graduate of the University of British Columbia in mechanical engineering, class of 1953.

**Wm. G. L. McAllister,** S.E.I.C., is now plant engineer with National Gypsum (Canada) Ltd. in Dingwall, N.S.

Mr. McAllister graduated from the Nova Scotia Technical College in mining engineering in 1953.

**H. Orlando,** S.E.I.C., has joined the staff of the Ontario Department of Highways at Hamilton, Ont.

Mr. Orlando graduated in civil engineering from the University of Toronto in 1953.

**Andre Chamberland,** S.E.I.C., is now an engineer on the staff of the Town of Plessisville, Quebec. He was previously assistant engineer for the Town of Drummondville, Que.

Mr. Chamberland graduated in civil engineering from Laval University in 1953.

**S. P. J. Dubeau,** S.E.I.C., is now a designer of electrical equipment with the Department of National Defence in Ottawa, Ont.

He was previously associated with Canadian Westinghouse Co. Ltd. in Granby, Que.

**Christopher G. M. Kirby,** S.E.I.C., has recently joined the technical staff of the temperature and radiation section of the physics department of National Research Council.

He was previously associated with the Montreal Engineering Company on the construction of Price Brothers and Company Ltd. power project at Chute des Georges.

**P. Francois Bisson,** S.E.I.C., has joined the staff of the engineering department of the Ste. Anne Pulp and Paper Company in Beaupre, Que.

**F. W. Parsons,** S.E.I.C., has joined the Iron Ore Company of Canada at Knob Lake, Que.

He was formerly associated with Standard Lime Co. Ltd. at St. Marc des Carriers, Que.

**L. E. Packham,** S.E.I.C., has joined the staff of A. V. Roe Canada Ltd. in Toronto.

## Visitors to Headquarters

**C. E. Howard,** M.E.I.C., Ottawa, Ontario, April 27, 1954.

**Alan E. Cameron,** M.E.I.C., Halifax, Nova Scotia, April 29, 1954.

**R. C. T. Stewart, M.E.I.C., Halifax, Nova** Scotia, May 5, 1954.

**E. Mason,** M.E.I.C., Trail, British Columbia, May 7, 1954.

**W. T. Butler,** M.E.I.C., Sault Ste. Marie, Ontario, May 13, 1954.

**R. R. Colpitts,** M.E.I.C., Moncton, New Brunswick, May 26, 1954.

**E. R. Jacobsen,** M.E.I.C., Sao Paulo, Brazil, June 4, 1954.

**W. O. Richmond,** M.E.I.C., Vancouver, British Columbia, June 4, 1954.

**George M. Dick,** M.E.I.C., Sherbrooke, Quebec, June 9, 1954.

**Marjorie Peebles,** Vancouver, British Columbia, June 11, 1954.

**A. Peebles,** M.E.I.C., Vancouver, British Columbia, June 11, 1954.

# Obituaries

*The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.*

**Paul Roderick Gransaull,** M.E.I.C., of St. Augustine, Trinidad, B.W.I., died on October 5, 1953.

Mr. Gransaull was born at St. Joseph, Trinidad, on January 15, 1881. After attending public and private schools, he served his apprenticeship for six years with H. R. Marwood, M.I.C.E., resident engineer for the Trinidad Government Railways. During that time he was engaged in the preparation of drawings, specifications and tracings; leveling, the taking of small surveys, setting out, supervising and measuring up work.

In 1904 he came to Canada where he joined the staff of Canadian Pacific Railways as topographer. During the following years he was employed as instrumentman with the Atlantic Quebec and Western Railway, as transitman with Canadian Pacific Railways at Moose Jaw, Saskatchewan and at the Winnipeg terminals, and as resident engineer at Souris, Manitoba and at Winnipeg. He was transferred to Edmonton, Alberta, in 1914.

In 1915 Mr. Gransaull returned to his native island of Trinidad and became assistant district engineer for the Siparia Railway Extension in St. Joseph. He moved to Port of Spain where he was employed as an engineering contractor and manufacturers' agent in 1921, and seven years later he was appointed general manager of the Palo Seco Oilfields in Palo Seco, Trinidad. In 1935 Mr. Gransaull was employed in Tunapuna, Trinidad, as road officer for the Tacarigua Local Road Board. He retired from active engineering work in 1949.

Mr. Gansaull joined the Engineering Institute of Canada as a Student in 1905, transferring to Associate Member in 1911 and to Member in 1940. In 1952 he was granted Life Membership in the Institute.

**Clayton Dewitt Dean,** M.E.I.C., former comptroller of taxation with Imperial Oil Limited, died at his home in Toronto on March 26, 1954.

Mr. Dean was born in Decewsville, Ontario, on June 28, 1888. After completing his elementary education, he attended the University of Toronto, where he received his B.A.Sc. degree in 1911.

During the summer months of his university training he was employed with the Grand Trunk Pacific, the Canadian Northern Railway, and Imperial Oil Limited.

After graduation he joined Imperial Oil Limited on a permanent basis as draughtsman and designer in Sarnia, Ontario. In 1912 he became engineer in charge of the company's construction at Fort William, Ontario, and a year later, he was appointed assistant to the chief engineer and the mechanical superintendent there. By 1916 he held the position of technical and process advisor to the directors on construction and manufacturing matters.

Mr. Dean was named vice-president and manager of Imperial Pipe Line Company Limited in 1928, and was appointed comptroller of taxation in 1933. He retired in 1950 after completing about 40 years of service with the company.

Mr. Dean was active in devising safety measures for loading and unloading trucks, one of which is the familiar use of ground chains on gasoline trucks to equalize static electricity, making it possible to transport gasoline on city streets with safety. He also made the first comprehensive analysis of cracking from large scale runs, as well as initial developments on vacuum distillation for improving lubricating oils.

Mr. Dean joined the Engineering Institute of Canada as an Associate Member in 1919, transferring to Member in 1940.

**James R. Paget,** M.E.I.C., president of Assiniboia Engineering Company Limited in Calgary, Alberta, died suddenly in Calgary on November 3, 1953.

Mr. Paget was born in Sundridge, Ontario, on January 21, 1884. After completing his high school education, he began his engineering career in 1902 as a rodman on construction work with the Canadian Pacific Railway. Two years later he became transitman on the construction of the company's double track between Winnipeg and Fort William.

During 1906 and 1907 he served as assistant city engineer at Monterey, Mexico, but returned afterwards to Canadian Pacific Railway construction work as instrumentman.

In 1908 he was appointed resident engineer in charge of the construction of the division yards at Watrous and Biggar on the Grand Trunk Railway. Two years later he was named assistant engineer in charge of a Canadian Pacific Railway location party which ran 1,460 miles of preliminary survey and 940 miles of located line in Saskatchewan, Alberta and British Columbia.

In 1914 he became resident engineer on construction, and two years later he was appointed assistant engineer in charge of field work on the Winnipeg aqueduct. In this latter position he constructed the cavity and pressure sections of the aqueduct, as well as the valve chambers and ventura meters. He served as locating engineer from 1919 until 1921 in the running of 620 miles of preliminary line and 218 miles of located line for the Canadian Pacific Railway, and in 1921 he became transitman on maintenance of way with the Medicine Hat subdivision.

In 1922 Mr. Paget entered into private practice and was engaged in making surveys and estimates on irrigation projects in Alberta and Montanna.

Mr. Paget in 1932 became president of the Assiniboia Engineering Company which has been engaged in contracting work in Ontario and Saskatchewan.

He entered into semi-retirement in December, 1952, and was active only in an advisory capacity for Assiniboia Construction Company Limited who took over the work of his own company, namely Assiniboia Engineering Company Limited and J. R. Paget and Company at that time.

He was a member of the Association of Professional Engineers of Saskatchewan.

He joined the Engineering Institute of Canada as an Associate Member in 1920, transferring to Member in 1940.

**Eric Morrell Coles, D.F.C.,** M.E.I.C., vice-president of Canadian Westinghouse Company Limited, vanished in his personal aircraft on April 12 while on his way to Vancouver, accompanied by his wife. The last message received from the Westinghouse executive came from 13,000 feet over the City of Seattle when Mr. Coles reported to ground control

**Eric Morrell Coles, M.E.I.C.**

that the engine had cut out. It is presumed that the aircraft crashed in the waters of Puget Sound.

Mr. Coles was born in London, England, on December 2, 1895. He received his early education in Vancouver public and high schools, and after a year at the University of British Columbia, he interrupted his course in 1915 to join the Royal Flying Corps. He proceeded overseas with the rank of lieutenant. When this branch of the Service was later changed to the Royal Air Force, Mr. Coles was subsequently promoted to the rank of captain and flight commander. He took part in more than one hundred bomber operational flights, and at the age of 21, was decorated with the D.F.C. for his service.

At the close of the war he resumed his studies at the university and graduated in 1922 with a B.A.Sc. degree in mechanical engineering. Immediately afterwards he was appointed an instructor and later, an assistant professor of electrical engineering by the University of British Columbia.

Mr. Coles joined the Canadian Westinghouse Company in 1926 as a design engineer in the synchronous motor and generator section of the engineering department and, in 1928, he was placed in charge of all patent activities of the company. He was named assistant to the vice-president in 1937; the assistant to the president in 1939; and vice-president in 1940.

After World War II was declared the training of sufficient numbers of flying personnel became a pressing problem for the Allies. The Empire Air Training Plan was launched and Mr. Coles' knowledge and experience in this field proved invaluable. At that time he was a vice-president and director of the Hamilton Flying Club and worked tirelessly in the training of fledgling pilots. He became vice-president of No. 10 Elementary Flying School and made a major contribution to the school's fine wartime record.

In 1944 he was appointed vice-president and director of engineering of the Canadian Westinghouse Company, and in 1948 he was elected a director of the company. Later positions were those of vice-president in charge of planning and development, and vice-president and general manager of the apparatus division.

Mr. Coles was a member of the American Institute of Electrical Engineers, the Association of Professional Engineers of the Province of Ontario, the Canadian Manufacturers Association, the Canadian Electrical Manufacturers Association, the Canadian Standards Association, and the Hamilton Chamber of Commerce.

He joined the Engineering Institute as a Student in 1922, transferring to Associate Member in 1926, and to Member in 1940.

**Walter James Poyner,** M.E.I.C., staff assistant and production manager of the Canada Starch Company in Cardinal, Ontario, died in the Brockville General Hosiptal on March 13, 1954, as a result of injuries sustained in a head-on collision near Iroquois on March 12. He and his wife had been motoring to Cornwall to attend the dinner-dance of the Cornwall Branch of the Engineering Institute.

Mr. Poyner was born in Montreal, Quebec, on August 2, 1915. After attending public school in Cartierville, Quebec, he went to West Hill and Westmount high schools in Montreal, and afterwards to McGill University where he graduated with a B.Sc. degree in chemical engineering in 1938.

Upon graduation he joined the Canada Starch Company and spent three years as a student engineer at the Pekin and Argo plants of the Corn Products Refining Company in Illinois. On his return he was appointed refinery superintendent in charge of manufacturing and refining of glucose, sugar, syrup and edible oil. Then, in 1947, he was named production manager and staff assistant, and as such, was responsible for the scheduling and co-ordinating of production in all departments, and for the supervising of warehousing, shipping and the operation of the plant railroad.

Mr. Poyner served as president and director of the Cardinal Consumers Co-operative Store. He was an active badminton and tennis player and also participated in many of the theatrical presentations of the Brockville Theatre Guild.

Mr. Poyner joined the Engineering Institute of Canada as a Member in 1952.

# Employment Service

**THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.**

**NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.**

**REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.**

**INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.**

## Situations Vacant

### CHEMICAL

A CHEMIST WITH a B.Sc. degree in chemistry or better with good background in organic chemistry, preferably with one or two years' experience in the pulp and paper industry, but not an absolute requisite. Duties include special analytical work, experimentation on cooking and bleaching of kraft base pulp, also on development of by products. File No. 4835-V.

GRADUATE CHEMIST REQUIRED TO BE trained as assistant to chief chemist. Plant located at Cardinal in Ontario in one of Canada's oldest food industries. Forward all details of experience, education, with pictures, and anticipated salary to File No. 4837-V.

CHEMICAL ENGINEERS required for research and development department of large world wide organization with plant located in Montreal. Duties to do development work on various products made from fibres or adhesives. This work will consist of improving our present operations and finding new methods of processing. A certain amount of research work on developing new products will be undertaken. File No. 4844-V.

CHEMICAL ENGINEER, required 1954 graduate with pulp and paper experience. Investigation of paper quality or production problems on both laboratory and mill scale, analysis of test date, development of test methods, etc. Working under the divisional chemist. File No. 4864-V.

### CIVIL

GRADUATE CIVIL ENGINEER wanted for municipal work in Alberta and Saskatchewan. Please submit details of experience and when available. Experience in water and sewer utility construction preferred. File No. 4811-V.

CIVIL ENGINEER required for Ontario Government to take charge under direction, of the administration of The Provincial Aid to Drainage Act throughout the Province. Should have experience with land assessments and understand the municipal drainage act. Position requires mostly office administration work, but some contact work with municipal officials throughout the Province is required. Full employee privileges available, including three weeks vacation, a day and one-half per month illness credit, and superannuation. Interested parties should apply in own handwriting giving full particulars of age, education and especially experience in the type of work to be performed. Salary can be set to suit qualifications of successful applicant. File No. 4812-V.

CIVIL ENGINEER, registered professional engineer with experience in municipal engineering required by firm of consulting engineers. Applicants must be capable of making detailed designs and supervising field crews. Work will be in Alberta from Edmonton office. Address all applications giving full details of qualifications, experience, references and salary required to File No. 4814-V.

CIVIL ENGINEER required for bridge design in a large transportation company with headquarters in Montreal. File No. 4850-V.

ASSISTANT CHIEF ENGINEER wanted for large construction company. Applicant must have thorough knowledge and experience in reinforced concrete design capable of estimating building of road construction and all branches of general construction work. Excellent salary to the right man. Good prospects for the future. Do not apply unless you are thoroughly experienced. File No. 4853-V.

CIVIL ENGINEER REQUIRED by the technical co-operation service department of Trade and Commerce, Ottawa. Canada, to serve in Burma. The union of Burma has plans for an expansive scheme in Hydro Electric development. The engineer should be Canadian and will act as special advisor to the chairman of the Burmese electricity supply board to review the designs and specifications and supervise general construction. Salary would be in the range of $14,000 to $17,000 per annum. Free furnished accommodations, cost of internal travel, free hospital and medical treatment. File No. 4857-V.

CIVIL ENGINEER required, preferably recent graduate of McGill University with at least one year's experience in the field. Will be sent to U.S.A. for two months to study the methods of operation, after which time he would be attached to Montreal office. Applicant must be Canadian. File No. 4860-V.

ENGINEER CIVIL PREFERABLY, wanted for young progressive construction company. Preferably one with experience in sewage and water supply as well as cement work as we are specializing more in this line of work. When replying, please state age, graduation and experience. File No. 4865-V.

### ELECTRICAL

SALES ENGINEER required by well established and highly respected company in the field of scientific illumination. Duties, after a specific training period of approximately two years duration, will involve the sale of prismatic lighting units and the discussion of lighting applications with architects, consulting engineers and electrical contractors, officials of industrial and commercial firms, municipal and hydro offices. Qualities of personality, diligence, and dependability along with a sincere desire for a permanent career in the lighting industry are of prime importance. File No. 4807-V.

ELECTRICAL ENGINEER with several years experience required mainly with experience on production engineering of electronic equipment. Salary would commensurate with the applicant's experience and qualifications. File No. 4862-V.

THREE ELECTRICAL ENGINEERS to work on progress reports, the study of time costs, coding for time and equipment reports for large construction job located in Labrador. File No. 4867-V.

SENIOR ELECTRICAL ENGINEERS required by contractor working in Labrador. Applicants should be fully familiar with the installation of equipment for power plants. File No. 4867-V.

TORONTO MANUFACTURER requires a designer for aircraft electrical systems: A.C. and D.C. generators and motors, regulators and protective devices. A degree in electrical engineering or equivalent in design experience is essential as work includes basic design calculations. Familiarity with A.N. specifications a real asset. Reply with full particulars and salary required to File No. 4870-V.

ELECTRONIC ENGINEERS required for attractive positions. Degree in electrical engineering or equivalent, 5 to 10 years general experience with 1 to 5 years specific radar experience. Supervisory ability, able to maintain liaison and work efficiently under pressure. Canadian citizenship or British nationality a requisite. Attractive employee benefits. File No. 4874-V.

### MECHANICAL

MECHANICAL ENGINEER $6,420. to $7,200, department of Public Works, Ottawa. Details and application forms at your Civil Service Comm. Office, National Employment Office, Post Office and University Placement Office. Quote competition No. 54-1202. File No. 4805-V.

PROFESSIONAL ENGINEER preferably mechanical but not necessary required by real estate organization. Age 40 to 50 years with experience where work would result in the greatest general knowledge of different types of industry, or allied work. Ability to meet and sell senior industrial executives. Group commission plan. Applicant will be trained to become assistant manager of the department. Location Toronto, a knowledge of the Toronto area would be helpful. File No. 4821-V:

ENGINEER REQUIRED BY large beverage company located in Montreal with experience in all types of material handling. Top salary to right man with all benefits. Mechanical preferred. Age 35-45 years, bilingual if possible. File No. 4834-V.

DESIGN ENGINEER WITH minimum eight years' experience in gear design and automotive transmissions. Age 45 or under. Must be creative and willing to do actual design work on board. File No. 4842-V.

DESIGN ENGINEER WITH minimum eight years' experience in the design of farm tractors or other farm equipment. Must be creative and willing to do actual designing on the board. Age 45 or under. File No. 4842-V.

DESIGN ENGINEER WITH minimum eight years' experience in the design of internal combustion engines, preferably as applied to tractors. Age 45 or under. Must be creative and willing to do actual design work on board. File No. 4842-V.

DESIGN ENGINEER with minimum eight years' experience in hydraulics preferably as applied to tractors. Age 45 or under. Must be creative and willing to do actual design work on board. File No. 4842-V.

PLANT FACILITIES ENGINEER required for a major appliance manufacturer. Graduate mechanical engineer with a minimum of 3 years' machine design and a sound knowledge of electrical welding and substations. A challenging position is offered to a person capable of initiating and carrying through cost reduction, machine and process improvement including working with maintenance supervisors on installation and maintenance. Age to 45. Salary commensurate with ability. File No. 4845-V.

POWER PLANT EQUIPMENT sales engineer, mechanical graduate of Canadian university, wanted to form own company to sell and later to assemble in Eastern Canada, power plant controls and instruments. Prominent American manufacturers launching extensive expansion program of sales and service in Canada. Several years experience in sales to power plants or in operating steam plants essential. Any personal capital advantageous. File No. 4849-V.

CHIEF MECHANICAL ENGINEER, salary up to $7,200. required by Department of National Defence, Ottawa. Details and application forms at your nearest Civil Service Commission office, National Employment Office and University Placement Office. Quote Competition No. 54-1204. File No. 4855-V.

MECHANICAL ENGINEER required in mechanical department to teach machine design and physical metallurgy among other subjects. Applicant should have his M.S. in M.E. The faculty rank of the position will depend upon the qualifications of the person engaged. A properly qualified individual can expect to be the head of the department in 4 or 5 years. One with less experience will be given a contract as an instructor or assistant professor. File No. 4863-V.

MECHANICAL ENGINEER required by outstanding worldwide industrial organization engaged in research and development in the field of aero and thermodynamics. Excellent opportunity for graduate engineer and preferably one who has specialized in thermodynamics. File No. 4875-V.



MECHANICAL ENGINEER, one with 2 or 3 years experience preferred but not essential, for modern sulphate pulp mill, located north shore Lake Superior on C.P.R. main line and highway 17. New attractive Townsite, housing or firts class hotel accommodation at subsidized rates. Good recreation facilities and benefit plans. Well established engineering department offering good future and working conditions, five day week. Write giving full particulars to File No. 4879-V.

MISCELLANEOUS

THREE SALES ENGINEERS required by manufacturer of multiwall Kraft bags and related paper products. 1954 graduates to 3 years of experience. Training period in Montreal. Subsequent work in variety of locations. File No. 4777-V.

CHEMICAL OR MECHANICAL ENGINEER with from two to five years experience on industrial maintenance work. The position is in the maintenance department working as a project engineer on projects on the maintenance of the buildings and equipment of the plant, including some design work in the nature of alterations and improvements. Location P.Q. File No. 4808-V.

SENIOR DESIGNER required for work on steam boilers and associated equipment. Applicants should have 3 to 5 years recent experience in this field. The work will include the detailed handling of contracts, and the design work necessary for the preparation of proposals and specifications. The applicant should be conversant with heat transfer as it relates to steam power equipment. A knowledge of work on pressure vessels and heat exchangers will be desirable. Location Toronto. File No. 4810-V.

QUALITY CONTROL SUPERVISOR required in Montreal. A Canadian manufacturer of fibres, adhesives and plastics is seeking a graduate engineer with industrial experience in quality control and knowledge of statistical methods. This key position with a future requires a man with ability to plan, organize and supervise all of our quality control activities and to carry out liaison work with our American parent companies. Bilingual required. Salary will be negotiated. All inquiries and applications will be treated in confidence. Please send a complete resume of your educational background, work experience, personal data and references etc. to File No. 4813-V.

FEDERAL CIVIL SERVICE requires a number of engineers for employment as patent examiners at Ottawa to undergo training in patent law and patent regulations in force in Canada, and then to assume the responsibility for the examination of applications for patents in the field of engineering with a view to making recommendations for the award or denial of patents. The desirable qualifications include a bachelor's degree in applied science with specialization in mechanical, chemical or electrical engineering from a university of recognized standing. File No. 4815-V.

ENGINEERS ARE REQUIRED by the International Economic and Technical cooperation Division, Ottawa Canada for the government of India. Mechanical and Civil graduate engineers with particular experience in connection with hydroelectric design, preferably for high dams, having had responsible charge of the work of design groups involving supervision of planning and scheduling work of subordinates and of the execution and adequacy of designs. The Bhakra-Nangal project is a multi-purpose river valley development scheme for harnessing Sutlej River waters to extend irrigation. File No. 4817-V.

SALES ENGINEER required by a growing organization in the compressor and compressed air equipment field. Area would be South Central Ontario. Straight salary basis. File No. 4818-V.

U.N.E.S.C.O. HAS BEEN requested for assistance in recruiting suitable candidates for vacant university professorships abroad. Burma: agronomic chemistry and soil chemistry. India: economics, civil, mechanical and e ectrical engineer. Indonesia: technological subjects. Israel: hydraulics and/or sanitary engineering, electrical (Electronics and telecommunication), mechanical, mathematics, general mechanics, and oscillations, metallurgy, aircraft structures, aircraft propulsions (applied aerodynamics). Turkey: electro-technics hydraulics (power), roads and communications, construction and building materials. Uruguay: construction of buildings. Venezuela: roads and communications, hydraulics (construction), building material and soils. File No. 4819-V.

MANUFACTURER OF complete line of industrial, electrical motor control equipment has just completed a new plant in Galt, Ontario. Competent sales engineers are required for Ontario and Quebec territories. Applicants should have electrical mechanical or engineering business training. File No. 4820-V.

SALES ENGINEER is required by a prominent Canadian electronics manufacturer. This man must be a recent graduate in physics, engineering physics or chemistry and have sales experience or aptitude. The product is a wide range of high quality electronic research and control equipment and the sales territory includes all Quebec. Industrial centres with headquarters in Montreal. Reply should include details of age, experience and education. A recent photograph should be included if possible. File No. 4822-V.

ENGINEER REQUIRED WITH experience in methods and standards. Applicant should have a good technical and work shop training with a knowledge of time study. Location Ontario. Manufacturer of machine tools. File No. 4823-V.

STRUCTURAL ENGINEER with a few years experience for consulting office in Montreal. Inside and outside work, design, calculation, drawing and supervision. File No. 4825-V.

THE PAKISTAN INDUSTRIAL DEVELOPMENT Corporation invites applications for position of works manager for their paper mills at Chandraghona. File No. 4827-V.

THREE DESIGN engineers required by department of Transport Ottawa. Structural, electrical, mechanical to design and develop program for new airport terminal buildings, across Canada, and also modifications to existing terminal buildings. File No. 4832-V.



MECHANICAL OR CIVIL engineer with a minimum of five years up to ten year's experience to undertake work supervising installations, etc., which would be engineered in our engineering department. File No. 4835-V.

SENIOR PLANNER REQUIRED by suburban planning board, London, Ontario for preparing physical phases of comprehensive plan and supervising routine subdivision and zoning work. Graduate in planning, civil engineering or architecture preferred. Salary in accordance with experience and training. State qualifications, references and salary expected to File No. 4838-V.

PATENT FIRM long established in Ottawa has a vacancy for young engineer, preferably chemical or electrical. Some experience in patent matters is desirable but not essential. Replies should outline qualifications and experience and should state age and marital status. File No. 4839-V.

THREE TECHNICAL SALES TRAINEES required to understudy various positions throughout the sales organization which include inside representative, field salesman, technical serviceman, sales administrator. Graduate from Canadian University '52, '53 or '54. Location Toronto initially, could be located in any one of six major Canadian cities. File No. 4840-V.

SALES DEVELOPMENT engineer, mechanical, civil or metallurgical required for sales force of long established fabricating plant. Experience in pulp and paper mill or mining field an asset. Location Montreal with considerable travelling. File No. 4843-V.

CHEMICAL OR MECHANICAL ENGINEER, recent graduate, required by oil company in Montreal. Age limit 25-32. Preferably bilingual and car owner. Salary depending upon qualifications. File No. 4846-V.

ENGINEERING LIBRARIAN required to operate technical library with staff of seven, serving aircraft engineering department of 750 personnel. Applicants should have an aeronautical engineering degree or the equivalent aeronautical engineering experience, library training and direct experience in the operation of a technical library. Replies should indicate training and experience in detail, and salary requirements. File No. 4848-V.

LECTURER OR ASSISTANT professor of chemical engineering required to give unit operations course with laboratory and design calculations course to junior and senior year classes. Time available for graduate study and research. Industrial experience desirable but not requisite. Salary dependent upon qualifications. Apply Nova Scotia Technical College, P.O. Box 1000, Halifax, Nova Scotia. File No. 4851-V.

RESEARCH ENGINEER required by Saskatchewan Department of Mineral Resources $326-$397 per month. Recent graduate in ceramic, chemical or geological engineering; to carry out lab. and pilot scale experimental work, field exploration, and economic surveys dealing with the non-metallic or industrial minerals of the province. Good pension plan and conditions of employment. For further information and application forms contact the Public Service Commission, Legislative Building, Regina. File No. 4852-V.

CIVIL AND/OR MECHANICAL engineer required by a firm of consulting engineers in Western Ontario. Preference given those with experience in municipal engineering and sewage treatment plant design, or commercial and industrial building design. This position can lead to an interest in the firm if qualifications are sufficient. All replies treated with strict confidence. Please provide complete outline of experience and background with first letter. File No. 4854-V.

RESEARCH PHYSICIST or engineer required by the Pulp and Paper Research Institute of Canada to take charge of a long-range project now being initiated on the fundamentals of mechanical pulping, i.e. the factors governing the mechanical separation of paper making fibres from wood. Necessary qualifications will include a post-graduate physics or engineering degree with emphasis on mechanics and mathematics; experience in planning, executing, and reporting research projects, and the ability to confer with mill staffs on the practical data pertinent to the problem. Salary will be commensurate with training and experience. File No. 4856-V.

ENGINEER REQUIRED by paper board converter organization manufacturing a wide variety of cardboard containers and special packaging. Duties include a considerable amount of machine design and in addition to investigate a preventative maintenance program to cover all production equipment. Applicant should be prepared to continue on as assistant engineer in the engineering department. Salary would be based on qualifications. The location will be London, Ontario. File No. 4858-V.

PRODUCTION MANAGER required for manufacturers of aluminum doors and windows. Someone experienced in this phase of work would be appreciated, but not absolutely necessary. Applicant should be 30 years of age or over and bilingual. Salary is open, depending upon qualifications. File No. 4861-V.

CHIEF PLANT ENGINEER required for a senior position. Applicant must be a graduate engineer with extensive experience on design and construction of office and plant buildings and plant mechanization and be capable of planning and guiding the work of a large department. File No. 4866-V.

GRADUATE CHEMICAL or mechanical engineer required preferably with three to four years chemical plant experience to act as project and assistant to the chief engineer. Plant is situated 40 miles west of Montreal. Duties will involve about 50% of the time on bottling and packaging installations, maintenance, cost studies and methods improvements, project engineering involving estimates, upkeep and installation of boiler house operations, grain handling and milling distillation, and ware housing, and including all services, such as air, water and steam. File No. 4868-V.

MECHANICAL OR MINING ENGINEER required by small expanding sales engineering company backed by large financial organization, handling conveyors, belts, transmission equipment and related items to mines, quarries, and larger industrial organizations. Applicant should be 25-35 be prepared to travel in Ontario and Quebec, operate from Montreal primarily and later to open Toronto office. Salary and commissions with travelling paid, set on incentive basis, with no top limit. Average man should earn minimum $6,000.00. State qualifications and availability. File No. 4869-V.

SENIOR TIME STUDY engineer required by a progressive plant in south western Ontario. A production engineer 28 to 35 years of age to head their time study department. Applicants should state experience, age and salary expected. File No. 4871-V.

ASSISTANT TO HEAD OFFICE sales division manager required by well established Montreal Engineering and manufacturing firm. A man between 25 and 35 to assist in industrial marketing with emphasis on technical applications and sales supervision. Must have a minimum of five years experience, with particular reference to sales application in electronic and mechanical fields. Graduate engineer preferred; but not essential provided adequate background exists. Analytical and visualization aptitudes along with clarity of written expression are most essential. File No. 4872-V.

SALES ENGINEER wanted by established transformer manufacturer, for Montreal district. Bilingual preferred. State age, education, experience and salary required. File No. 4873-V.

MEMORIAL UNIVERSITY OF NEWFOUNDLAND, St. John's, invites immediate applications for the following position to take effect in September 1954. Assistant or Assistant Professor in the Department of Engineering. The duties would include lecturing and laboratory supervision. The subjects of instruction are drawing, surveying and mechanics. The university has a liberal pension scheme and a generous sabbatical leave programme. Appointments are provisional for the first two years. Travel expenses to a maximum of $750.00 will be paid. Immediate applications or requests for information should be sent by airmail with curriculum vitae and names of three references. File No. 4830-V.

FOUNDRY METALLURGIST required by large manufacturing concern in Montreal, operating steel cast iron and bronze foundries. Experience desirable but not essential. File No. 4876-V.

SENIOR ELECTRONIC ENGINEER with degree in physics or electronics from a recognized university with at least five years experience in electronic circuit design. British subject preferred. Salary commensurate with ability. Send resume to File No. 4877-V.

## Situations Wanted

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc. (E.E.) McGill 1950, age 26, single, bilingual, C.G.E. test course graduate. 6 months transformer designs. 2½ years assistant electrical superintendent on construction of industrial plant. Desire work of permanent nature with responsibilities commensurate with experience. File No. 385-W.

ELECTRICAL ENGINEER, Jr.E.I.C. B.Eng. (McGill '50), age 26, married, since graduation employed by firm manufacturing pulp and paper mill machinery with experience including design, production and engineering sales. Desires responsible position with electrical firm offering an opportunity to specialize in the electrical power field. Location Montreal preferred but will consider locating anywhere in Canada. File No. 730-W.

STRUCTURAL STEEL DETAILER REQUIRES immediate employment anywhere in Canada; now in Toronto. Long term preferred, short term accepted. Have capacity for checking, supervision, estimating, and sales. Contract tenders submitted. M.E.I.C., P.Eng. (Que.) File No. 1935-W.

GRADUATE ENGINEER, B.A.Sc., M.E.I.C., P.Eng. (Ont.) seeks technical development work as assistant to works manager or chief engineer of medium sized company. Experience includes office work and training course with Canadian electrical manufacturer, for years in Canadian patent office, and ten years varied work on technical phases of design, development and manufacture of domestic refrigeration and other products. Recent aptitude testing confirms suitability for this type of work. Present earnings $7,500. File No. 1953-W.

PUBLIC UTILITY ENGINEER, nine years experience, water, hydro, gas, sewerage. Present contract expires June 1954. Supervising $3 million project including preparation rate structure, construction, design, purchasing. Canadian, aged 40, married. B.A.Sc., M.E.I.C., C.E., P.Eng. Desires position as public utility engineer or staff consultant anywhere in Canada. File No. 2468-W.

MECHANICAL ENGINEER M.E.I.C., P.Eng. (Que.) 8 years experience including 3½ years with a telecommunications manufacturing concern, checking mechanical design, supervision of prototype work and liaison with factory. Interested in obtaining position with responsibility and scope for advancement, preferably in electronic or allied industry. Apply in writing to File No. 2829-W.

ELECTRICAL ENGINEER Jr.E.I.C., P.Eng., B.Sc. (E.E.) Manitoba 1950, age 30, married, one child. 1½ years experience on induction motor design. Over 2 years experience in the supervision of transformers. Also gained experience in the specifying and supervision of installation of new testing equipment. Interested in securing a responsible position in Western Canada with either a manufacturing firm, a utility, or a governmental branch, preferably in Regina or Winnipeg. Available on one month's notice to present employer. Complete qualifications upon request. File No. 3309-W.

GRADUATE MECHANICAL ENGINEER, Sask. 1948, Jr.E.I.C., married, R.C.A.F. veteran. Three years experience in production control, method analysis, time study, cost control and industrial relations. Also some experience in steel mill maintenance. Three years experience on construction jobs supervising mechanical installations including heating, ventilating and plumbing trades, boiler installation, water treatment and mine installations. Desires position with firm requiring above mechanical experience and/or opportunities for design with consultant firm, preferably in central Canada. File No. 3516-W.

MECHANICAL ENGINEER, Jr.E.I.C., P. Eng., B.E. 1950, single, age 27, bilingual, presently employed as assistant chief engineering draughtsman with wide responsibilities, 30 months diverse experience prior to graduation in pulp and paper and automotive industries. Seeking position with increased responsibility would consider overseas assignment. File No. 3931-W.

MECHANICAL ENGINEER, Jr.E.I.C., P. Eng., 1950 honours graduate, age 27, married. One year's experience in the operation and administration of a small railway system including some supervision of personnel. Three years experience on layout and design of machinery utilizing air, hydraulic and electrical power supplies, and the setting up of controls for same. I have been responsible for the planning, layout, design and field installation of equipment in several large plants. Interested in a position involving design and development work, production engineering or plant engineering with the opportunity to take on responsibility. File No. 3975-W.

EMPLOYERS are you looking for a potential future executive in production or management? Ambitious professional engineer (electrical) with the following qualifications desires change of employment with future possibilities of primary importance McGill 1951, age 26, married, C.G.E. test course, wire and cable engineering, presently employed as assistant project engineer with large chemical manufacturer. File No. 4014-W.

CHEMICAL ENGINEER, McGill 1950, Jr. E.I.C., P.Eng., 3½ years experience in control, development and operation. Desires permanent position with promising future. Development work preferred, but would consider other offers. File No. 4042-W.

CHEMICAL ENGINEER, Queens' 1949, Jr. E.I.C., veteran, 33, married. Three years supervisory experience in the development, control and production phases of a large chemical plant. Desire the same type of experience in another manufacturing field. Canadian or Foreign. File No. 4166-W.

MECHANICAL - CHEMICAL ENGINEER, (M-Eng.-Dresden-Karlruhe) M.E.I.C., P. Eng. Former lecturer at McGill. 15 years experience as plant engineer and assistant manager in heavy industrial and chemical plants. Process and design for chemical plants. Bilingual. Single. Location anywhere. File No. 4183-W.

CIVIL ENGINEER, B.A.Sc., P.Eng., Jr E.I.C., seeks position with contractor or manufacturer. Five years concentrated experience civil and mechanical design, estimating, supervision. Am interested in position with opportunities in Ontario. Presently employed. Available upon reasonable notice. File No. 4191-W.

MECHANICAL ENGINEER, M.E.I.C., graduated, married, sound Canadian practice, twenty years experience includes: design, estimating in piping, heating, ventilation, air conditioning, refrigeration plumbing, steam and powerplant installations. Experience in manufacturing industry, foundry, boilers, pressure vessels, pumps, compressors, valves, shopwork, paper and pulp industry construction. Capable for administrations, organizing, supervision, sales. Desire a position of responsibility suitable to past experience with possibilities for advancement. Location in Montreal. Available on one month's notice. File No. 4211-W.

MANAGEMENT ENGINEER, M.E.I.C., age 39, family. Queen's 1936, B.Sc. (Hon.) mechanical, P.Eng. (Ont.). Seventeen year's industrial experience, eight years in aircraft, three years in bus and five years in miscellaneous sheet-metal manufacture; last year spent in light construction industry operating own business. Experience includes all phases of factory operation as well as top level general management assignments. Good record in organization work, labor relations and product development through all phases of design, tooling, material and production control, sales cost accounting and management control. Seeking management career opportunity, any location domestic or foreign with Southern Ontario preferred. Available on short notice. File No. 4219-W.

ELECTRICAL ENGINEER, B.A.SC. (UBC, 1951), age 29, experience: design and development of induction motors, power stations, high voltage switchgear, surveys of manufacturing and test facilities, training course with large manufacturer; desirous of improving present position; supervisory, administrative, junior executive jobs preferred. File No. 4239-W.

1943 GRADUATE IN CIVIL ENGINEERING University Berlin, age 34, married, 2 children. Specialization in hydraulics, 7 years experience in design of navigable waterway, dams, locks and hydro power stations, hydraulic research and hydraulic laboratory work, and also river regulations and water supply. File No. 4244-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng. (Que. & Ont.), married, age 30, presently employed, with 8 years experience ranging from construction of residential, industrial and commercial bldgs.; design of timber structures including glue laminated members; considerable purchasing cost accounting, job liaison, estimating, and responsibility for complete execution of contracts, desires position where diversified abilities may be best utilized leading to future advancement in responsible position. File No. 4254-W.

SALES ENGINEER, graduate mechanical engineer, married with family, good personality, initiative, keen business acumen, very adaptable, bilingual, 10 years diversified technical sales experience, general machinery equipment, sheet metal, ball bearings, heating equipment, experience in all types of material handling, desires position with opportunity. Available on short notice. File No. 4300-W.

CHEMICAL ENGINEER, 32, B.A.Sc. (Hon), P.Eng., Jr.E.I.C., veteran, 1½ years process and quality control supervision, 2½ years process development in cellulose products, lacquers and solvent recovery, 3 years business experience, desires responsible position preferably in Southern Ontario, supervisory and/or technical. File No. 4391-W.

CIVIL ENGINEER, D.L.C. (Hons), M.E.I.C., P.Eng. (Ont.); G.I. Struct. E., awaiting election to A.M.I.C.E. Age 28, single. 6 years experience on construction of dry dock and deep-water quay, power station, air fields, bridge, roads, railways; surveys, design of steel piled cofferdams, track layout and construction schemes. Responsible for supervision of layout, construction, concrete inspection, pile driving, under-water drilling, pressure-grouting, test boreholes, and diving operations. Measurement of quantities and cost reports. Presently employed as area engineer on construction of chemical plant. Seeks position of responsibility suitable to past experience. Location anywhere in Canada. File No. 4420-W.

ELECTRICAL ENGINEER, M.E.I.C., A.M. I.E.E., British, 37 years of age, with considerable experience in the design and development of naval and associated installations, also in testing of all types of shipboard equipment and preparation of test programs, data, etc.; and also having considerable experience of servo mechanisms and other remote control devices, including railway power signalling systems; having been responsible at various times for preparation of specifications, quotations, purchase orders, estimates, etc.; and having supervised the activities of junior engineers, draughtsmen, technicians and electricians in various capacities; seeks a lucrative and responsible post in August, 1954. Will serve anywhere, and would be fully prepared to travel extensively, if necessary. Seeking a post which will lead to a senior position and permanency. File No. 4441-W.

MECHANICAL ENGINEER, M.E.I.C., P. Eng., married. 20 years experience industrial equipment layout, mills crushing plants, smelters, handling equipment, design and supervision of design and construction. Two years plant engineer. Location preference Toronto area. Desires position in engineering office as supervisor or assistant in plant layout and design. File No. 4442-W.

CIVIL ENGINEER, M.Sc., 1931, technical University of Warsaw, A.M.I. San.E., war veteran, age 48, 15 years experience in hydraulic works, water supply and sewerage, formerly residing in Great Britain and nearly one year in Canada. Seeks position with a municipality or a firm which offers a good opportunity for advancement. Location secondary, available in two weeks notice. File No. 4443-W.

GRADUATE MECHANICAL ENGINEER, McGill 1950, with master of business administration degree, University of Michigan 1954, looking for a career with a progressive company. Three and a half years experience in industrial engineering and also summer work in several industries. Would want to start in production or industrial engineering work. File No. 4444-W.

MINING ENGINEER, P.Eng. in Alberta, M.E.I.C., Jr.C.I.M.M., graduate 1951, age 30, married, veteran. Practical experience in steel work in shipyards, carpentry, contracting and sales. 2 years experience in geophysics for major oil company. Experience in water and sewerage systems and mining exploration. Highest references. Very versatile. Desires permanent position with responsibility and advancement. Preferably in Alberta. File No. 4445-W.

ELECTRICAL ENGINEER, Jr.E.I.C., 31, McGill 1950, P.Eng. (Ontario), 3½ years experience in electrical layout and design of plant distribution and services and design of automatic sequincing control for process equipment in automotive industry, desires work with consulting firm or industry with diversified and interesting work. File No. 4448-W.

ENGLISH CIVIL ENGINEER B.Sc. (Hons.) A.M.I.C.E., aged 27. Hoping to emigrate to Canada with wife in May, desires responsible job in connection with the design of water supply and sewage schemes in which he has experience. Would also consider site control work in this field and would prefer to work in Vancouver district although other facts considered. File No. 4449-W.

CIVIL ENGINEER (M.Sc., P.Eng.), University of Warsaw, Poland, age 41, presently employed. Twelve years successful experience in structural designing, which includes 8 years of site supervision. Seeks opening with progressive firm. Specialist in prestressed concrete. Bilingual. Three years Canadian experience as senior designer. Available on short notice. File No. 4450-W.

CONSTRUCTION ENGINEER, M.E.I.C., age 45; no dependents, 30 years general construction and mechanical experience, 21 since graduating, 10 years sales. Extensive public speaking, lecturing and public relations experience. Now completing an operation. Free to travel or relocate anywhere, Canada or foreign. Prefer north country, frontier or foreign—general construction, townsite, supervisory, public relations. File No. 4451-W.

CIVIL ENGINEER, S.E.I.C., B.Eng. McGill 1953, with construction and field work experience, seeks position in the field preferably on construction. Single, willing to work anywhere in Canada. File No. 4452-W.

CIVIL ENGINEER, Jr.E.I.C., N.S.T.C. 1952, veteran, age 28, married. Approximately one year experience in surveying and drafting for road construction job, and one year working with municipal type of construction and maintenance. Seeks employment with either consultant engineer, municipal engineer, or town planner, doing calculations, designing, and drafting. The possibility of technical experience derived is of paramount importance. File No. 4454-W.

CIVIL ENGINEER, N.S.T.C., 1949, M.E.I.C., P.Eng., provincial land surveyor of Nova Scotia and New Brunswick, age 27, veteran, married, 2 children. Experience survey of naval base construction; instrumentman on construction of train boat, gypsum disposal plant, topographical survey; resident engineer on construction of services for 100 houses project; 3 years resident engineer on highway construction, both subgrade and pavement; 1 year office engineer on materials takeoff, ordering, and control; 1 year design of industrial buildings, municipal services, specification writing, project supervision. Present work expected to terminate in May. Prefer construction or associated work with a good future. File No. 4455-W.

EXPERIENCED CONTROL ENGINEER, B.Sc. electrical engineering, Laval University 1947. One year post graduate studies in servomechanisms electronics and network theory, Ohio State University. Age 30, married. Six years experience in U.S.A. on design and development of control systems such as auto-pilots, remote flight control systems, speed and voltage regulators for inverters and air turbine driven alternators. Also design experience on magnetic amplifier. Circuits. Canadian citizen desires to return to Canada and will consider any reasonable opening with Canadian firm. Would prefer position involving both administrative and technical duties and a certain amount of travel. Preferred location Montreal area. File No. 4461-W.

MECHANICAL ENGINEER (Technikum Winterthur, Switzerland, grad. 1949), 29, married. Experience in welding, design and estimating of pressure vessels, platework, piping. Completely familiar with ASME and API codes, high pressure water tube boilers. Capable of supervision desires responsible position in office or shop, vicinity of Edmonton, Calgary or Vancouver. File No. 4465-W.

CIVIL ENGINEER, Jr.E.I.C., now interested in broadening his background. Five years experience in surveying for many purposes, including construction and pulp and paper manufacture. Very much interested in design. Available April 30th. File No. 4466-W.

CIVIL AND STRUCTURAL ENGINEER, M.A., Cambridge University, graduated 1947, professional engineer (Ontario) Jr. E.I.C., 6½ years experience civil and structural engineering in industry, consulting engineering and research. First class administrator with considerable organizational experience. Expert in structural analysis and design in both steel and concrete. Specialist in prestressed concrete. Presently employed in Toronto, and would prefer to remain there, or would represent Canadian organization in England. Position of responsibility required, where good use can be made of organizational ability and where there is opportunity for advancement. File No. 4467-W.

MECHANICAL ENGINEER, married, age 43, M.I.M.E., Ch.Eng. attached to Dutch Merchant Navy during second world war. Twenty-five years experience in construction, operation and maintenance of high pressure steam plants, turbo generators, diesel engines and refrigeration plants. Available on one month's notice. File No. 4468-W.

CIVIL AND SOIL MECHANICS ENGINEER, Jr.E.I.C., B.Sc. with post graduate studies. Age 34, married, 3 children. R.C.A.F. veteran. 6½ years experience. Experienced in organizing soil mechanics laboratories, lab testing, interpretation of laboratory results. Slope and slide investigations. Supervision of drilling and foundation investigations for dams, buildings, highways. Earth and concrete materials investigations. Retaining walls, earth and concrete dams. Tunnelling in clay. Deep shafts in clay and gravel. Studies in open channel flow. Reinforced concrete. Reports, design and supervision of construction. Mathematically inclined. Some knowledge of German. Available after May 15th. File No. 4469-W.

BRITISH GRADUATE (Electrical) 45 years of age, married, 1 child, 5 years in Canada; P.Eng. M.A.I.E.E., M.E.I.C., etc., formerly specialist in electric traction but very adaptable and with wide experience in other engineering realms; has initiative, pleasing personality, good contact man; possesses diploma in salesmanship; good liaison engineer, correspondent, writer of specifications, reports and articles; highest references, desires scope for advancement; now resident near Montreal. File No. 4470-W.

GRADUATE MECHANICAL ENGINEER, 34 years of age desires position where high quality design work is appreciated. Experience as follows: Internal combustion engines 3 years, chemical plant machinery 3 years, agricultural machinery 2 years, at present mining equipment. File No. 4471-W.

MECHANICAL ENGINEER, SASK. 1947, Jr.E.I.C., P.Eng. (Que.), age 31, with 7 years experience sales and application heating, ventilation and air-conditioning with large Canadian firm. Industrial consulting and public building mechanical specifications, desires position with consulting engineers or architects. Location Ontario or Western Canada. Available on reasonable notice to present employer. File No. 4472-W.

ELECTRICAL OR MECHANICAL SALES. P.Eng., S.E.I.C., B.A.Sc., U.B.C., mechanical 1951. Graduates test course with C.G.E. One year preparing for outside sales, over one year successfully selling full range of electrical power apparatus in Toronto and Western Ontario for large nationally known electrical manufacturer. Experience with steam turbines, pumps and various other types of mechanical equipment. Excellent executive valuation report, together with business and education resume sent on request. Desire position leading to outside sales work or managerial position with progressive company in British Columbia or Alberta. File No. 4473-W.

RESPONSIBLE POSITION WANTED by graduate chemical engineer, McGill 1949. Presently employed by pulp mill engineers, supervising field and layout work. Veteran, age 32, with industrial and direct selling experience. Has proven initiative and willing to accept responsibility. Desires position providing executive training and a challenge. File No. 4474-W.

ELECTRICAL ENGINEER, graduate 1949, power and machinery, Edinburgh, Scotland. M.E.I.C., grad. I.E.E., Whitworth Prizeman, age 29, married, two children. 5 years electrical engineering apprenticeship, 3 years electrical draughting, 3 years electrical engineer. Experience on rural and urban distribution, construction, maintenance and operation, H.V. and M.V. lines, cables, substations and associated gear, estimating, profile surveying, pressure testing, fault location, etc. Also inspection, testing and maintenance of all types industrial electrical machinery and cabling in paper mills, quarries and other industry, i.e. generators, motors, switchgear, transformers, elevators, etc. Desires employment on either distribution work plant maintenance or with consulting engineer, commencing beginning of September. File No. 4475-W.

CHEMICAL ENGINEER B.A. 1937, B.A.Sc. 1938, U.B.Sc., P.Eng. (Ont.), member of the Chemical Market Research Association, married with 2 children desires responsible position chemical or allied industry. Diversified experience in explosives, pulp and paper and plastics. Most interested in development type of work or production. Well experienced in preparation of reports on markets and economics. Resume of experience on request. File No. 4476-W.

CIVIL ENGINEER P.Eng., Jr.E.I.C., with two years experience in reinforced concrete, detailing and design. Seeks part time employment in Montreal area. File No. 4477-W.

MECHANICAL ENGINEER graduate Nova Scotia Technical College 1946 M.E.I.C. Eight years experience in design, application and installation of heating ventilating, air conditioning and combustion equipment. Desires change of employment where past experience could be best utilized. Location preferred Ontario or Quebec. File No. 4479-W.

SENIOR MECHANICAL ENGINEER B.Sc., P.Eng., M.E.I.C., age 41 years. Member A.S.M.E., A.S.H.V.E., A.S.R.E., over twenty years experience in air conditioning, heating and ventilating, piping, plumbing, refrigeration design and installation, waterworks and sewerage plant, workshops and plant layout, buildings, roads, and utilities and fully experienced in all mechanical and steam power plant boilers, pumps, hot water systems, design, specifications installation, maintenance and planned maintenance desires an engineering appointment anywhere in Canada, U.S.A. or on overseas projects. Previous experience as resident engineer on very large projects overseas, on construction of varied type jobs on contract basis for government departments. Further particulars will gladly be forwarded to interested employers. File No. 4481-W.

EXECUTIVE MANAGEMENT career development desired by Chemical Engineer, M.E.I.C., age 37, married, no children. Strongest capabilities are organisation, administration, adaptability, and effective contacts. Successful and well-rounded experience in operations, technical control, research and development, and management techniques in major manufacturing industry. Seeks challenging opportunity as Manager, Assistant, or equivalent, with progressive enterprise willing to delegate responsibility upon proof of ability. File No. 4482-W.

MECHANICAL ENGINEER, M.E.I.C., Graduate of Delft Institute of Technology. Holland. 20 years experience, particularly in boiler houses, steam and condensate handling, instrumentation, water treatment, air handling, plant layouts. Also office management, business administration, sales promotion. Seeks senior position with manufacturing concern, consultants or sales organization.

Sound Canadian Practice. Bilingual. Location anywhere in Canada. File No. 4483-W.

MECHANICAL ENGINEER, 1947, P.Eng., M.E.I.C., with 6 years experience as sales engineer handling mining, contracting, industrial and pulp and paper machinery, desires position of expanded responsibility in sales field or with mechanical maintenance department of industry. 34 years old, married. File No. 4484-W.

ELECTRICAL ENGINEER, M.E.I.C., P. Eng. (Alberta), age 35, single, 5 years general engineering training with one of the largest electrical manufacturers in U.K., 3 years mechanical design in light engineering works, 4 years in oilfields and refinery abroad on installation, erection, and maintenance of electrical and mechanical plant which included pumps, air compressors, A.C. and D.C. motors, steam and diesel power plants, power distribution and lighting. Desires position in construction or in which experience can be utilized. Location anywhere. File No. 4489-W.

INDUSTRIAL ENGINEER, Mechanical engineering degree, age 38 with fifteen years experience in light industry on: manufacturing methods, time and motion study, process engineering, production control, factory engineering, administrative engineering and production supervision, available immediately. File No. 4493-W.

HARVARD BUSINESS SCHOOL and Toronto engineering and business graduate seeks marketing position with a manufacturer of consumer goods. Presently employed outside Canada with a similar firm. Prefer Southern Ontario basing. Age 25, married. File No. 4494-W.

ADMINISTRATOR, PROFESSIONAL ENGINEER experienced in chemicals production, management and training with definite sales potentials, plus some sales training and experience. Seeks challenging opportunity, in technical sales or service, leading to sales management in chemical or pharmaceutical firm. Presently in Toronto, will locate anywhere. File No. 4496-W.

MECHANICAL ENGINEER, graduate 1951, Jr.E.I.C., single, age 24, experience in materials handling, and pulp and paper desires position with opportunity for advancement. File No. 4498-W.

MECHANICAL ENGINEER, graduate, A.M.I.M.E., A.M.I.E.T., government certificate, 15 years experience design and development field work, oil refinery, material handling plants, installations, machinery grainery, conveyors, elevators, construction, structural steel, reinforced concrete, docks, timber structure; knowledge of Spanish, Italian, Arabic, little French, desires employment South America, Peru. Age 36, Canadian citizen. Past experience also includes report writing, drafting, estimates, civil engineering. Presently employed Engineering and Research Department. Salary secondary to opportunity for advancement. Free to travel anywhere at short notice. File No. 4499-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., P.Eng., age 38, married, veteran. Eight years industrial experience, mainly in chemical plant design including pressure vessels, high measure piping, material handling, steel and reinforced concrete construction, steel fabrication, etc. and cost estimating. Also some construction and some maintenance experience. Desire employment with responsibility and with future possibilities. Preferable location Alberta. File No. 4503-W.

GRADUATE ENGINEER, B.E. Mechanical and electrical, Sydney University, Australia, 1948. Age 32, single, 4 years experience plant engineering, construction, steel industry, sugar, hydroelectric industry. Interested in position; design, development production engineering or plant engineering; inventive. File No. 4504-W.

CHEMICAL ENGINEER Jr.E.I.C., 27, graduated from University of Toronto 1950. Four years experience in the protective coatings industry dealing with plastics, paints, varnishes, and waxes. Engaged in sales, supervisory and research capacities. Presently employed but seeking a more challenging position. Would consider other fields than protective coatings if sufficiently interesting. File No. 4505-W.

ELECTRICAL ENGINEER, Australian citizen, age 39, single. Associate Member of Institution of Engineers Australia and Member of Association of Professional Engineers Australia. Desires position with a supply authority whilst establishing professional status in Canada. Twenty years experience in Electrical industry, 14½ with supply authorities in Australia and 1¼ with consultants and construction engineers Great Britain. Experienced in design, construction, maintenance and operation of distribution works, substations and thermal station electrical installations. Experience up to 66KV. Field experience on 275 KV general line construction British electricity authority. File No. 4506-W.

CIVIL ENGINEER S.E.I.C., P. Engineer located in Montreal desires evening work in draughting, design etc. File No. 4507-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc. Manitoba 1950, married, 2 children. Age 30. Seeks position in electrical utility or plant maintenance in industrial concern. 4 years in transformer design, production and test. Some sales. Western Canada preferred. File No. 4508-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng. (Ont.) B.A.Sc. 1948, M.A.Sc. 1951, U.B.C., age 28, married, one year on design of substation layout and control with a large public utility prior to receiving M.A.Sc. Completed industrial training and sales course with a large electrical manufacturing company. Experience in application and manufacture of low voltage air circuit breakers, power fuses and grounding resistors. Design of metalclad switchgear control circuits and layout of wiring diagrams. Also teaching experience. Desires position requiring initiative, organizing and supervisory ability with opportunity for advancement. File No. 4509-W.

ELECTRICAL ENGINEER B.Sc. Queens 1951; power option; Jr.E.I.C., P.Eng. aged 26, married, one son, and am a veteran. Employed since graduation by large chemical company. Have had varied experience in mechanical design, plant start-up trouble shooting and in electrical maintenance. Some experience with pneumatic instrumentation. Good knowledge of electronics through signal corps and amateur radio. Have done electrical estimating on minor plant projects. Would like to further electrical training through position with construction company installing generation equipment, or with consulting engineer on design and layout of plant power distribution systems. Location no object. Will send transcript of education, details of work background and references on request. File No. 4510-W.

CIVIL ENGINEER, honours graduate, of Glasgow University, with two years of construction experience, desires position in design office or on construction. Single, willing to work anywhere in Canada. File No. 4514-W.

CHEMICAL ENGINEER S.E.I.C., Laval 1953, presently working for the Defense Research Board with chemical engineering group. Age 25, married, one year experience. I would be glad to meet possible employers at any time. File No. 4515-W.

CIVIL ENGINEER, Manitoba 1952, Jr.E.I.C., age thirty, married, one child. Presently employed by oil company on work becoming more the province of petroleum engineer desires employment with consultant or contractor on heavy construction or municipal projects. Five summers experience in highway and drainage construction, bituminous and concrete paving as instrument man and resident engineer. Location immaterial. File No. 4518-W.

MECHANICAL ENGINEER seeks senior executive position in chemical or allied industry, or firm of consulting engineers. 12 years experience in the financial and engineering side of large scale plant expansions in the chemical industry. Excellent knowledge of the following processes: ammonia, methanol, urea, formaldehyde, chlorine, wood saccharification, alcohol distillations, 5 years experience in dyestuffs including complete design and erection of services and maintenance workshop. Superintendent planning engineer in charge of drawing office of 40 men, reorganization of engineering department of large concern. Excellent references, bilingual, graduate 1942, M.E.I.C. File No. 4519-W.

ELECTRICAL ENGINEER, M.E.I.C., P. Eng., with 3 years urban distribution experience and CGE test course in switch gear, motor generator, installation and transformers seeks post with utility, involving generation, transmission and distribution. Present salary in power transformer engineering sales $350 per month. File No. 4525-W.

EUROPEAN CIVIL ENGINEER would accept some part time work in structural designing. File No. 4526-W.

AGRICULTURAL ENGINEER, M.E.I.C., U. of S. 1945 available December 1, 1954. 4 years teaching experience, 3 years research engineer for Sask. Research Council. Thoroughly acquainted with automotive and internal combustion equipment. Age 38, married. File No. 4527-W.

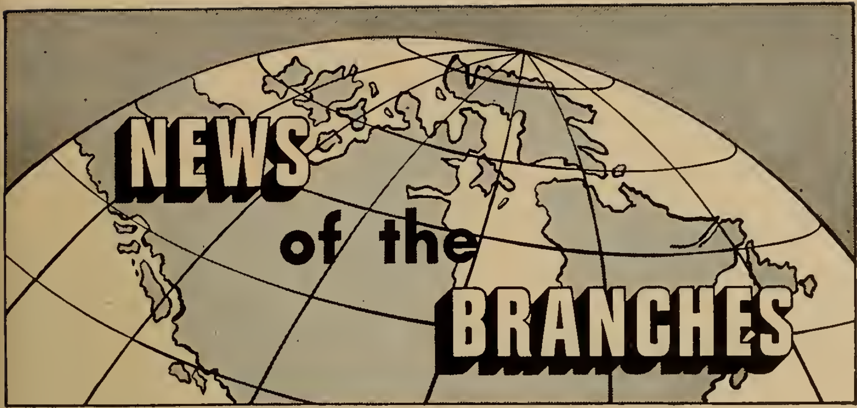
ELECTRO - MECHANICAL ENGINEER, P.Eng. (Ont.) membership several English Professional Institutions. 2 years post graduate course in servo-mechanisms and control equipment. Practical experience of electro-hydraulic mechanisms. Desires position in administrative capacity. Minimum salary $7,000 per year. File No. 4528-W.

STRUCTURAL ENGINEER, A.M.I. Struct E., P.Eng., desires responsible position in the Hamilton area. Experienced in the competitive design of light and heavy industrial and commercial structures and road and rail bridges. Eight years and three years English and Canadian experience respectively. At present employed in Hamilton. File No. 4529-W.

CIVIL ENGINEER graduate of U. of Latvia in Riga 1926. 18 years experience in railroad, road, reinforced concrete and structural steel constructions. Seeking position in any part of Canada. File No. 4530-W.

ELECTRICAL ENGINEER, graduated Norwegian University 1950, age 30, married. Experience: 2 years design and development of hydro-power station and lighting engineer, 1 year as a sales engineer. Available immediately, location anywhere. File No. 4531-W.

CIVIL ENGINEER (European), graduate Polish University College, London, Jr. E.I.C., age 41. Married. Seven years experience (including two years in Canada) in design, draughting and supervision of all sorts of engineering structures, buildings, industrial plants, bridges and earthworks. Will accept position in line with his experience. Location preferred Montreal or Southern Ontario. Available on reasonable notice. File No. 4532-W.




**Activities of the Forty-seven Branches of the Institute and abstracts of papers presented at their meetings**

## Corner Brook

B. C. McGrath, Jr.E.I.C.,
*Secretary*

**September Meeting**

The meeting was held on Tuesday, Sept. 15, 1953 in the Conference Room of Bowater's Nfld. Pulp and Paper Mills, and was called to order at 8.30 p.m. E. Hinton occupied the chair.

The following members were present: Messrs. Hinton, Hughson, Read, Langins, St. George, Tibbo, Butler, Green, McGrath.

The minutes of the meeting of June 28, 1953, were read by the secretary. On motion by Mr. Hughson, seconded by Mr. Tibbo, the minutes were adopted as read.

On motion by Mr. Hughson, seconded by Mr. Green, the appointment of B. C. McGrath as the new secretary was adopted. Mr. Read was nominated as treasurer. There being no further nominations Mr. Read was appointed by acclamation.

The chairman read the letter of resignation of the vice-chairman. On motion by Mr. Hughson, seconded by Mr. Tibbo, the secretary was instructed to write the vice-chairman and regretfully accept his resignation and wish him much success in his future work.

On motion of Mr. St. George, seconded by Mr. Butler, Mr. Hughson was nominated as vice-chairman and member of the nominating committee, the position vacated by Mr. Franklin. Mr. Hughson was elected by acclamation.

**Unity**

A letter from the Association of Professional Engineers of Newfoundland was read re the proposed agreement between these two organizations and their unwillingness to have such agreement at the present time. A discussion followed and it was decided to let the matter stand for the present.

**November Meeting**

On Nov. 20, 1953, the meeting of the Corner Brook Branch came to order in the Conference Room of Bowaters Nfld. Pulp and Paper Mills with W. R. Hughson in the chair.

The minutes of the previous meeting were circulated and adopted after correction on motion by K. Bulins and seconded by E. Langins.

A short report was made by W. Read on the president's visit. A vote of thanks was extended to the Entertainment Committee.

Due to the small number of members present and the absence of the chairman of the Branch it was decided to postpone decisions on some of the business brought up by the acting secretary.

## Eastern Townships

W. J. Sutherland, M.E.I.C.,
*Secretary-Treasurer*

J. Brisson, Jr.E.I.C.,
*Branch News Editor*

**Telephone and Television**

On March 5 forty members of the local branch listened to a talk given by Lucien Moise of the Bell Telephone Co. of Canada Ltd. The speaker's subject was the simultaneous carrying of telephone conversations and television programs over microwave radio equipment.

He started by explaining that just like sound, pictures could be transmitted over wires by converting them into electrical impulses by means of a photocell. He pointed out that the first research in that field was undertaken by a German scientist Dr. Paul Nipkow in 1884. He illustrated the theory by using the Nipkow disc, an apparatus developed by this scientist.

Following this he explained how microwaves could replace wires in the transmission of long distance conversations. "Our experience shows," said Mr. Moise, "that the joint use of a radio relay system for telephone and television is advantageous for all concerned."

He concluded his talk by giving a demonstration with two miniature microwave towers transmitting both telephone conversations and radio programs.

At the end of the meeting H. Gardner, superintendent of Crows Nest Pass Coal Co. of Fernie, B.C., brought us greetings from Western Canada.

The meeting was presided over by Gaston Masse, vice-chairman of the branch.

## Edmonton

P. M. Butler, M.E.I.C.,
*Secretary-Treasurer*

K. Provost, M.E.I.C.,
*Branch News Editor*

**The President's Visit**

The president of the Institute R. L. Dobbin, visited the Edmonton Branch from March 2 to March 4 and was greeted by members of the Edmonton Branch Executive on his arrival. On March 3, the president had a busy schedule which included a press interview at his hotel suite, luncheon as guest of the Alberta Association of Professional Engineers and a visit to the University. That evening he addressed a dinner meeting of the local Branch.

On the 4th day of March, the executive of the Edmonton Branch discussed current problems with the president during luncheon at the Edmonton Club. Following a tour of Edmonton, Mr. Dobbin was guest of the Engineering Students Society at their annual banquet.

In his address to the members of the Edmonton Branch, Mr. Dobbin described his trip to Britain as representative of the Engineering Institute of Canada at the Coronation.

Engineering progress and opportunities in Canada were outlined briefly. Mr. Dobbin told of the progress being made by Premier Smallwood in Newfoundland and of the need for engineers there. All across Canada, Mr. Dobbin observed technical developments were continuing at an ever-increasing pace, giving new opportunities to engineers.

The president, in conclusion, expressed his pride in the engineering profession and his belief that the public also was proud of the work engineers are doing in developing Canada.

C. A. Davidson thanked the president for his address and expressed the appreciation of the Edmonton Branch for his work.

## Halifax

K. F. Marginson, M.E.I.C.,
*Secretary-Treasurer*

F. H. Tremain, M.E.I.C.,
*Branch News Editor*

A meeting of the Halifax Branch was held on the evening of February 22 in the auditorium of the Sea Gull Club.

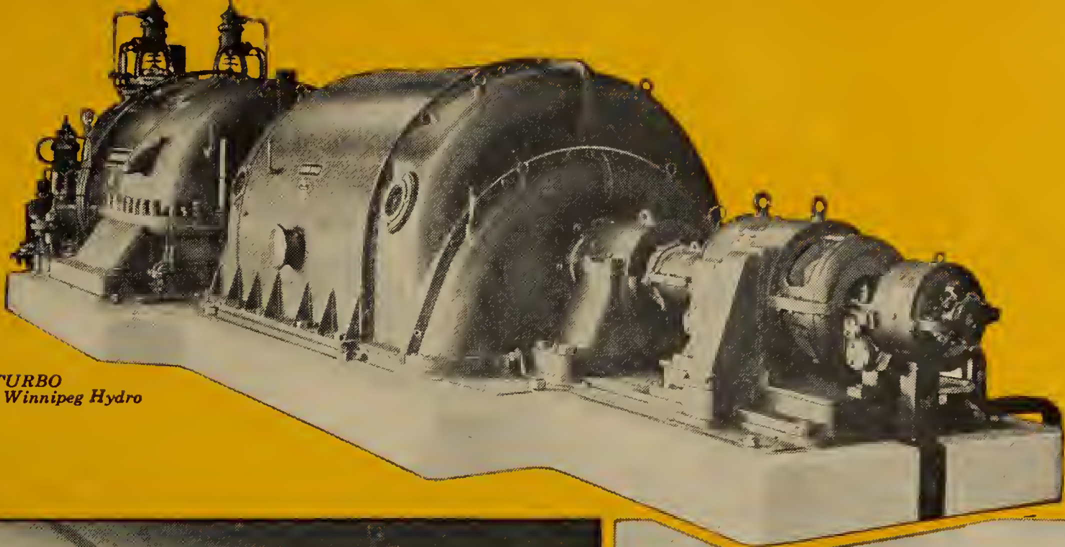
The senior class of engineers from the Nova Scotia Technical College were the guests of the Halifax Branch at this meeting.

A. H. Roy, a senior student at N.S.T. gave a report on the students activities at the annual meeting of the Institute which was held in Halifax in May, 1953.

The E.I.C. certificate, which is awarded annually to the student of highest standing in his final year and for his activities with students in connection with engineering society affairs was presented to George Haviland Martin.

**Canadian Engineering Achievements**

The highlight of the evening was a very interesting, illustrated, address by the E.I.C. Field Secretary, Dr. L. F. Grant. His subject was "Canadian Engineering Achievements Over the Past 100 Years." Dealing chiefly with



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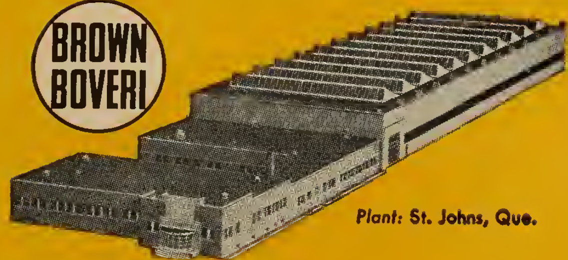

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transportation: including canals and waterways, railways and highways; Dr. Grant spoke about the achievements on the St. Lawrence and Niagara Canals which have opened a waterway to the heart of the continent.

The meeting closed with a social period which was enjoyed by the 85 members and students present.

#### March Meeting

A buffet supper meeting was held at the Nova Scotian Hotel on Thursday, March 18. Approximately 60 members were present to enjoy an interesting illustrated talk on "Petroleum Refinery Modernization" by J. C. Maguire, chief process engineer, engineering division of the manufacturing department, Imperial Oil Limited, Sarnia, Ontario.

This talk was of particular interest to the Halifax Branch as Imperial Oil Limited, is at present engaged in an extensive modernization program of their plant at Imperoyal, Dartmouth, N.S.

The chairman of the Branch, O. Nelson Mann, introduced the new secretary-treasurer, K. F. Marginson, of the engineering staff at Dalhousie University.

It was announced that the April meeting would be a joint meeting with the Military Engineers of the Halifax area.

## Hamilton Branch

N. A. Parry, Jr.E.I.C.
*Secretary-Treasurer*

F. S. Gue, Jr.E.I.C.,
*Branch News Editor*

#### Air Defence in Canada

The February meeting of the Hamilton Branch featured an address of keen interest to the membership from both the engineering and citizenship points of view. Air Vice Marshal A. L. James, Air Officer Commanding, Air Defence Command, spoke on "Air Defence in Canada" to an attentive group in the Fireside Room, Westdale Hotel.

AVM James listed the RCAF's responsibilities as threefold: Defence of North America; Fulfillment of NATO obligations; Provision of a nucleus for RCAF expansion if necessary in time of war.

He stated that Canada in 1954, for the first time in her history, is faced with a threat to her national security, lying as she does athwart the path across which the titans in any future war would trade punches. The pat saying that "The best defence is a good offense" was given as leading to Hitler's downfall, since he stubbornly refused to acknowledge that the offensive must be mounted from a secure base. Air Defence of Canada is designed to secure that base.

The state of preparedness, mobility, and power of Canada's air force was illustrated by the reference to the successful flying of the First Air Division, by entire wings, across the Atlantic. The first time such an operation had ever been attempted with equipment like the F86.

The difficulty of the present day air defense problem was underlined when AVM James said that heavy bombers today would have to be intercepted and destroyed in weather in which World War II aircraft would not even have taken off. In addition, the atom bomb now makes it profitable for an aggressor to suffer a much higher rate of attrition than before. The defenders must aim for 100 percent interception and destruction.

Close dovetailing of the U.S. and Canadian efforts was stressed. AVM James indicated that international co-operation here was remarkable, with a flexible interlocking control which might find U.S. aircraft under the direction of a Canadian just as readily as the Canadian pilot might find himself under the direction of an American.

AVM James paid high tribute to the work of the reserve and volunteer observer personnel, and stated that, judging by the cross-section of the "younger generation" he sees in his work, the safety of Canada is in good hands.

The speaker was introduced by Group Captain D. Annan, of the RCAF Auxiliary, who pointed out in his remarks that all 10 of the senior officers of the RCAF are engineers.

AVM James was thanked by Frank Milne.

## Kingston

D. R. Graham, M.E.I.C.,
*Secretary-Treasurer*

G. D. Burwash, Jr.E.I.C.,
*Branch News Editor*

#### Joint Dinner Meeting

The annual joint dinner meeting of the Kingston branches of the Chemical Institute of Canada and the Engineering Institute was held in Wallace Hall, Queen's University on March 23.

The guest speaker was Robert Legget, director of building research, National Research Council, Ottawa. His topic was "The Report of the Royal Commission of National Development in the Arts, Letters and Sciences". In part the speaker criticized the report for its lack of references to engineering and the applied sciences. In fact of the 400 pages of the report only 25 are devoted to a discussion of the place of the sciences in Canada today, and of the 130 pages of conclusion exactly half a page was enough to contain the recommendations on science.

The report contains many plaintive pleas for the stimulation and strengthening of the humanities in Canada while there were almost incidental references to the physical aspects of Canadian life and development.

Mr. Legget said it was misleading to blame technological advance, which had brought such untold benefits in its train, for admitted cultural defiiciencies.

The speaker was introduced by Dr. S. D. Lash and thanked by S. H. Rochester. Chairman of the meeting was Dr. R. C. Spooner.

## Huronia

L. Morgante, Jr.E.I.C.,
*Secretary-Treasurer*

On Feb. 24 last a meeting was held of the Huronia Branch of the Engineering Institute of Canada in the Y.M.C.A. in Orillia. Some thirty engineers were present.

#### Mine Equipment

H. C. Knight manager of the Dorr Company in Canada showed two very interesting films each of which lasted about half an hour. One film was entitled the "Dorr Way." This excellent film in color traced the history of the company showing how it had it's beginnings in California; H. V. N. Dorr started as a mill superintendent in a small California gold mine and realized that technological improvements were necessary in the separation of liquids from solids. As a result he invented the Dorrco thickener and the Dorrco classifier of which there are several types, all of which were adequately described in the film. The film went on to show how this equipment is now used the world over in a tremendous number of industries such as gold, copper, zinc, lead, fertilizer, pulp and paper, chemical industry, and sewage disposal. We understand this film cost one hundred thousand dollars to produce and it is certainly recommended for other engineering groups.

#### Pure Water

The second film was entitled "Pure Water", recently produced in Holland. This film shows the necessity of adequate sewage disposal plants to stop the wide spread of putrefaction in our natural water courses.

Following these two films a short talk was given by Mr. Knight in which he pointed out that his company is very largely an engineering organization. They have some nine hundred employees scattered the world over and about 1/3 of these are engineers. They do not undertake manufacturing themselves but do design plants and make recommendations.

Many questions were asked during this meeting regarding sewage disposal problems. All concerned realized the necessity of doing more in the way of proper sewage disposal now that shortages of labor and material no longer exist.

## Lakehead

G. E. Cook, M.E.I.C.,
*Secretary-Treasurer*

H. Penner, Jr.E.I.C.,
*Branch News Editor*

#### Motor and Trolley Coaches

On Thursday, February 19 at Trinity Church Hall, some 30 members and guests of the Lakehead Branch heard a very interesting talk by Lloyd B. Walker, divisional engineer of the Canadian Car Plant in Fort William.

Mr. Walker touched on only one of many possible topics, namely production of motor and trolley coaches. He compared bus designs here with those in Britain, pointing out that Canadian and American design preferred the semi rigid type of chassis where the side walls of the bus carried load bending movements. The similarities and differences of bus design to motor car design formed an interesting basis of comparison. Theoretical calculation was of necessity the basis of design said Mr. Walker, but to be of any value theory must be used in conjunction with experience. It was very humorously pointed out that someone has said that design of bus springs was an art not a science. Since that time said Mr. Walker he too had become a patron of the arts.

The talk was illustrated by an excellent film showing the Canadian Car's plants and an assembly line tour at the Fort William plant. The speaker was introduced by W. D. Beckett and thanked by W. C. Byers.

#### President's Visit

On Monday, March 15, the Lakehead Branch was favoured by the long deferred visit of Ross L. Dobbin, E.I.C. president. The president was to have come to the Lakehead in January on the westward leg of his journey across Canada but failed to put in an appearance due to flight cancellation.

Mr. Dobbin arrived on Sunday night, and spent Monday at the Lakehead. The day's activities included a morning meeting and luncheon of the Lakehead Branch executive. Topics discussed included the possibility of a Regional Meeting at the Lakehead in 1955 and the "Plan for Unity" brought forward by J. H. Smith, former APEO president. The Lakehead group has for a long time been a supporter of a scheme for a joint agreement.

After lunch the president spoke to a group of students at the Lakehead Technical Institute, who are in their first year of engineering. Some 40 members turned out to a dinner meeting and heard the persident's account of his travels to England during the coronation and his almost completed visits to the 48 branches of the E.I.C. across Canada. G. S. Halter, branch chairman, presided at the meeting. Mr. Dobbin was introduced by D. I. Nattress, a personal friend of the president. J. Antonisen moved the vote of thanks to the speaker.

With reference to the above, Mr. Antonisen, former city engineer, has moved the vote of thanks to the visiting presidents for the past 15 years. Mr. Antonisen is now 85 years old, is quite active physically and mentally.

## Lethbridge

R. D. Hall, Jr.E.I.C.,
*Secretary-Treasurer*

***President's Dinner Banquet***

On February 10, 1954, the Lethbridge Branch held their President's Dinner Banquet at the Marquis Hotel under the chairmanship of D. Cramer. The entertainment was under the direction of E. A. Lawrence. Following a singsong the group was entertained by Howard Ritchie (Mr. Magic) and vocal selections by Dorothy Cameron, Mary Thomson and Janet McLeod. Acting Mayor, Cliff Black welcomed the president to the city of Lethbridge.

The speaker was introduced by P. M. Sauder. Mr. Dobbin gave a very descriptive and entertaining talk on his trip to the Coronation. The garden parties were attended by African Chieftains, Arab Sheiks, Indian Princes and many other representatives of the British Empire in their varied native costumes. The Premiers of all the Dominions were represented. With the Coronation Ceremony starting at 2.30 p.m. the guests were supposed to be in Westminster Abbey between 6 and 7 a.m. Two books were given each guest, one containing the order of service and the other a list of people in the procession.

Mr. Dobbin emphasized the role played by the engineers in the preparation for the Coronation. The electrical engineers did a wonderful job in installing the public address, television and radio system throughout the Abbey. The microphones were toned to suit various types of speakers and for various distance from the microphones. The stands along the Procession route were designed so that the materials used for construction could be dismantled and used again since no nails were used.

President Dobbin finished his talk by expressing his admiration for the English people who are loyal (not in a loud way) and for the great pageantry which only a nation like England could exhibit. The president was thanked by N. H. Bradley.

The secretary of the Engineering Institute, Dr. L. Austin Wright, commented favorably on the existence of the engineers' wives club and the idea of having a small concert before the meeting. Dr. Wright explained about the employment in Canada of American consulting engineering firms for jobs that could be done by Canadian engineers. The solution of this problem is getting more complicated unless Canadian employers of engineers realize the full capability of the Canadian engineer.

## London

D. M. Jenkins, M.E.I.C.,
*Secretary-Treasurer*

C. H. Osborne, M.E.I.C.,
*Branch News Editor*

***Dr. T. A. Boyd Guest Speaker***

Dr. T. A. Boyd, research consultant, research laboratories division, General Motors Corporation, was guest speaker for the February meeting. Dr. Boyd's subject "Trail Blazing in Industry Today" described the advancement of industrial products and production methods as a result of research program being carried on by many companies. The new Research Development Centre of the G.M.C. situated north of Detroit is an example of the extent of a research program adopted by a large industry.

The March meeting was a joint meeting of the Engineering Institute and the Professional Association. The presence of two executives of the Professional Association, Professor W. L. Sagar, president, and T. M. Medland, executive director, drew a large attendance.

President Sagar gave an enlightening address on the topic "Can Activities of the Engineering Profession be Centred in One Body." He summarized the functions of the Ontario Association and illustrated the feasibility of the combination of the E.I.C. and the Provincial Associations in a single body.

Mr. Medland, enlarged on the functions of the Association and pointed out the encouraging advancement in public recognition of the engineer.

## Montreal

R. J. Harvey, M.E.I.C.,
*Secretary-Treasurer*

J. A. Paget, M.E.I.C.,
*Publicity Chairman*

***120 K.V. Cable***

"120 KV Cable Installed at Montreal" was the title of a paper given on March 1, by D. M. Farnham, chief engineer, engineering design division, Quebec Hydro-Electric Commission before a joint meeting of the E.I.C. Montreal Branch and the local branch of the American Institute of Electrical Engineers. Mr. Farnham introduced into Canada insulated cables above 69 KV rating and was responsible for the use of the first 120 KV aluminum sheathed oil filled cable in Canada. He described how part of Montreal's growing electrical requirement is supplied by four cables strung under the Jacques Cartier Bridge. The four cables measure nearly 19 miles in length. One of these, capable of carrying 120,000 volts, was the first of its kind in Canada, he said. It was protected by two layers of metal, with nitrogen gas between the layers for insulation and to prevent deterioration. The cable weighed 12 pounds per foot and could withstand temperatures from 35 degrees below zero to 100 degrees above. It was made of a special alloy to prevent damage by vibration. The meeting chairman was J. M. Sharpe and meeting arrangements were by W. H. Fong.

#### *Concrete Mixtures*

"Modern Developments in Concrete Mixtures" was the topic of a panel discussion held on March 2 before the Montreal Branch. The moderator was V. Wilson, M.E.I.C., and the panel consisted of C. Cartier, Laboratoire Industrielle, D. O. Robinson, M.E.I.C., Canada Cement Company and F. MacNaughton, Milton Hersey Co. The panel discussed the modern theory of mix design, mixing, batching and placing and the physical properties of hardened concrete. Meeting arrangements were by R. J. Kane.

#### *The Engineer and Patents*

On March 4 Alan Swabey of Alan Swabey and Co., patent attorneys, addressed the Montreal Branch on the subject "The Engineer and Patents". Mr. Swabey stated that although ninety percent of the patent applications filed in Canada come from abroad, several Canadian companies now have patent departments. The speaker felt that the clause in Canadian Patent Law making it necessary for a patent holder to manufacture in Canada within three years or run the risk of having to grant compulsory licences was largely responsible for the rapid development of the Canadian television industry. The speaker included among his points on patents the following:

1—Time limits on obtaining a patent are important and should be investigated immediately when a patent is considered to be desirable.
2—The patent office libraries in Washington and Ottawa are a very valuable source of technical data on all technology.
3—Firms paying patent licence fees should check regularly to be certain that they are actually using that portion of the process covered by the patent in effect.
4—The name of the true inventor should appear on the patent even though others do much of the necessary development work.
5—The simplest Canadian patent costs about $225.00 to obtain depending on the prominence of the attorney and the amount of time he has to spend on the work.
6—Canadian government contractors are protected against infringement claims in connection with their work for the government.
7—A product such as insulin which is being presented to humanity should still be patented by the inventor or the first person to improve the process substantially will get control.

In conclusion the speaker pointed out:

1—That engineering thinking and patent thinking are poles apart.
2—That a little knowledge in the patent field may be quite valuable if it leads to prompt investigation.
3—Patents are here to stay because they help develop Canadian manufacturing facilities.

The chairman was W. C. M. Luscombe, meeting arrangements were by D. P. J. McDonald. The attendance was seventy-three.

### Niagara Peninsula

H. C. L. Joe, Jr.E.I.C.,
*Secretary-Treasurer*

J. H. Saldat, Jr.E.I.C.,
*Branch News Editor*

#### *Plant Tour*

March 18, 1954, was the day the Niagara Branch of the Engineering Institute of Canada was treated to an outstanding plant tour by the English Electric Company of Canada, Limited, St. Catharines, Ontario.

From 3 to 5 p.m. the members of the Engineering Institute of Canada were conducted through the large departments of electrical manufacturing and assembly lines. The members witnessed the stacking of cores for some of the largest transformers being built today.

The assembly lines for tiny transformers gave an indication of the wide range of transformer work the company is capable of handling.

A tour of the switchgear department revealed advanced designs in the field of electrical controls. The cabinets are imported from England and the installation of the latest Canadian-made switchgear results in a finished switchboard.

The motor plant, as with the transformer and switchgear departments, maintains an elaborate testing and inspection department.

When the tour ended at about 5 p.m. it was evident that the fusegear, generating equipment, power transformers, rolling mill drives, and switchgear are products which every Canadian could be proud of.

***Dinner Meeting***

Following the plant tour, the members met at the Queensway Hotel, St. Catharines, for a dinner meeting.

A. J. Bennett, M.E.I.C., was the presiding chairman. D. O. D. Ramsdale, M.E.I.C., sales manager of the English Electric Company of Canada, Limited, introduced the guest speaker for the evening. H. C. Tucker, contracts manager, was the guest speaker. Mr. Tucker spoke on "The English Electric Company of Canada, Limited." He described how the Canadian company was formed and pointed out that the company now has plants in such places as Preston, Bradford, Stafford, Liverpool, Toronto, Montreal, South Africa, Australia, etc. It has become one of the few companies capable of supplying both electrical and hydraulic equipment for almost any job.

The company employs some 500,000 people the world over; approximately 800 of those being in the St. Catharines plant alone.

P. Pasquet extended a vote of thanks to Mr. Tucker and the English Electric Company of Canada for a most enjoyable afternoon and evening.

Approximately 50 members attended the plant tour and dinner meeting.

## Northern New Brunswick

L. L. Marshall, M.E.I.C., *Secretary-Treasurer*

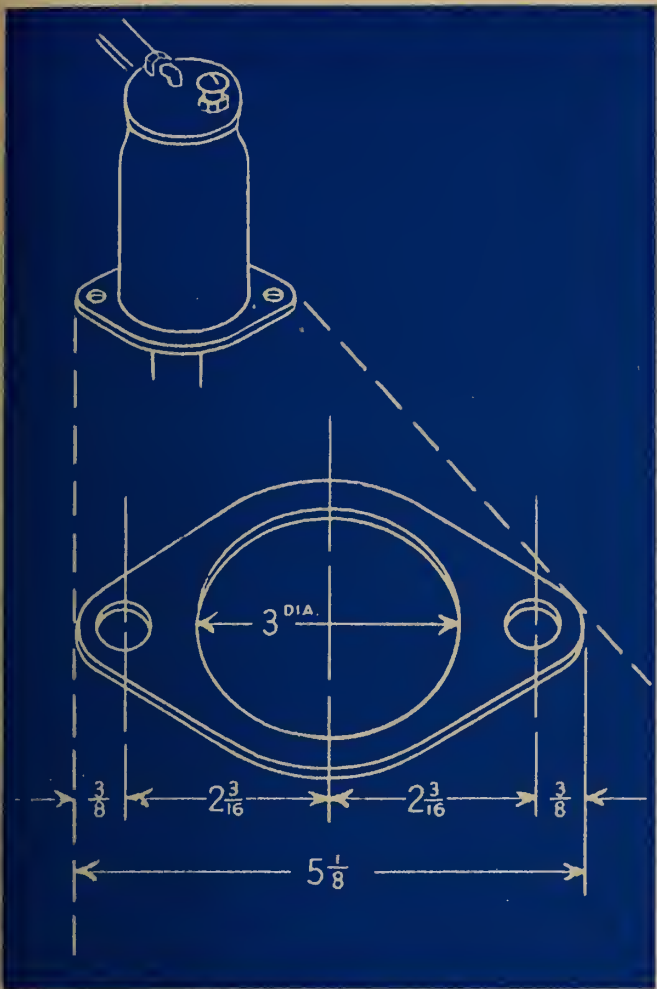
R. W. Rankine, Jr.E.I.C., *Branch News Editor*

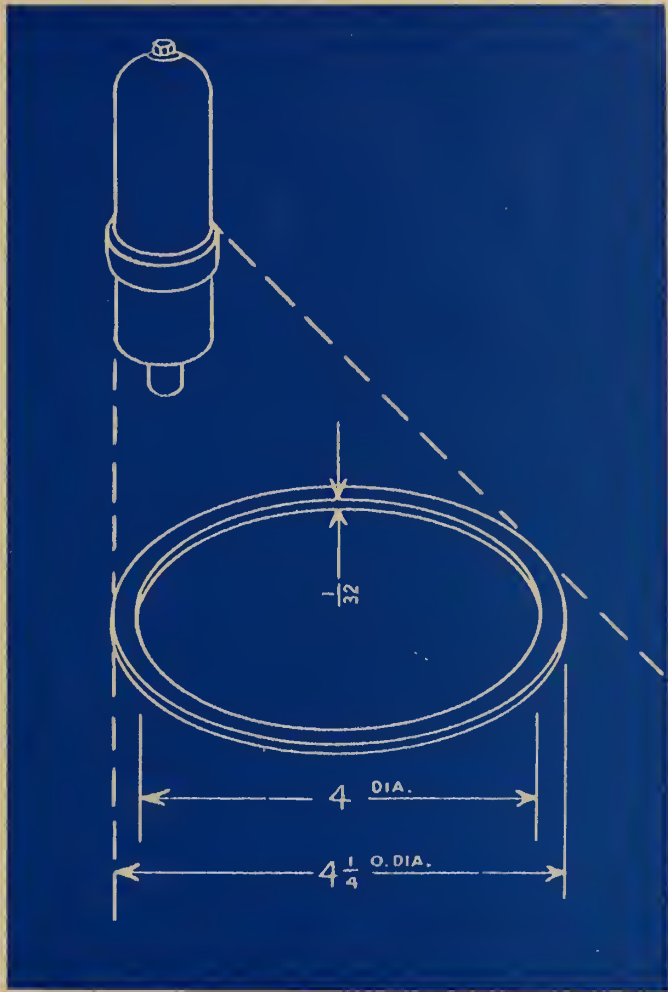
***Engineering Institute Meets***

The Northern New Brunswick Branch of the Engineering Institute of Canada held its first general meeting of 1954 on February 4 in the Gloucester Hotel at Bathurst.

***St. Lawrence Seaway***

Following a short business meeting the first speaker was Col. L. F. Grant, past president, and at present Field Secretary of the E.I.C., who gave an informative talk on the history of the St. Lawrence seaway and some of the problems involved. Col. Grant stressed the point that a 1941 agreement between Canada and the United States providing that the portion of the seaway constructed in the international section of the St. Lawrence should be constructed in the United States under American direction, had been rejected by the United States, and that on Nov. 4, 1952, Canada had informed the U.S. government that she considered the agreement to be null and void. Historically the St. Lawrence canals have been the responsibility, and under the control of




# *New fiber gasket*

## won't dry out or shrink

Glue-glycerine saturants normally are fugitive. When they leave a plant fiber gasket material, a gasket gets dry, shrinks, and usually leaks. In storage, it may distort and become unusable.

That's what a tractor manufacturer discovered when the fiber gasket in the engine governor shown at left above brought complaints from the tractor's users. Oil had leached out the gasket's glue-glycerine binder, causing gasket failure.

After testing several materials, tractor engineers solved the problem with an entirely new gasket material — Armstrong's Accopac®. Accopac's binder is rubber latex. It's non-extractable and non-volatile, so Accopac can't dry out, shrink, or crack in service. Field tests on Accopac CS-301 showed it positively prevented oil leaks at the governor flange. So, when Accopac went into production, complaints stopped.

Accopac helped this manufacturer solve a production problem, too. The oil filter ring shown at right had to be stored for several months. Many of these gaskets warped so badly they became unfit for use.

Accopac gaskets are now used for this sealing job, too, because their dimensions and performance are virtually unaffected by variations in temperature and humidity. They still fit even after months of storage.

Accopac's excellent dimensional stability and high, even compressibility have brought this new fiber material wide acceptance in a variety of sealing jobs. Today Accopac is used in thousands of applications — in pumps, aircraft, automatic washers — wherever there's a need for efficient sealing at low cost.

**FREE 24-PAGE GASKET MANUAL** — For full information on Accopac and other Armstrong's gasket materials, see the 1954 edition of "Armstrong's Gasket Materials." It has 24 pages of specification information, data on cost reduction, gasket tolerances, etc. For a personal copy, write Armstrong Cork Canada Limited, Industrial Division, 6911 Decarie Boulevard, Montreal, P.Q.

# ARMSTRONG'S ACCOPAC

Canada, as those above Lake Erie have been the responsibility of the United States. Col. Grant continued by saying that if the United States does join Canada in the construction of the seaway and if the 1941 agreement is upheld, it will mean that the seaway, which began as a Canadian project and upon which Canada has spent a considerable sum of money, will be largely under American control.

#### "The Big Jib"

The second speaker for the evening was A. Lee-White of Gill and Company Ltd., Saint John, N.B., who gave a short talk and showed a very interesting film on "The Big Jib", the largest walking dragline in the world. This machine took four years to design and build and cost about $1,500,000, as it is a protype of its kind. Powered by 3,000 horsepower in electric motors its working weight is 1,650 tons, about that of a destroyer, and its 20 cubic yard bucket rotates at a 260 foot radius of discharge. The dragline moves to its operating location by means of two eccentrically mounted walking legs. In particular the film dealt with the fabrication of the jib, which is 282 feet long and took two years to assemble.

After the meeting was adjourned the members and guests enjoyed refreshments.

## Ottawa

G. A. Sutherland, M.E.I.C.,
*Secretary-Treasurer*

C. E. Howard, M.E.I.C.,
*Branch News Editor*

#### Canada's National Parks

At the luncheon meeting held in the Chateau Laurier on March 11, 1954, Lt. Col. C. G. Childe, E.D., B.Sc., superintendent, National Historic Parks and Sites of the Department of Northern Affairs and National Resources, gave an interesting talk on "National Parks of Canada—An Engineer's Impression". A resume is as follows:

"When the first transcontinental railway, the Canadian Pacific, was being pushed forward from the plains of what is now Alberta through the Rockies, members of a survey party discovered the hot mineral springs at Banff that are now among the great attractions of that famous resort, and subsequently filed claims under the provisions of the Dominion Lands Act. Fortunately, the Government of the day, with most commendable foresight, decided not to permit development of the springs by private enterprise, and instead chose to preserve them as a public possession by passing, in November, 1885, an Order in Council reserving to the Crown an area of ten square miles surrounding the springs. The wording of this Order in Council, is interesting in view of later developments:

"There have been discovered several hot mineral springs which promise to be of great sanitary advantage to the public, and in order that proper control of the lands surrounding these springs may remain vested in the Crown, the said lands in the territory including said springs and in their immediate neighborhood, be and they are hereby reserved from sale or settlement or squatting."

#### Banff

In 1887, the Parliament of Canada established Rocky Mountains Park, comprising 260 square miles surrounding the hot springs. The area of the park was subsequently greatly enlarged and re-named Banff Park. It now comprises 2,564 square miles, or an area greater than that of Prince Edward Island.

#### The System of National Parks

From this beginning Canada's system of national parks has evolved. There are now 17 national and 11 national historic parks, which range in size from a few acres to hundreds of square miles, their aggregate area being in excess of 29,000 square miles. National Parks are located in every province except Quebec and Newfoundland; national historic parks in all but British Columbia, Alberta, Prince Edward Island and Newfoundland. Last year visitors to the national parks numbered well over 3,000,000, and that was an increase of 463,000 over the previous year.

The parks are administered by the National Parks Branch of the Department of Northern Affairs and National Resources, under the authority of the National Parks Act and Regulations made thereunder. Annual expenditure in the parks is now in the order of $7½ million, the annual revenue about $1 million

#### Established by Parliament

National parks may be established only by Act of Parliament amending the existing National Parks Act. Several have been so established since 1930, when the Act was passed, including Prince Edward Island, Cape Breton Highlands and Fundy. In the establishment of new parks it has been the policy to require the Government of the province concerned to take the initiative by offering a clear title to the area under review. Following receipt of such an offer it is examined by an officer of the department to ascertain whether or not it measures up to National Parks standards. If in the affirmative, the necessary legislation is passed by Canada, free from all encumbrances. The new area is then formally established by Act of Parliament, and its administration and development carried on by the National Parks Branch.

#### National Historic Parks

An outstanding feature in the development of national parks has been the establishment of the National Historic Park, of which, there are 11 at present. The National Parks Act permits the Governor in Council to set apart any land, the title to which is vested in the Crown in right of Canada, to commemorate an historic event of national importance. Thus the following have been established and are being maintained as national historic parks:

**Niagara Peninsula Dinner and Plant Tour**

**(Left), the head table, left to right: Paul E. Buss, councillor for Niagara Peninsula Branch; Harold E. Treble, vice-chairman; Harold C. Tucker, English Electric Company of Canada Limited; Arthur J. Bennett, chairman; Donald O. D. Ramsdale, sales manager of English Electric Company; P. A. Pasquet, past chairman; Howard Joe, secretary-treasurer. (Right), a photo taken in the switchgear works of the English Electric Company of Canada, Limited. The equipment shown is a high rupturing capacity (600-volt) fusegear switchboard.**

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For 70 years, MORRIS engineers have been investigating and solving Materials – Handling problems – problems just like **yours!** They draw on the vast, diversified wealth of experience gained through these years of meeting the needs of both light manufacturing and heavy industry.

All this thought, engineering skill and research has gone into every item in the MORRIS line, be it overhead, jib and gantry cranes, trolley conveyors, ash elevators or portable hoists and monorail systems.

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Comprehensive manual on all types of MORRIS Cranes and Hoists available on request. Simply write Department H, Herbert Morris Crane & Hoist Company Ltd., Niagara Falls, Ontario.

**MORRIS INDUSTRIAL CRANES** are smooth-running, fast-moving units easy to service and maintain. Available in wide speed selection for each motion and full range of lifting-capacity combinations.


**MORRIS ELECTRIC ROPE HOISTS** Lighter, faster. Detachable, enclosed motor operated from 110-volt, pushbutton station. Automatic, electro-mechanical braking. Strong, guarded rope sheaves. Easy, grease-gun lubrication.

**MORRIS ELECTRIC CHAIN HOISTS** are extremely adaptable to all conditions. Require no special wiring. Just hang up, plug into the nearest electric socket and start lifting. Available also for 3-phase current supply.


**MORRIS CHAIN-HOISTS,** although almost 40% lighter in weight, sacrifice none of the inherent strength or safety of former designs. Rugged performers under all conditions. Conform to modern preference for portability with durability.

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# CRANES & HOISTS

**The HERBERT MORRIS CRANE & HOIST COMPANY LIMITED**

*Niagara Falls, Ont., Branch Offices: Toronto, Montreal and Hamilton*

1. The Fortress of Louisbourg, on Cape Breton Island, Nova Scotia, Massive ruins of the French city and fortifications captured by the British in 1745 and 1758.
2. Fort Anne, at Annapolis Royal, Nova Scotia, which changed hands many times during the wars between the French and British in the 17th and 18th centuries.
3. Port Royal, eight miles from Fort Anne, where an exact replica of the Habitation of des Monts and Champlain of 1605 has been rebuilt on the original site, the first European settlement in North America, north of Florida.
4. Fort Beausejour, midway between Amherst, Nova Scotia, and Sackville, New Brunswick.
5. and 6. Forts Chambly and Lennox, on the River Richelieu, south of Montreal, P.Q.
7. Fort Wellington, Prescott, Ontario.
8. Fort Malden, Amherstburg, Ontario.
9. Lower Fort Garry, near Winnipeg, Manitoba.
10. Prince of Wales's Fort, Churchill, Manitoba.
11. Fort Battleford, Battleford, Saskatchewan.

It is expected that Halifax Citadel, on which the department has expended several hundred thousand dollars in the last three years on restoration, will shortly become a national historic park.

#### Engineering in Development

Engineering plays a major role in the development of a park, in locating, constructing and maintaining highways, roads to open up especially scenic areas, fire trails and telephone lines for forest protection. The total mileage of motor highways in the parks is about 750, of which about one-half is hard surfaced; the remainder surface treated asphaltic oil or calcium chloride. Secondary roads total 170 miles, fire and park trails about 3,000 miles, and forest telephone lines about 1,300 miles.

The life of a park engineer is interesting and varied. Besides roads and highways he may be called on to supervise construction, operation and maintenance of public works and utility services within the park, such as domestic water supply, sewerage, telephone, electric power, streets, street lighting, fire protection, bridges, wharves, campgrounds, and supervision and, where there are townsites in the park, he may have to be building, plumbing and electrical inspector."

Two films, one showing the Banff-Jasper Highway and the other the Fundy National Park, half way between St. John and Moncton, N.B., were presented.

Col. Childe was introduced by the chairman, R. Hayes and thanked by L. Shearer.

### Saguenay

C. C. Louttit, jr.e.i.c.,
*Secretary-Treasurer*

#### Taxation

"Taxes and You—From Rags to Rags" was the subject of an address Tuesday, March 16, by W. G. Donnelly of Alcan Property Department, Arvida, before the Saguenay Branches of the Engineering Institute of Canada and the Corporation of Professional Engineers of Quebec at the Saguenay Inn.

Mr. Donnelly, whose recent work in the field of taxation includes the preparation of a brief for the Tremblay Commission, gave a very comprehensive talk based on his personal impressions and observations.

Without elaborating on income taxes, the high-lights of the tax structure were described with reference to the history and development of the system and the responsibilities and fields of taxation of the three levels of government, federal, provincial and municipal. Taxation is very intimately tied up with the structure and obligations of government. As these change as occasioned by the times, technology, population shifts and other factors, the tax structure must similarly change so that government can continue to meet its financial responsibilities. This process of change sets up stresses in the tax structure, and since in our Canadian tax system there are three levels of government all dealing with the same taxpayer the process of change is considerably slower and more difficult than in a monolithic system consisting of only one taxing authority. Our three level system has advantages over a one level system insofar as it promotes local independence as well as a national consciousness. Therefore, in operation, the system because of conflicting interests becomes one of compromise.

### The Basis of Tax Structure

The British North America Act of 1867 set up the basis of Canada's government and tax structure. The federal government while free to tax in any field was specifically given the right to various direct and indirect taxes notably tariffs and customs which had been a major source of revenue in those days but are no longer of such relative importance today. The provincial taxation field was set up of direct taxes of lesser importance to enable the provinces to meet the obligations of social welfare with which they were entrusted.

Direct taxes are defined as taxes demanded of those who are directly affected, such as retail sales tax, excise tax or income tax, while indirect taxes are passed on or "hidden" taxes such as federal sales tax.

Subsequent to the passage of the B.N.A. Act, because of a reluctance on the part of the provinces to exercise their perogatives of entering the direct taxation fields, and to enable the provinces to balance their social welfare budgets, a system of federal subsidies to the provinces was begun. The basis of this system was rather complicated and amounted to 80 cents per head up to a population of 400,000 in an effort to balance all provincial budgets under a uniform rate. After various modifications, the federal subsidy program was discontinued in 1893 when the provinces entered the field of direct taxation.

### Rowell-Sirois Commission

During the 20th century as their responsibilities increased with the changing nature of Canada's economy, the provinces entered more and more into the direct taxation fields, which had hitherto been unexploited, until finally after the First World War and the depression of the early thirties, the tax system could keep up no longer and basic changes were required. Accordingly a Royal Commission, the Rowell-Sirois Commission, was constituted and brought in its report in 1940. This report was of profound importance and represented the first attempt at permanently solving the inherent weaknesses in Canada's tax structure as set up by the B.N.A. Act. Its recommendations were relatively radical and leaned essentially towards centralization.

The war intervened before any of these recommendations could be implemented and throughout the war years a temporary series of federal-provincial agreements enabled the provinces to get by. Essentially, these agreements consisted of federal grants to the provinces, in return the provinces rented various taxing powers to the federal government. In 1945, a federal-provincial conference was held at which the Rowell-Sirois recommendations and the continuation of the wartime agreements were discussed. While this conference was not successful as far as making one agreement with all the provinces was concerned, by 1947 all but two of the provinces had entered into separate agreements with Ottawa. In 1951 Ontario joined the fold, and at the present time only Quebec has not such an agreement. It is difficult to say whether these tax rental agreements are good or bad as there are good arguments both pro and con.

### Municipal Responsibilities

Municipal government in Canada began with the incorporation of Quebec in 1832 and Toronto in 1834, and the first system of local government was established in 1840. In Quebec at the present time there are 76 municipalities and 34 chartered cities, both groups with taxing powers, while all other cities and towns fall under the cities and towns act. Counties have no taxing powers. Municipalities both urban and rural are governed by councils elected by the proprietors and in general derive their income from property, retail sales and public utilities taxes.

Particularly, since the last war the municipalities have been very hard pressed to meet their obligations. While the federal and provincial shares of the tax dollar both percentagewise and in terms of of buying power have increased, the municipal share has decreased on both counts, despite disproportionately larger municipal obligations to be met. This imbalance has had to be met temporarily by subsidies, and a Royal Commission, the Tremblay Commission is presently sitting to attempt to find a more permanent solution to the problem. Various trends have contributed to the present imbalance, amongst these the population shift away from the cities, the accent on more and more social services and our automobile habits causing the need for more and better roads.

### Education

In the field of education which is one of the major municipal responsibilities these defects in the municipal tax structure are very obvious. Education in Quebec is administered by about 1700 protestant and catholic school boards and central boards. Revenue is derived by a 1 per cent sales tax and by property taxes on immovable property including industrial property but excluding religious, charitable or educational property. School boards are elected by the property owners, and funds are prorated between the protestant and catholic boards on the basis of population. The school boards have in general been subject to the same trends and factors as the municipal councils and as a result have just as little money. Provincial grants have to date been the only means of preventing deficits from becoming too great. Some of the trends which have contributed to this serious situation are the population shift to urban areas, the raising of the minimum compulsory education level to 14 years of age, general prosperity with the result that children can be kept in school longer, increasing emphasis on specialized courses which require more elaborate equipment such as laboratories, gymnasia, etc., and trends to decrease the ratio of pupils per teacher or classroom.

In recent attempts to provide more revenue for municipal and educational purposes various taxes such as work taxes, taxes on industries which exploit some national resources, and taxes on certain industries whose employees use certain municipal facilities have been levied. Certain of these taxes are discriminatory in that they penalize success, size, duplicate other taxes and do not apply equally to all industries.

In conclusion, Mr. Donnelly stated that the tax structure would continue to change along with the political, technological and social development of our country, and that unless we, the taxpayers, who pay all taxes in the final analysis scrutinize and control these changes, it would not be unlikely that the trend of the past would continue and that a greater and increasingly greater portion of the citizen's dollar would go into taxes of various sorts in the years to come.

## Sudbury

George Fleming, M.E.I.C.,
*Secretary-Treasurer*

T. C. Robertson, M.E.I.C.,
*Branch News Editor*

The large attendance at the March dinner meeting of the Sudbury Branch of the Engineering Institute of Canada held at the Granite Club showed the interest of the members in "Members Night". The speakers of the evening, R. H. Moore, Hugh MacKinnon and A. D. Finlayson were introduced by R. H. Charlap, A. D. McAdam and H. S. Stavang respectively.

### Mine Hoists

"Bob" Moore, chief mechanical and electrical engineer of Falconbridge Nickel Mines Ltd., outlined his trip to Sweden to obtain first hand information on Koepe or friction mine hoists. Leaving from New York he travelled by plane to Prestwick, Scotland, by way of Gander, Newfoundland, and thence on to Stockholm, the city built on islands.

He described many interesting sidelights such as the Vigeland Park at Oslo with its sculpture figures in stone and bronze, depicting life from childhood to old age, and his trip to Stravanger by train which in 3 hours passes through 156 tunnels, the longest one being 10 miles long. The wide use of concrete in place of steel, the punctuality of the electric railways and the absence of complete shaft timbering in mine shafts were other generalities which Mr. Moore discussed.

### Hoisting Scheme

The Koepe hoisting scheme is a system whereby the hoisting rope is passed over the driving sheave located in the headframe, much like a belt. At the ends of this rope the conveyances are attached and a tailrope is added below for continuous balance of the moving system. This idea was originated by Carl Friedrick Koepe back about 1876 and has developed along with the drum winder hoist in speed, depth and pay load. The hoisting ropes are designed with a higher rope safety factor than is used in this country and are thus much larger in diameter than those used in Canada. In order to overcome the twisting effect of the ropes and also to make the rope lighter to handle, four ropes in parallel are commonly used today. He cited an instance where 4 - 1½" ropes in parallel were used to hoist a 13 ton payload from a depth of 4200 ft. The hoist was powered by a 4250 h.p. motor.

Mr. Moore pointed out that the saving in power due to the balancing effect of the tail ropes could be obtained by adding a tail rope to our drum winder hoists but the lower inertia of the moving parts of the Koepe hoist to be accelerated would lead to considerable saving. The hoisting trend was to automatic operation and most hoists were pushbutton controlled as in the usual building elevator.

At the close of his address Mr. Moore showed some slides depicting Koepe hoists.

### Weather Forecasting

The second speaker, Hugh MacKinnon of the Sudbury Hydro Electric Commission, explained the compilation of the weather map and how it is used as a basis for weather forecasting.

Weather observations are taken simultaneously at prearranged synoptic hours in strategic locations over an extended area of approximately one-fifth of the earth's surface. These weather phenomenon are then coded according to an international code and transmitted to a central office where in the short period of one hour and ten minutes a comprehensive synopsis of existing world wide weather conditions is mapped. This map is then analysed and by the application of known reactions the weather trend can be predicted with remarkable accuracy.

During the war years when weather information was extremely valuable to our war effort, Mr. MacKinnon explained that enemy occupation, the radio silence of ships at sea, etc., made it impossible to obtain the complete picture. This hampered them to a considerable extent in forecasting during this time.

The speaker explained just how different air masses are formed at various altitudes and showed how their origin, whether tropical or polar, could effect our weather in the temperate zone when considered in conjunction with the pressure distribution. The pressure distribution would determine the wind direction and thus the movement of these masses. When the frontal zones of these air masses meet or move up or down, as determined by the pressure, various weather conditions would result.

### Synoptic Charts

Mr. MacKinnon then showed synoptic charts for three consecutive days to depict the pattern of pressure distribution, air masses, and frontal zones that occurred across the North American continent and explained the general movement of the weather picture from chart to chart with particular reference to the frontal disturbance which brought the rain, sleet and snow storm to Southern Ontario during the middle of February.

### Concrete Mixtures

The last speaker, A. D. Finlayson of the engineering staff of The International Nickel Co. of Canada Ltd., spoke on the control and design of concrete mixtures. All too often, stated Mr. Finlayson, the design of concrete is left to Antonio and his cement mixer who in many cases is fortunately not too bad. The noted Belgian engineer Prof. G. Magnel remarked recently that the poor quality of concrete produced by contractors in the United States is one of the greatest obstacles in the way of more common use of prestressed concrete in that country.

Throughout his address Mr. Finlayson used as an example the design and control of the concrete of the foundation for the chimney presently being constructed at Copper Cliff by the International Nickel Company.

The value of the water cement ratio as a factor affecting the strength and durability of the concrete, the methods used to obtain the moisture content of the aggregate and the difficulties encountered in the winter months due to the variations caused by steam heating were explained and some of the test equipment used was shown. Mr. Finlayson outlined the economy of a proper aggregate which would give a concrete with a uniform strength to resist weathering. The use of pit gravel which might possibly be 25 per cent stone when a correct aggregate might be 60 percent stone proved to be poor economy when the amount of cement and the strength of the concrete were considered.

The slump tests applied and the variations found in this test were outlined. The smaller the slump the better the concrete but, of course, the harder to work. In Europe where concrete is generally of a higher quality, concrete is designed for no slump.

After a question period Kelvin Sproule thanked the speakers and the meeting adjourned.

## Winnipeg

C. S. Landon, M.E.I.C.,
*Secretary-Treasurer*

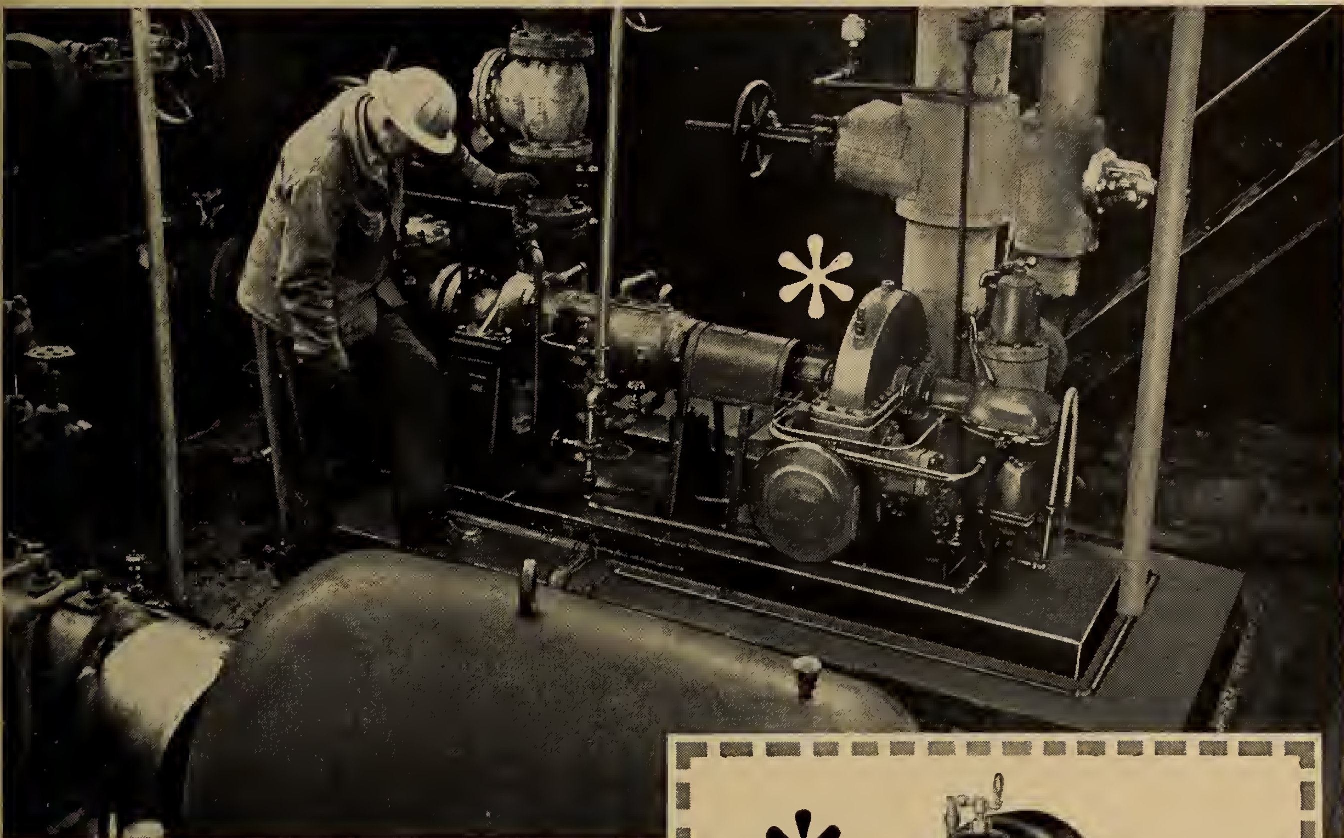
W. Victor Morris, M.E.I.C.,
*Branch News Editor*

### Prizes Presented

At a meeting of the Winnipeg Branch held on March 18 under the chairmanship of Professor J. Hoogstraten, three prizes were presented to fourth year engineering students of the University of Manitoba for theses written during the summer of 1953.

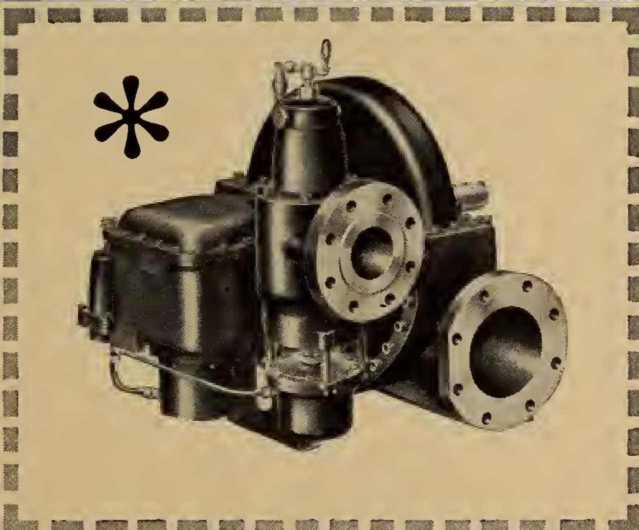
# New Mechanical Turbines

## offer special features at no extra cost




Refinery process foreman adjusts pump valve. This Type DP-20, 125 hp turbine increased by 75% the oil thru-put of this pump which supplies oil for the refinery's distillation unit. Total daily thru-put of pump equals former capacity of two.

• G-E Type DP turbines—incorporating many superior design features—set a new standard in mechanical-drive turbines, yet they're priced no higher than conventional machines. Two G-E big-turbine features are . . . "built-in" hydraulic governing, for a much wider speed range with greater accuracy of control than is possible with standard type governors . . . plus pressure-oiled bearing for constant, positive lubrication. Many other features exclusive with the Type DP are added to give maximum performance and reliability, plus low maintenance. Standardization keeps initial costs low . . . permits easy interchanging of parts and fast replacement. Get the complete story on G-E Type DP Turbines by contacting your nearest C-G-E sales office.




*Type DP Turbine* . . . one of the new C-G-E line of improved mechanical-drive turbines for pumps, compressors, blowers. Sturdy construction and safety features fit them ideally for many petroleum industry applications.

**GENERAL ELECTRIC MECHANICAL-DRIVE TURBINES**

*APPARATUS DIVISION*

AAD-101

**CANADIAN GENERAL ELECTRIC COMPANY LIMITED**

At the joint meeting of the Winnipeg branches of the E.I.C. and I.R.E. (left to right): Prof. N. A. Williams, chairman Electrical Section E.I.C., A. J. Groleau, chief engineer, Toll Area, Bell Telephone Co. Montreal, J. Greenaway, Chairman, I.R.E.

Yukon Branch executive with President R. L. Dobbin. Left to right: F/L. G. H. Hicks, treasurer, John L. Phelps, secretary, President Dobbin, Lt.-Col. M. C. Sutherland Brown, chairman, Brigadier H. W. Love, Lt. K. J. Baker.

The civil engineering prize was presented to Arnold B. Bjornsson for his thesis, "A Discussion on the Use of Cantilever Trusses in the R.C.A.F. Standard Maintenance Hangar and Workshops". Mr. Bjornsson was introduced to the members by Professor W. F. Riddell, chairman of the university's civil engineering department.

Professor N. A. Williams, chairman of electrical engineering, introduced the winner in the electrical engineering department, Ernest Bridges, whose thesis title was "General Supervisory Control Equipment of the Winnipeg Electric System".

Ronald G. Nicholls, student in mechanical engineering, was introduced by Professor N. M. Hall, chairman of the mechanical engineering department, who remarked that he was very pleased to see that Mr. Nicholls, a mechanical student, had done such a commendable job on a civil engineering subject, "A Study of Bearing Piles as Applied to the Alcan Project at Kitimat, British Columbia".

On behalf of the faculty of engineering and architecture Dean A. E. Macdonald thanked the Engineering Institute for the encouragement given to students to write summer theses.

#### Gas Turbines

Following the presentation of prizes, J. S. Quill of Schenectady, New York, spoke to the members of the application of gas turbines to the pumping of gas through pipe lines. This particular subject holds special interest for engineers in this part of the country at this time in view of the possibility that natural gas from Alberta will soon be piped to and through Winnipeg.

Mr. Quill is with the industrial engineering section of General Electric Company, at Schenectady. His talk was accompanied and illustrated by a series of coloured slides showing a number of installations of gas turbines in gas pipelines and in other applications. After the swiftly-paced, entertaining, and informative talk, a discussion period followed, during which Mr. Quill answered questions and enlarged upon points of particular interest to the Winnipeg members.

### ELECTRICAL SECTION

G. Flavell, Jr.E.I.C.,
*Section News Editor*

#### Circuit Breakers

D. F. Amer, engineer in charge of high voltage switchgear, Reyrolle & Company Limited, Durham, England, spoke to a gathering of the electrical section on February 4. His paper entitled "A Review of British Air-blast, Dead Tank, Oil Break and Porcelain Clad Small Oil Volume Circuit Breakers for 66 k.v. and Above".

Mr. Amer described, with the aid of slides, the general construction of the three different types of breaks in question, pointing out the features of each type and the theory behind certain points of construction.

The performance characteristics of the three types were then compared under the following conditions:

1. Normal load breaking
2. Small inductive currents
3. Breaking capacitive currents
4. Breaking short circuit currents
5. Automatic reclosing
6. Asynchronous load breaking
7. Resistence switching

Mr. Amer briefly outlined the factors affecting insulation in the three types of breakers, brought about by oil and air contamination due to arc products.

The location and application of current transformers for protection was discussed in detail in each case.

#### Future Developments

Commenting on future developments for circuit breakers, Mr. Amer felt that larger testing stations would help engineers design simpler, more efficient and higher capacity circuit breakers, but up to the present time, testing station capabilities have lagged behind the increase of available fault power in supply networks.

The attending members expressed their gratitude to Mr. Amer for his very fine paper.

The meeting adjourned for refreshments.

#### TD-2 Microwave Link

A joint meeting of the I.R.E., Winnipeg Section, and the E.I.C., Electrical Section on February 17, was attended by over 250 people, which included visitors from the Canadian National and Canadian Pacific Telegraphs and the Manitoba Telephone System.

Mr. Groleau, chief engineer of toll area for the Bell Telephone Company in Montreal, presented a paper describing the microwave system linking Buffalo, Toronto, Ottawa and Montreal.

The system which has been in service about a year and a half operates on a 4000 megacycle frequency and will ultimately carry 12 channels, each channel having a capacity of a TV channel or 480 telephone circuits. At the present time there are facilities for one video and one telephone channel each way between Toronto, Ottawa and Montreal, and dual frequency between Toronto and Buffalo for diversity operation of 1 - one-way video and 1 - one-way telephone channel. Only 98 of the 480 circuits available in the channel are in use, with a total of 170 to be used later this year. The system will be able to handle colour TV when available.

#### Preparatory Engineering Work

With the aid of slides Mr. Groleau outlined the preparatory engineering work that was necessary, and described the field tests carried out, using mobile transmitting and receiving stations and portable towers.

Mr. Groleau described the inspection and servicing routine set up for maintenance of the unattended relay point.

Tube troubles have been minimized by the use of a controlled inspection program and due to specially designed tubes. The sample shown was a 4000 megacycle triode using a grid wire of .0003 inches in diameter. The tubes cost between $200.00 and $300.00 each.

Mr. Groleau concluded by summerizing the advantages of microwave systems, such as, the one he described, but clearly pointed out that microwave could only be economical under certain conditions and applications, and it is not intended to replace land-time communication.

Following an interesting discussion, Mr. Groleau was accorded a vote of thanks by those in attendance.

### Toronto

L. F. Bresolin, Jr.E.I.C.,
*Secretary-Treasurer*

H. Fealdman, Jr.E.I.C.,
*Branch News Editor*

#### The St. Lawrence Seaway

Colonel L. F. Grant, E.I.C. Field Secretary, discussed the question of the St. Lawrence seaway from economical, historical and political standpoints before a joint meeting of the Toronto Branch and the Canadian Institute of Mining and Metallurgy on Friday March 19. This meeting, which was held in the Northgate Hotel, was preceded by dinner, and Colonel Grant's address came as a fitting climax to an enjoyable evening.

After having traced the historical development of navigation on the St. Lawrence and the Great Lakes, Colonel Grant stated that the plan now before the House of Representatives for joint U.S. and Canadian participation in the seaway which provided for the international section to be built on the U.S. side, would deprive Canada of her historic control of the St. Lawrence to the sea. The Canadian Government had served notice to the U.S. that Canada was prepared to go ahead on her own and Colonel Grant urged that this be carried out. Such an undertaking, in relation to the country's economy would be simple when compared to the achievement of the construction of the Welland canal in 1833.

Colonel Grant also voiced some personal objections to the seaway, in that he was not assured that the Maritime Provinces would not be harmed economically, that the C.N.R. would suffer, and that beauty spots would be destroyed and small peaceful communities would be turned into large cities. He also felt that it was not fair to ask the country, as a whole, to bear the cost which should be paid for by toll charges on shipping. This should be insisted upon, despite heavy pressure which would be brought to bear by the shipping companies.

## Yukon

JOHN L. PHELPS, M.E.I.C.,
*Secretary-Treasurer*

K. J. BAKER, JR.E.I.C.,
*Branch News Editor*

***President's Visit***

On March 5 the newly formed Yukon Branch was honoured by a five day visit from the president, Mr. Dobbin. All efforts were made to try to show him as much of our territory as the short stay would allow.

Mr. Dobbin stayed at the home of Lt. Col. and Mrs. M. C. Sutherland Brown and on the night of his arrival was entertained, along with the branch executives and their wives, at a buffet supper at their home.

***A Busy Schedule***

The next morning Mr. Dobbin, with the branch chairman Lt. Col. M. C. Sutherland Brown and branch secretary John Phelps toured the Whitehorse area showing him all the points of interest in the army and air force installations. After lunch at the Officers' Mess, a further tour was made to the local museum and utility plants.

In the evening a banquet for all members, branch affiliates and their wives was held at the Whitehorse Inn ballroom. Because of the large attendance Mr. Dobbin was able to meet about 90 percent of the membership. A very interesting talk on the Coronation was given by Mr. Dobbin after dinner.

The following day, Mr. Dobbin, Lt. Col. M. C. Sutherland Brown, J. L. Phelps and the United Keno Hill Mines Co. road superintendent D. Finlayson, drove to the United Keno Hill Mines property at Elsa Camp, a distance of 256 miles almost due north of Whitehorse, to be the guests of C. E. White, M.E.I.C., the general manager. This brought Mr. Dobbin to within 130 miles of the Arctic Circle.

On the way to Elsa the party stopped at the Yukon Coal Mines at Carmacks for lunch and then were guests for tea at the home of Mr. and Mrs. Barwise. Mr. Barwise is foreman of the new four million dollar hydro plant of the Northwest Power Commission which was completed last year to supply electric power to the Mayo mining area.

Monday, March 8, Mr. White and his staff showed the group through his mine and mill. It will perhaps be of interest to the E.I.C. members to know that this property is now the largest silver producer in Canada as well as one of Canada's most northerly mines.

***Joint Meeting***

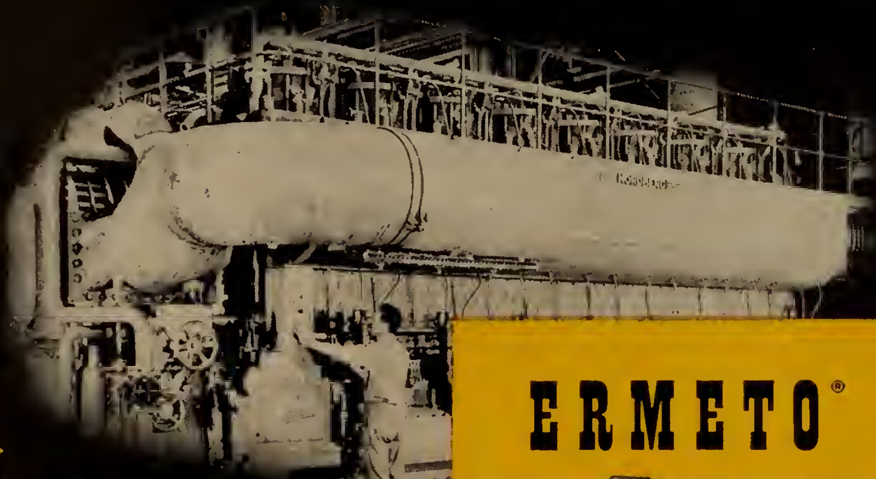
Monday night Mr. Dobbin and Mr. White presided over a joint E.I.C. and C.I.M.M. meeting which was attended by about 20 engineers and their wives. Engineers from all the other mines in the area turned up at the meeting to hear and meet Mr. Dobbin.

Tuesday, the party went to the town of Mayo where Mr. Dobbin flew to the historic City of Dawson. Due to shortage in time Mr. Dobbin was not able to visit Dawson but was flown over the city and the various creeks of '98 fame were pointed out to him.

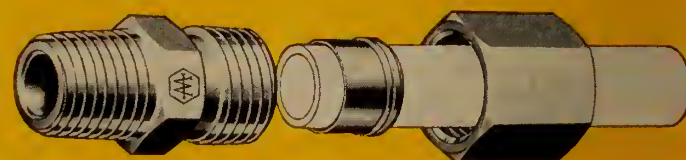
The party then flew back to Whitehorse where Brig. H. W. Love, M.E.I.C., gave a stag dinner at the Officers' Mess for the branch executives, the Commissioner of Yukon and Dean Hardy, M.E.I.C., of the University of Alberta.

The next morning, March 10, Mr. Dobbin returned via CPA to Edmonton.

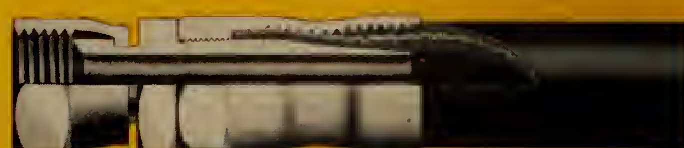
It must be recorded that it was through the visit of a past president, Col. L. F. Grant, that the Branch was formed in 1953. It is interesting to note that Mr. Dobbin was the first president to visit the Branch. The honour and pleasure of his visit was enjoyed.

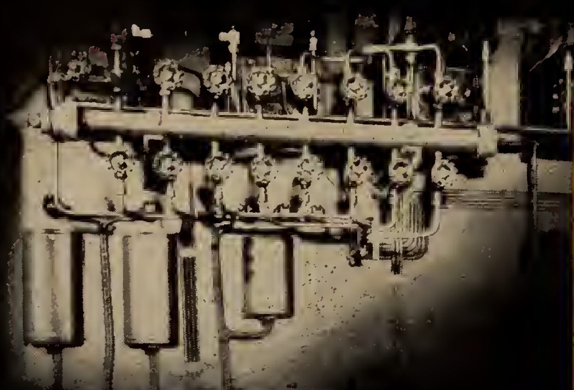




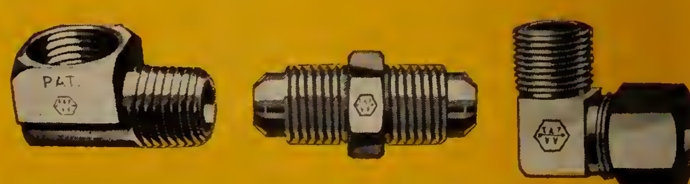








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# LIBRARY NOTES

## Additions to the Institute Library

**Reviews — Book Notes — Abstracts**

## BOOK REVIEW

**Résistance des matériaux, théorique et expérimentale. Vol. 1, Théorie de l'élasticité et des structures élastiques.** R. L'Hermite. Paris, Dunod; Montreal, Fomac, 1954, 860 pp., figs., $33.60.

During the past twenty years, strength of materials, theories of elasticity, of plasticity, and of stability have made great strides.

In an effort to bring together in one work as much of this scattered information as possible, we now have the first of our proposed volumes by Monsieur L'Hermite.

This volume is devoted primarily to theories of elasticity in two and three dimensions, elastic structures, flexion and torsion, bent slabs, and shells.

It is definitely not intended as a textbook, but is written for specialists, constructors, and physicists who wish to enlarge their point of view, and keep up with modern developments in their subject.

Theories have been condensed to a minimum, and principles of methods and results have been stressed.

Bibliographies are in the form of footnotes and collectively will prove an invaluable source for more detailed reference material. However, the author states that he has not included additional books on the same subject. They are all books he has already referred to in the text.

Running page headings and bold type paragraph titles are an invaluable help to quick reference.

The latter are repeated in the detailed table of contents at the front of the volume. An alphabetical author list, and subject index follows at the back.

The whole is a scholarly presentation, arranged for maximum usefulness for reference or for full reading, and will be an invaluable contribution in its field.

E.K.

## BOOK NOTES

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*Book notes marked by an asterisk have been provided through the courtesy of the Engineering Societies Library in New York.

**Bibliography of rivers and harbors and related fields in hydraulic engineering.** R. S. Rowe. Princeton, University, Dept. of civil engineering, Rivers and harbors section, 1953. 407pp.

This bibliography contains over six thousand references in many languages covering books, reports, monographs, handbooks, etc., but does not include articles in periodicals, or abstracts, the majority of the listings have been taken from the Library of Congress catalogue.

The entries are divided into nine sections: hydraulic engineering, rivers, harbours, canals and inland navigation, interoceanic canals, reclamation, flood dams and reservoirs, water power and water supply engineering. Each of these sections is further divided into smaller topics. In addition to general listings for the subjects, there are, in the majority of sections, entries for specific rivers, harbours, canals, etc. There are author and subject indices, the latter listing mostly specific geographic features.

This bibliography should prove very useful to all those connected in any way with the important field of hydraulic engineering.

**Blazing Alaska's trails.** A. H. Brooks. Washington, Arctic Institute of North America, 1953. 528 pp., illus., $4.50 (U.S.).

Published jointly by the University of Alaska and The Arctic Institute of North America, this is a posthumous publication of the work of the late A. H. Brooks, formerly head of the United States Geological Survey work in Alaska. It is edited by B. L. Fryxell, with a foreword by John C. Reed, of the Arctic Institute.

Detailed information includes climate, topographical formation and geology, flora and fauna, history, economic, political and cultural, and both Russian and American exploration and occupation.

Although there is no bibliography as in such, a few bibliographical footnotes are included, and there is a detailed index.

**Britain's atomic factories.** K. E. B. Jay. Ottawa, United Kingdom Information office, 1954. 100 pp., illus., $1.25.

In England, just as the name Harwell is synonymous with atomic energy reresearch, so Risley is synonymous with atomic energy production. This report traces in outline the story of Risley from its inception in 1946, through the design and construction of its three factories, to the present day when they are all in production. There is also a final chapter giving plans for the future, and the possibilities of producing power from nuclear fission.

Although written primarily for the layman, the report should also be of great interest to both scientists and engineers, particularly as details are given of the actual production side which involved the design and construction of engineering works of what must necessarily be a new type. The report emphasizes the use made of engineers, ". . . wherever one goes at Risley one encounters an engineer . . . Every operation except the purely administrative and clerical is controlled and usually performed by an engineer because only by so doing is it possible to ensure that the engineering point of view prevails". Reference is made to the special training programme instituted in connection with the work, and to the part that younger engineers are playing in the development — the average age of those employed being just over thirty.

This report, written by a member of the Division of atomic energy, together with that published some time ago in activities at Harwell, make very interesting reading.

**Canadian conference on prestressed concrete.** Toronto, University Press, 1954. Irreg. paging, spiral binding, $2.50.

Designed as a concise review of prestressed concrete for Canadian engineers, architects, and builders, each paper at this conference was prepared by a specialist in the particular field, including Professor Magnel, from the University of Ghent.

Topics covered include why we use prestressed concrete, strain gauge tests on beams, introduction to the theory, control of quality, steel for use, significant features, statistical indeterminacy, reports on research, and a discussion of the world's largest concrete beams.

## LIBRARY REGULATIONS

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### Bibliography and Reference Service

Short subject bibliographies are compiled on request. When placing these requests, please give as much detail and background information as possible.

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Most speakers have included bibliographical references with their papers, and the whole is well illustrated, with both diagrams and photographs.

***Construction methods and machinery.** F. H. Kellog. New York, Prentice-Hall, 1954. 415 pp., illus., $10.00 (U.S.).

In this book the principles of scientific management are applied to construction work. Part one treats planning of operations, control of work for maximum production, and economics of equipment-selection, costs, depreciation, etc. Part two discusses the fundamentals and economical utilization of machinery for power, transportation, hoisting and conveying, and pumping. In the third part—about half the book—methods of conducting scientific operations are described and evaluated.

***The design of dams.** A Bourgin, tr. by F. Fergusson. Toronto, Pitman, 1953. 344 pp., figs., $9.00.

Part I of this translation from the French is an introductory summary of the basic formulas and theories. Part II is a thorough exposition of the well-established design procedure for gravity dams. Part III discusses in considerable detail the mainly theoretical methods of design of arch dams. And part IV deals briefly with counterfort and hollow dams. It is extensively illustrated by diagrams and graphs.

***Design in structural steel.** J. E. Lothers. New York, Prentice-Hall, 1953. 454 pp., figs., $10.00 (U.S.).

With its emphasis on real structures and practical problems of design in steel, this text will be useful to both practicing engineers and students. It begins with consideration of structural members and connections, covers base-plates, built-up beams and plate girders, roof trusses, and industrial building bents, and concludes with a chapter on steel bridges. Many practical problems are given.

**Diesel engine design,** 2nd ed. Toronto, British Book Service, 1953. 415 pp., diagrs., $7.50.

"The Diesel engine, like all other heat engines, converts the latent heat energy of the fuel into mechanical work. The heat in the fuel is released by combustion and is transferred to a working substance. The Diesel engine is classed as an internal combustion engine because this working substance actually takes part in the process of combustion."

As the Diesel engine is concerned with this conversion of heat into energy, chapters on thermodynamics and combustion problems are included. The dynamics of the connecting rod crank mechanism are also investigated, and a solution to facilitate treatment of the crank shaft as a continuous beam.

Worked examples for eight-mass torsional vibration and four-mass balancing problems are also considered, and further analysis of these can be had through bibliographical references, which are included with some of the chapters, and also at the end of the text.

**Electrical year book,** 1954 ed. Manchester, Emmott, 1954. 360 pp., diagrs., tables, 3/–.

In addition to mathematical tables showing such things as areas and circumferences of circles, squares, etc., this Year book contains tables of British standard Whitworth bolts and nuts, and screw threads.

The various articles in the Year book cover many topics connected with electrical engineering, including electrical calculations, space heating, switch gear and switchboards, electric wiring, meters and measuring instruments, etc. There are completely new sections on electrical equipment in automobiles, and on safety precautions in the use of portable electric tools. Other sections have been revised.

This 1954 edition of the Year book should be a useful addition to any library reference shelf.

**Electro-magnetic machines.** R. Langlois-Berthelot; Lieut.-Col. H.M. Clarke, tr. London, Macdonald, 1953. 535 pp., illus., 65/–.

This book was originally published in French, and due to war conditions, has only just come out in an English edition.

The author, in addition to directing one of the most modern and best equipped high voltage laboratories in Europe, is chief research engineer for production and transformer equipment at L'Electricité de France, and professor of Electrical Engineering at L'Ecole Supérieure de Paris.

He has divided his work into six parts, considering questions common to the different classes of transformers and rotating machines.

Part one deals with the various types of machine.

Part two — The general constitution and stenography.

Part three — The machine as seen by the designer responsible for the creation of the machine, and how it will answer the demands of industrial physics.

Part four — The machine as seen by the engineer who must define its working conditions.

Part five — A general outline of abnormal conditions theory, i.e. harmonics, unbalance, transients.

Part six — General discussion of flux, reactive power, industrial research, etc.

An appendix deals with elementary basic algebraic problems.

Unfortunately, the index is poor. However, the general format of the volume is excellent, and the logical arrangement of the information makes for ease of consultation.

***Elements of electrical engineering,** 6th ed. L. Cook and C. Carr. New York, Wiley, 1954. 682 pp., diagrs., $6.75.

This standard textbook is intended as a short course for electrical students and for non-electrical students in college. The extensive coverage, arranged to be used and combined as required, is divided as follows: fundamentals of electric and magnetic circuits; basic relations for electrical machines; d-c. machinery; a-c. circuits; a-c. machinery; instruments, electronics, special applications.

***Elements of statistics.** H. C. Fryer. New York, Wiley, 1954. 262 pp., $4.75.

A textbook for an introductory course in probability and statistics. The book aims to give the student a background in elementary methods, probability, and frequency distributions, and an introduction to sampling now in common use.

**Essentials of engineering thermodynamics.** H. J. Stoever. New York, Wiley, 1953. 279 pp., figs., $4.50.

This is a basic undergraduate introductory text book, condensed from the nineteen hundred and fifty-one title Engineering Thermodynamics.

It is conveniently divided into three parts, dealing successively with the first and second laws of thermodynamics, and then the application of the principles and methods developed.

In keeping with its identity as a class room text, problems are included, and an appendix of basic tables.

**Exécution du béton précontraint.** L. Bourgine. Paris, Editions Eyrolles, 1954. 116 pp., illus., $4.00.

Besides the preparation of prestressed concrete, a perhaps even more important part of the construction job is the way the mixture is used. And this is the angle stressed by the author in this little volume.

Copious detailed photographs accompany the text, and clearly defined sections and paragraph headings greatly facilitate its use.

It will be a small, but most valuable addition to the field.

**Fabricated materials and parts: a comparison of cost and design factors.** T. C. Du Mond. New York, Reinhold, 1953. 332 pp., illus., $6.50 (U.S.).

The author of this volume is also editor of MATERIALS AND METHODS. A considerable amount of the information contained first appeared in a special section of METALS AND ALLOYS, and later in more detail entitled Fabricated Materials and Parts in MATERIALS AND METHODS.

The object of this publication is to bring together in one volume all the important information which must be considered in deciding what method of production best meets the needs of the individual making the decision.

The book is well illustrated, and logically arranged, but the index is brief.

**The Firestone story; a history of the Firestone Tire and Rubber Company.** Alfred Lief. Toronto, Whittlesey House, 1951. 437 pp., illus., $4.50.

The Firestone Tire and Rubber Company was founded in 1900, and this history of its first fifty years covers the period from the horse-and-buggy days to the present. The development of rubber tires, from the first solid one used on carriages to the various types now used on many kinds of vehicles, is outlined, and the growth of the company to meet changing conditions is shown. The author had free access to the archives of the company, and the book will be of interest to those connected with the rubber industry, or interested in the commercial history of the United States.

***Fourth symposium (international) on combustion, September 1952.** Baltimore, Williams and Wilkins, Toronto, Burns and MacEachern, 1953. 926 pp., diagrs., $7.00.

The range of topics of the papers presented in this symposium was limited in order to place emphasis on the physical aspects of combustion, treated from both experimental and theoretical standpoints. The one hundred and twelve papers are broadly classified under the following headings; flammability; ignition; laminar combustion and detonation waves (fifty papers); cellular flames and oscillatory combustion; turbulent flames; quenching, flash back, and blow-off; stabilization by flame holders; fuel jets; burning of fuel droplets; combustion in rockets and engines; and survey papers.

**Glossary of terms used in petroleum refining.** New York American petroleum institute, Division of refining, 1953. 188 pp., $6.00 (U.S.).

The petroleum industry has its own colloquial and technical terms, just as any other industry, and although this glossary does not attempt to give authoritative definitions, it is a valuable tool for those in the industry. The definitions are taken from published sources, such as technical dictionaries and encyclopedias. There is an Appendix giving both Pitman and Gregg shorthand outlines of the terms in the Glossary, very useful for any secretary in the petroleum industry.

***The growth of integrated oil companies.** G. McLean and W. Haigh. Boston, Harvard Business School, Division of Research, 1954. 728 pp., figs., $12.00 (U.S.).

The emergence of large integrated oil companies as the predominant form of organization in the oil industry is the subject of this study. Part one depicts the structure of the industry in nineteen hundred and fifty; part two discusses the technological, economic and business factors which resulted in integration; part three analyzes seven representative companies to determine differences in structure and in managerial policies; part four examines the position of the small refiners in the industry.

**Guide to audio reproduction.** David Fidelman. New York, Rider, 1953. 232 pp., illus., $3.50 (U.S.)

The aim of this book is to present an introduction to the principles and techniques of sound reproduction, and is intended for those who are familiar with the basic principles and components of electronic circuits, but who are not specialists in electronics or audio. A minimum of mathematics has been used in the text.

The book begins by outlining the principles of high fidelity reproduction of sound, and shows the application of the principles to audio systems. Also covered are the basic theory of sound and musical instruments, the design and construction of amplifiers, loudspeakers and cabinets, and their location in a room.

This book should be of use to all those interested in sound reproduction, both the amateur and professional.

***Hydraulique technique.** Charles Jaeger. Paris, Dunod; Montreal, Fomac, 1954. 510 pp., $21.50.

Beginning with a section on fundamental hydraulic principles, this text has three subsequent major sections on steady flow, unsteady flow, and flow in underground strata. Particular attention is paid to basic hydrodynamic equations, open-channel flow, surge tanks, and water hammer. An appendix discusses experimental values for hydraulic calculations dealing with the effect of bends and other physical conditions.

**Industrial inorganic analysis.** R. S. Young. Toronto, British Book Service, 1953. 368 pp., diagrs., $7.25.

Presented in alphabetical order of chemical names, the author has prepared this volume primarily for the use of the industrial analytical chemist. But it is also hoped that it will be of use to the younger analytical chemists in inorganic chemical industries and in the mining and metallurgical field.

Each section includes a short discussion of the material being considered, its properties etc. This is followed by general procedure, and special procedure, and a list of bibliographical references.

The whole text is followed by three and one half pages of general bibliography and an author and subject index.

**An introduction to railway engineering.** R. A. Inglis. Toronto, British Book Service, 1953. 200 pp., diagrs., $4.25.

Subtitled "A short textbook of the theory and practice of railway surveying, construction and signalling for the use of students and civil engineers", this volume will also be a handy office reference book.

Surveying, construction and signalling are considered in the three general divisions of the volume.

The section on surveying is confined to methods and processes essential or peculiar to railway work. Railway construction is roughly limited to earthworks, trackwork and track construction. Signalling deals only with the methods currently in use with British Railways.

A two and one-half page bibliography comprises the references, and the book is well indexed.

**Introductory soil mechanics and foundations.** G. B. Sowers and G. F. Sowers. Chicago, Soiltest Inc., 1951. 284 pp., illus., $5.25 (U.S.).

The importance of soil mechanics in the fields of design and construction problems is receiving more and more recognition as time goes on.

Necessary pre-requisites for a study of this text are a knowledge of geology, and of applied mechanics; an understanding of

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structural design, and an appreciation of construction procedures.

The authors of the book make no claim to originality, but have freely drawn on the results of the work of world known specialists in the field.

The nature and physical properties of soils, soil deposits, seepage, drainage and frost action, foundation, earth pressure, fills and subgrades, and stability of earth masses, all are considered.

Problems and bibliographies are included, and also a list of nomenclatures and symbols, and the book is indexed.

**Maintenance engineers' pocket book,** E. Molloy, ed. Toronto, British Book, Service, 1953. 256 pp., diagrs., $3.00.

Another in a series edited by E. Molloy, this useful pocket book is intended for engineers in charge of the maintenance of all types of plant in factories, workshops, etc. It is a revision of the Plant engineer's pocket book, and is divided into five sections: Regulations (British) affecting the maintenance engineer; sources of power; transmission of power; plant and equipment; and essential services. The subjects dealt with in these sections include a-c. and d-c. motors, steam engines and boilers, roller chain drives, pumps, compressed air equipment and lighting. Much of the material is given in tabular form.

***Materials and processes,** 2nd ed. J. F. Young. New York, Wiley, 1954. 1,074 pp., figs., $8.50.

This book aims to present, in a single volume, a broad study of the materials and manufacturing processes employed by engineering designers, and thus to provide information directly useful in the selection of materials. It is intended for classroom use and for engineers who wish an overall picture. In addition to the general revision new chapters have been added on metallographic examination, statistical methods, and various non-metallic materials.

**Mechanical world year book,** 1954 ed. Manchester, Emmott, 1954. 264 pp., diagrs., tables, 3/6.

The 1954 edition of this useful Year book contains two new sections, namely a review of progress in the steam cycle and the performance of steam turbine plants, and an article on metal finishing, in addition to sections on patenting procedure, fuel and lubricating oils, machine tools, steam boilers, mechanical press work, etc.

There are many tables, a list of selected British standards relating to mechanical engineering, and a short classified buyers' guide.

**Les moteurs électriques à puissance fractionnaire.** C. G. Vienott. Paris, Dunod; Montreal, Fomac, 1954. 538 pp., figs., $20.25.

Originally published in New York by McGraw-Hill, under the title FRACTIONAL HORSE POWER ELECTRIC MOTORS, this volume will now be most welcome to French engineers in the electrical field.

The author describes existing types, the power required, what their potentialities are, and instructions for their repair.

Although primarily written to serve the needs of the installation, maintenance and repair man, it will also be of value and interest to everyone interested, from the mechanically minded, to the salesman.

The typical detailed French table of contents is a joy to use, and the alphabetical index at the back further enhances the book's usefulness.

***Nuclear moments.** N. F. Ramsey. New York, Wiley, 1954. 169 pp., figs., $5.00.

The first four chapters present introductory material and definitions, descriptions of interactions, methods for measuring nuclear moments, and a summary of significant results in the field and their relation to nuclear theory. These chapters are reprinted from the author's section of volume one of "Experimental Nuclear Physics" edited by E. Segre. The last third of the book is new material on applications to chemistry and solid state physics.

**The physical chemistry of melts: a symposium on molten slags and salts.** London, Institution of Mining and Metallurgy, 1953. 106 pp., figs., 15/–.

These six papers, plus an introduction and general discussion, compose a symposium on the nature of molten slags and salts held by the Nuffield Research Group in extraction metallurgy, London, twentieth of February, nineteen fifty-two.

Both the text of the paper, and the discussion, are included in each instance, and they cover construction and surface tension of silicates, liquid oxides, molten slags, and heats of mixing in the system ferrous oxide-silica in the liquid state.

References are included with each paper, which adds further to this small but important volume.

**Principles and practice of management,** ed. E. F. L. Brech. Toronto, Longmans, Green, 1953. 752 pp., folded charts, $9.00.

The field of management is becoming more and more complex with the development of systems and modern methods of thinking.

This work, the first of its kind to be published, dealing with the subject as a whole, is divided into four parts, each written independently by a specialist in the field.

Distribution, Production, Personnel and Control are the headings of the four main parts. Each one is clearly arranged under separate chapters and headed paragraphs, and carries a bibliography.

Besides these sections, the editor himself discusses Management in Principle in the introduction, and Management in Practice in the conclusion, all followed by a general bibliography on management and a good index.

Numerous folded charts serve as an additional attraction.

The usefulness of this work in practically all branches of engineering and production can scarcely be overestimated.

**Proceedings of Athabasca oil sands conference, September 1951.** Edmonton, Oil sands project, 1951. 371 pp., illus., $2.50.

The Government of Alberta arranged the Oil sands conference in 1951 for the purpose of studying the factors affecting development of the Athabasca oil sands, and this book contains a verbatim report of the papers presented there, and the discussions arising from them.

The conference was divided into four sections, and in each section papers were given by experts in the various fields. The four sections dealt with geology of the sands formation, possible mining methods, separation of the oil from the sand, and its refining and transport to markets.

There is a list of references at the end of each paper, and the report should be of great interest to all of our members connected with the oil industry.

***The radio amateur's handbook,** 1954 ed. West Hartford, American radio relay league, 1954. 788 pp., illus., $3.50 (U.S.).

This standard manual of amateur radio communications covers the entire field from the fundamentals to the latest techniques in equipment, design and construction. The considerable amount of technical data provided includes a comprehensive, up-to-date section of vacuum-tube data tables. The advertising section contains condensed manufacturers' catalogs. As usual, the new edition has been revised to conform to current practice, notably the chapter on v.h.f. receivers.

**Refuse collection and disposal for the small community.** U.S. Public Health service and American public works association. Chicago, American public works association, 1953. 39 pp., illus., $2.00 (U.S.).

The aim of this report is to present operational and cost data connected with establishing and providing sanitary refuse practices in a small community in such a way that they may be applied in specific cases.

Storage, collection and the various methods of disposal of refuse are covered and there is also a section on methods of financing an efficient garbage system.

The Appendices include a bibliography of articles, books, pamphlets and films on the subject, and model ordinances governing refuse storage, collection and disposal.

**Saben's commercial directory and handbook of Uganda, 1953-1954.** Kampala, Uganda, Saben, 1953. 432 pp., maps in pocket, 25/.

This new edition of Saben's Uganda directory presents a great deal of information in a very compact form about a part of the world with which the majority of people are little acquainted.

The first section of the directory deals with the geography, history and government of the country, and also includes a bibliography of books about Uganda and East Africa. The directory section lists in alphabetical order the towns and villages, giving a few words of information about each, and then lists the holders of Post Office boxes in each place, together with their telephone numbers. There is a list of companies doing business in Uganda, and the section devoted to finance, freights and customs has paragraphs on banking, company law, income tax, freight rates, customs duties, etc.

Information is given on the agriculture, industry and commerce of the country, and there is also data on communications, hotels, and other items of interest to the traveller or tourist. Also included in the book are maps of Uganda and the surrounding territories.

This Directory will be very useful to all those who have any interests in Uganda, and will prove a valuable reference book.

**Shell moulding.** London, Machinery publishing co., 1953. 94 pp., illus., $1.00. (Yellow back No. 34).

Shell moulding is a method of casting which is as yet not very extensively used. However, as it is applicable to practically any metal, its use will probably increase.

This book presents a selection of the information available on shell moulding, much of it having already appeared in the periodical Machinery. The principles of the technique are explained, as are the methods by which a number of firms in both the United Kingdom and the United States have put it into use.

The various topics covered are the principles and advantages of shell moulding, mould making, patterns, shell making, shell moulding machines, preparations for pouring gates and runners, high-quality castings, and light alloy castings.

This latest volume in the "Yellow Back" series issued by the Machinery Publishing Company should prove of value to all those interested in metal casting.

***Spending for industrial research, 1951-1952.** DeW. C. Dearborn and others. Boston, Harvard business school, 1953. 103 pp., $2.50 (U.S.).

Summarized quantitative information is given including scale of expenditures for research and development by industrial firms and variations of such expenditures among firms by industry and size. There are many tables analysing total cost of research, broken down into cost per research worker, cost of research, classification by types and size of industry, and research financed by Federal Government.

***Statics and strength of materials.** R. H. Trathen. New York, Wiley, 1954. 506 pp., diagrs., $7.50.

While the coverage of this book is similar to that of existing texts, the arrangement of material differs in presenting statics and strength of materials as a unit. The primary emphasis is on principles but throughout the text illustrative problems indicate methods of applying principles to the solution of engineering problems.

**Sudbury basin: the story of nickel.** D. M. LeBourdais. Toronto, Ryerson, 1953. 210 pp., illus., $3.00.

In November of eighteen eighty-three the first work train reached Sudbury. In eighteen eighty-seven the Canadian Pacific Railway which owned the site, had it surveyed. In eighteen ninety-three, having attained the thousand population status of a town, it was incorporated. Within the next few years public utilities were added, and it now boasts a population of forty thousand people besides fifteen thousand in the surrounding areas.

"Thus Sudbury epitomizes the evolution of a Canadian frontier community into an important city, which has occurred within the life span of many now living in the district".

From these first faltering beginnings, the author tells the story of the gradual discovery and development of the numerous ores and metals in the Shield, of the companies and personalities who financed and developed them and the pioneer faith and courage it took to achieve this.

Sudbury Basin will be of interest not only to the mining enthusiast and business man, but also to anyone interested in the growth and development of this country and its future potentialities.

***Thermionic valves.** A. H. W. Beck. Toronto, Macmillan, 1953. 570 pp., $10.25.

A comprehensive, theoretical account of the behavior of thermionic high vacuum devices, intended as an introduction to current research and a reference work for the practising engineer. The first of three parts deals with the fundamental physics of thermionic emission; the second considers the general theory of fields and electron motions related to charged conductors; and the last and longest section applies this material to various classes of tubes. Microwave tubes receive special attention.

***Timber; its structure and properties,** 3rd ed. H. E. Desch. Toronto, Macmillan, 1953. 350 pp., illus., $3.00.

Written in non-technical language for the user of wood, this summary of modern wood technology consists of four parts: Parts I, II, and III cover structure and classification, gross features and identification, and the physical properties of wood; Part IV, on wood utilization, deals with seasoning, defects, pests, preservation methods, timber grading, and briefly with wood as an engineering material.

***Traité théorique et pratique des engrenages. Volume I; théorie et technologie,** 2nd ed. G. Henriot. Paris, Dunod; Montreal, Fomac, 1954. 394 pp., figs., $15.75.

Volume one of this treatise on gears and gear design contains a review of fundamentals, an analysis of gear types and the generation of gear profiles, a study of gear interaction, and detailed treatment of tooth calculations and corrections. It suggests methods for improving gear quality and discusses both ordinary and epicycloidal geartrains.

***The Van Nostrand chemist's dictionary.** M. Honig and others, eds. Toronto, Van Nostrand, 1953. 761 pp., $12.00.

Although of primary interest to chemists, engineers may find need of definitions of some of the eleven thousand terms in this semi-encyclopedic work. The definitions vary from a few words to several paragraphs, and effective cross-indexing is provided by printing all listed words and topics in bold-face wherever they appear.

**Waves, tides, currents and beaches: glossary of terms and list of standard symbols.** R. L. Wiegel. Berkeley, Engineering Foundation, Council on wave research, 1953. 113 pp., illus., $1.00 (U.S.).

This glossary lists terms relating to waves, tides, currents and beaches as used by workers in the field of physical oceanography. The definitions are clear and concise, and include cross references. There are photographs and diagrams illustrating some of the terms.

A list of standard symbols and their definitions is included, and there is a useful bibliography of the reference sources used in compiling the glossary.

**World almanac and book of facts for 1954.** New York, New York World-Telegram and Sun, 1954. 896 pp., $1.00 (U.S.).

A wealth of information is condensed into a very compact form in this 1954 edition of the World almanac. There is a chronology of the events of 1953, both international and American, and a selection of the outstanding events of previous years is given.

There are lists of noted names of all nationalities, authors, poets, composers, historians, statesmen, actors, artists, of geographical and astronomical information, sports events, etc.

The major portion of the Almanac is devoted to the United States, and information is given on its government, history, population, laws, judiciary, etc. There are also political, economic and physical descriptions of the individual states, and of countries outside the United States.

The World almanac is a useful addition to the library or office reference shelf.

**The year that made the day.** London, British Broadcasting Corporation, 1953, 79 pp., illus., $1.50.

Here is the British Broadcasting Corporation's own account of the planning and preparation which went into the broadcasting and televising last June of the Coronation Service in Westminster Abbey, and the processions through London.

Although the Corporation had a year in which to prepare, when one reads how much planning had to be done, this period does not seem any too long. Details are given of the various ways in which the location of microphones and cameras was arranged, and of the complicated system of connecting circuits and lines which had to be set up.

There are many photographs, including some taken from the television screens. There are also photographs of the engineers, commentators and cameramen responsible for the broadcasts.

This little book should be of great interest to many of our members, especially in view of the joint meeting held by radio with the members of the Institution of electrical engineers when the Coronation broadcasts were the subject of the papers presented.

## BOOKS RECEIVED

**Aide-mémoire Dunod travaux publics,** 67e ed. C. Mondin. Paris, Dunod; Montreal, Fomac, 1954. 2 vols., figs., $2.25 each vol.

**Analyse matricielle des réseaux électriques.** P. Le Corbeiller, tr. par G. Lehr. Paris, Dunod; Montreal, Fomac, 1954. 124 pp., figs., $4.50.

**Annual report on the progress of rubber technology,** vol. 17, 1953. T. J. Drakeley, ed. Cambridge, Heffer, for the Institution of the rubber industry, 1953. 173 pp., 21/-.

**Applied electronics,** 2nd ed. T. S. Gray. Cambridge, Technology Press; New York, Wiley, 1954. 881 pp., $9.00.

**Atomic power symposium held at Chalk River, Ont., September 1953. Report.** Chalk River, Atomic energy of Canada, 1953. 202 pp., figs., $2.00. (CRR-548-A. AECL-82).

**Betonstobning om vinteren,** and English translation, **Winter concreting.** P. Nerenst and others. Copenhagen, Danish national institute of building research, 1953, 108 pp., figs., $1.25. (Avnisning No. 17).

**Britain: an official handbook.** Ottawa, United Kingdom information office, 1953. 334 pp., maps, $1.40 pa., $2.00 cloth.

**Chauffage et rafraîchissement combinés des habitations.** C. Boileau. Paris, Dunod; Montreal, Fomac, 1954. 2 vols., figs., v. 1, $6.80, v. 2, $3.30.

**The closed die forging process.** P. E. Kyle. Toronto, Macmillan, 1954. 140 pp., illus., fold. diagrs., $1.50.

**Conquest of the moon.** Cornelius Ryan, ed. Toronto, Macmillan, 1954. 126 pp., illus., $5.25.

**Effects of taxation on depreciation adjustments for price changes.** Boston, Harvard business school, 1954. 161 pp., $3.25.

**Elementary fluid mechanics,** 3rd ed. J. K. Vennard. New York, Wiley, 1954. 401 pp., diagrs., $5.50.

**Elements of mechanism.** V. L. Doughtie and W. H. James. New York, Wiley, 1954. 494 pp., diagrs., $6.00.

**Engineering contracts and specifications,** 3rd ed. R. W. Abbett. New York, Wiley, 1954. 429 pp., $6.00.

**Engineering mechanics.** F. L. Singer. New York, Harper, 1954. 525 pp., diagrs., $6.00 (U.S.).

**Flow and fan.** C. H. Berry. New York, Industrial Press, 1954. 232 pp., illus., $4.00 (U.S.).

**French-English dictionary for chemists** 2nd ed. A. M. Patterson. New York, Wiley, 1954. 476 pp., $6.50.

**Graphic problems in petroleum geology.** L. W. LeRoy and J. W. Low. New York, Harper, 1954. 238 pp., spiral binding, figs., $4.50 (U.S.).

**Heat-resisting steels and alloys.** C. G. Conway. Toronto, British Book Service, 1953. 160 pp., $5.00.

**Heating, ventilating and air conditioning guide,** 1954. New York, American society of heating and ventilating engineers, 1954. 1616 pp., diagrs., fold. maps, $10.00 (U.S.).

**High altitude rocket research.** H. E. Newell. New York, Academic Press, 1954. 298 pp., diagrs., $7.50 (U.S.).

**How to use meters.** J. F. Rider. New York, Rider, 1954. 156 pp., pa., $2.40 (U.S.).

**Kempe's engineers year book,** 1954. London, Kempe's, 1954. 2 vols., illus., $15.00.

**Liants hydrocarbonés, mortiers et bétons bitumineux.** M. Duriex and J. Arrambide. Paris, Dunod; Montreal, Fomac, 1954. 728 pp., figs., $25.20.

**Le matériel de travaux publics. v. 2 Tracteurs, motorscrapers, engins de transport, etc.** R. Pagni et al. Paris, Dunod; Montreal, Fomac, 1954. 102 pp., figs., $7.90.

**The mathematical solution of engineering problems.** M. G. Salvadori. Toronto, Oxford, 1954. 245 pp., $4.50.

**Mathematics for students of engineering and applied science.** L. B. Benny. Toronto, Oxford, 1954. 783 pp., $5.25.

**Mechanics of materials,** 3rd ed. P. G, Laurson and W. J. Cox. New York. Wiley, 1954. 414 pp., $5.75.

**Modern developments in fluid dynamics: high speed flow.** L. Howarth, ed. Toronto, Oxford, 1954. 2 vols., $12.50 per set.

**The new architecture in Great Britain.** E. D. Mills. London, Standard Catalogue, 1954. 209 pp., plans, $7.00.

**Prestressed concrete design and construction.** F. Walley. London, H.M.S.O., 1953. 279 pp., illus., figs., $5.00.

**Probability and information theory, with applications to radar.** P. M. Woodward. Toronto, McGraw-Hill, 1953. 128 pp., $5.40.

**Pumped storage for hydroelectric power.** Knoxville, Tennessee Valley Authority, Technical Library, 1953. 5 pp.

**Radio trouble-shooting guide book.** J. F. Rider and J. R. Johnson. New York, Rider, 1954. 156 pp., pa. $2.40.

**Second supplement receiving tube substitution guide book.** H. A. Middleton. New York, Rider, 1954. 41 pp., pa., 99 cents. (U.S.)

**TV trouble-shooting and repair guidebook,** v. 2. R. G. Middleton. New York, Rider, 1954. 156 pp., pa. $3.30. (U.S.)

**Technical aspects of sound,** v. 1. E. G. Richardson, ed. Houston, Elsevier, 1953. 544 pp., diagrs. $11.00 (U.S.).

**Les terrains perméables,** 2nd ed. A. Mayer. Paris, Dunod; Montreal, Fomac, 1954. 148 pp., figs., $4.40.

**Who's who in engineering,** 7th ed. New York, Lewis, 1954. 2861 pp., $17.50 (U.S.).

## Correction

**Recent developments in mineral dressing**, was erroneously announced in the April issue as coming from the Institute of Metals. It is published by the Institution of Mining and Metallurgy.

# TECHNICAL BULLETINS AND PAMPHLETS RECEIVED

**Alberta. Oil sands project:**

Guide to the Alberta oil sand area along the Athabasca River between McMurray and Bitumount, and to the oil sand separation plant of the Government of Alberta at Bitumount. 1951. Report on the Alberta bituminous sands, by S. M. Blair.

**American society for testing materials. Special technical publications:**

No. 144 — Symposium on fretting corrosion. No. 151 — Report on the elevated-temperature properties of chromium-molybdenum steels. No. 152 — Symposium on insulating oils, 5th series.

**American society for testing materials. Administrative committee on research:**

Some unsolved problems. 1954.

**American welding society.**

Recommended practices for postweld heat treatment of austenitic weldments (tentative) 50c.

**Bell telephone system. Monographs:**

No. 2091 — Control charts using mid-ranges and medians, by E. B. Ferrell. No. 2107 — Effect of electrode spacing on the equivalent base resistance of point-contact transistors, by L. B. Valdes. No. 2142 — Microstructure of capacitor paper, by D. A. McLean and others. No. 2144—Influence of echoes on television transmission, by P. Mertz. No. 2145 — The threshold law for single ionization of atoms or ions by electrons, by G. Wannier.

**British electrical and allied industries research association. Technical reports:**

No. A/T130 — The detection of very small amounts of iron in electrolytic copper, by P. Armes. No. G/T282 — Intrinsically safe electrical apparatus: relation of igniting current to circuit inductance for inflammable mixtures of calor gas (butane) and of cyclohexene with air, by E. M. Guenault and others. No. J/T152 — A review of work carried out at the National physical laboratory on the creep and corrosion resistance of steels for steam power plant, 1930 to 1951, by A. M. Sage. No. J/T155 — The influence of aluminium and of various heat treatments on the properties of low carbon steel superheater tubes, by D. C. Herbert and E. A. Jenkinson. No. M/T123 — Radio interference from motor vehicles. Comparison of British and German measuring equipment, by A. H. Ball and S. F. Pearce. No. V/T110 — Corrosion of buried copper and ferrous strip in natural and salted soils.

**British transport commission.**

Catalogue of the British transport film library. 1952.

**Canada. Dept. of insurance.**

Statistical report of fire losses in Canada. 1951.

**Canada. National research council. Reprint:**

Meteor echo duration and radio wave length, by D. W. R. McKinley. Reprinted from the Canadian Journal of physics, 1953. (N.R.C. No. 3081).

**Canada. National research council. Technical information service. Reports:**

No. 32 — Melting of brass and bronze, compiled by G. G. M. Carr-Harris. No. 35 — Mine filling: a selected bibliography compiled by J. S. Stratton.

**Canada. National research council. Technical translations:**

List of technical translations, August 1953.

**Canada. National research council. Government specifications board. Specifications:**

1-GP-90P — Paint; marine, non-skid, for decks (Provisional) 4-GP-38 — Cloth; wool, frieze. 4-GP-39 — Cloth; wool, pilot. 9-GP-15P — Fibreboard; insulating (Provisional) 9-GP-17P — Schedule of methods of sampling and testing fibreboard (Provisional)

**Canada. National research council. Technical translation:**

No. T. T. 361 — Moisture movement and moisture distribution in the walls of buildings, by H. Edenholm, translated by H. A. G. Nathan.

**Canada. National research council. Division of building research.**

La condensation dans la maison. (Serie: Bien batir, n. 4).

**Canada. National research council. Division of building research. Bibliography:**

No. 7 — A bibliography on the demolition of structures, by D. C. Tibbetts.

**Canada. National research council. Division of building research. Research papers:**

No. 10 — Thermal performance of frame walls. Part II Air spaces blocked at mid-height, by G. O. Handegord and N. B. Hutcheon. No. 11 — Settlement studies on the National Museum Building, Ottawa, Canada, by C. B. Crawford.

**Canada. National research council. Division of building research. Technical reports:**

No. 13 — Fundamental considerations in the design of exterior walls for buildings, by N. B. Hutcheon. No. 14 — Stud spacing in Canadian frame houses, by D. H. Rutherford. No. 15 — Determination of the sulfate resistance of portland cement, by David Wolochow.

**Canada. National research council. Government specifications board. Specifications:**

3-GP-7B — Gasoline; combat, automotive. 3-GP-10 — Gas; petroleum, liquefied. 3-GP-334A — Oil; cutting (mild types). 3-GP-662A — Oil; lubricating, black, general purpose.

**Canada. Dept. of resources and development. Forest products laboratories.**

The forest products laboratories of Canada, by J. H. Jenkins. (Reprinted from the Journal of the Forest products research society, Nov. 1953). Stress grading as related to mechanical properties of wood, by W. J. Smith. (Reprinted from The Parthenon, September 1953). Test loading of a composite concrete-timber deck bridge, by J. B. Alexander. (Mimeograph V-1014).

**Canada at work**, by Wilfrid Eggleston. 391 pp., illus.

**Canadian standards association. Approvals laboratories:**

Supplement "A" to the first edition of the list of approved oil-burning equipment. August 1953.

**Canadian standards association. Approvals laboratories.**

List of approved equipment, 4th ed., suppl. "C" September 1953.

**Carnegie endowment for international peace.**

The world's civil service, by F. R. Scott. (International conciliation, no. 496).

**Dominion board of insurance underwriters.**

List of inspected appliances, equipment, and materials, September 1953.

Standards for the installation of oil burning equipments. June 1953. (Pamphlet no. 31).

**Engineering Foundation. Research council on riveted and bolted structural joints.**

Second progress report. New concepts in structural joint design.

**India. Central building research institute. Bulletin:**

Corrugated concrete shell roofs, by Kurt Billig. (v.1., no. 3).

**Institute of metals. Reprints from the Journal:**

No. 1503 — The oxidation of aluminium-magnesium alloys by steam: a contribution to research on mould reaction, by Marjorie Whitaker. No. 1504 — Some creep characteristics of a group of precipitation-hardening alloys based on the alpha-copper-aluminium phase, by J. P. Dennison. No. 1506 — A survey of the uranium-nickel system, by J. D. Grogan and R. J. Pleasance, with an appendix on an X-ray examination of some uranium-nickel alloys, by B. E. Williams. No. 1507 — The low-stress torsional creep properties of pure aluminium, by W. Betteridge. No. 1508 — The copper-silicon eutectoid transformation, by A. D. Hopkins. No. 1509 — The melting point of titanium, by T. H. Schofield and A. E. Bacon. No. 1512 — The effects of some constitutional factors on the creep and fatigue properties of lead and lead alloys, by L. M. T. Hopkin and C. J. Thwaites.

**Institute of radio engineers. Proceedings. Reprint:**

Radiation conductance of axial and transverse slots in cylinders of elliptical cross section, by J. Y. Wong.

**Institution of electrical engineers.**

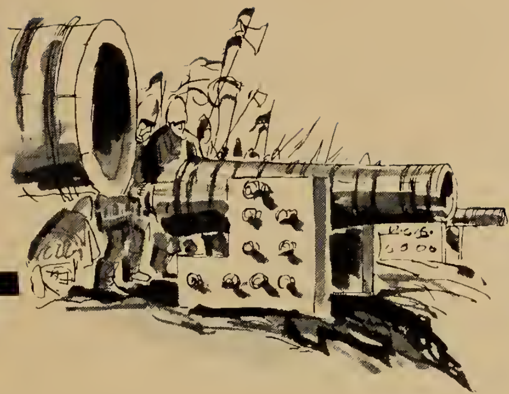
Abridged wiring regulations, 1954 supplement. Recommended practice for electrical installations in caravans. Regulations for the electrical equipment of buildings, 1954 supplement to twelfth edition.

**Institution of electrical engineers. paper:**

M1529 — A scaling unit employing multi-electrode cold-cathode tubes, by K. Kandiah.

**Institution of mechanical engineers. Advance papers:**

An experimental investigation into the



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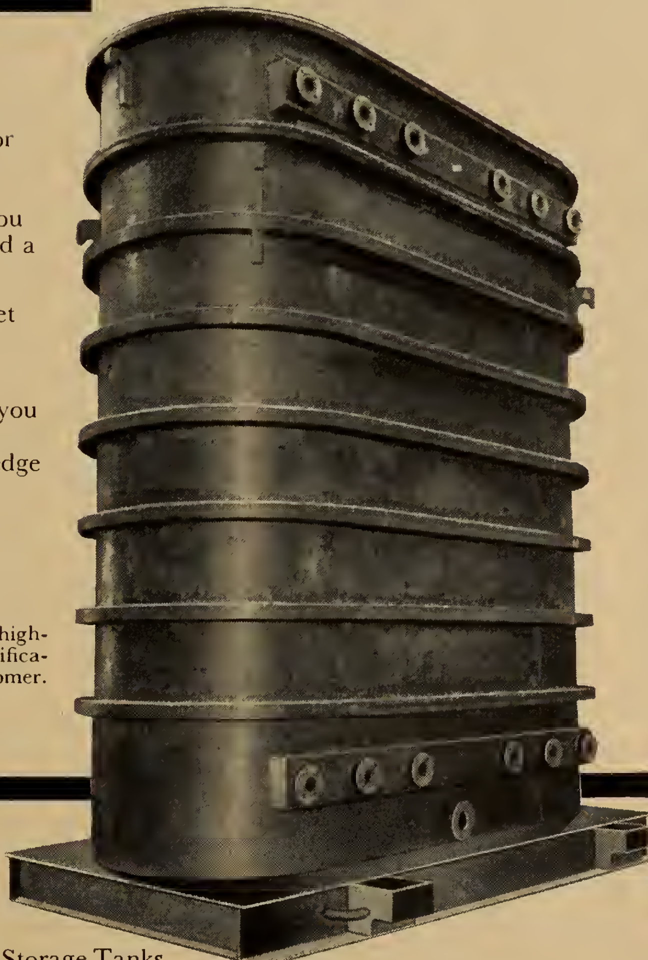

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effect of fuel addition to intake air on the performance of a compression ignition engine, by W. T. Lyn. The effect of auxiliary fuels on the smoke-limited power output of diesel engines, by L. D. Derry and others.

**Johns-Manville Company, Ltd.:** Johns-Manville products.

**Massachusetts institute of technology.** Proceedings of the conference on modern highways. Planning, surveys, design.

**Metal statistics, 1938-1952.** 41st annual issue. Frankfort on Main, Metallgesellschaft A.G., 1953.

**Micro precision instrument ball bearings.** New Hampshire Ball Bearings. Catalogue no. 53.

**Nova Scotia research foundation:** Sixth annual report, 1952.

**Pennsylvania. State University. Dept. of engineering research.**

Bibliography on sprays, 2d ed. New York, The Texas Co., 1953.

**Permafrost at Norman Wells, N.W.T.,** by R. A. Hemstock. Imperial Oil Ltd., 1953.

**Portland cement association.** Cement and concrete reference book, 1954.

**Quebec. Dept. of Mines. Geological surveys branch. Geological reports:**

No. 53 — Albanel area, Mistassini Territory, by J. M. Neilson. No. 57 — Allard River area, Abitibi-East County, by René Beland. No. 58 — Waswanipi Lake area (west half) Abitibi-East County, by Jacques Claveau. No. 59 — Waswanipi Lake area (east half) Abitibi-East County, by D. A. W. Blake.

**Society of the plastics industry. Reprints:**

Equipment digest: "What's new", by R. W. Powell. Statistical quality control in the plastics industry, by L. M. Debing.

**Taylor Forge & Pipe Works. Bulletin:** No. 533 — Design of hot tap tee connections in high pressure pipe-lines, by A. J. Del Buono and others. (A.S.M.E. Paper No. 53-PET-31).

**Toronto. University. School of engineering research. Bulletin:**

No. 195 — Development of the thermal conductivity probe, by F. C. Hooper and S. C. Chang.

**Union of South Africa. Dept. of Forestry. Bulletin:**

No. 36 — Utilisation notes on South African timbers, by M. H. Scott.

**United Kingdom Information Office.** Atomic energy developments in Great Britain, by Sir Christopher Hinton. Atomic energy research at Harwell, by Sir John Cockroft. Britain's atomic factories.

**United States. National research council. Highway research board. Research report:**

No. 15-B — Culvert hydraulics. (Publication No. 287).

**United States. Beach erosion board. Office of the Chief of Engineers. Technical memoranda:**

No. 53 — Analysis of moving fetches for wave forecasting. No. 42 — A study of sand movement at South Lake Worth Inlet, Florida.

**United States. Bureau of reclamation.** Hydraulic laboratory practice, (Engineering monograph no. 18). Water measurement manual.

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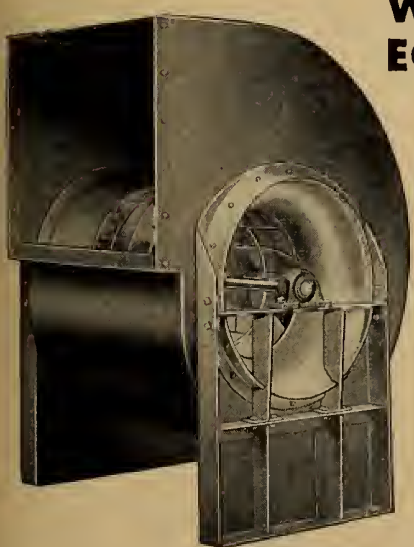

Keith and Silavent Fans • Utility Sets • Forced Draft Fans • Induced Draft Fans • Airscrew Fans • Axial Flow Fans • Medium Blowers and Exhausters • Mill Exhausters • Dust Separators and Collectors • Dust Filters • Centrifugal Blowers • Unit Heaters • Airwashers and Dehumidifiers • Spray-Rotor Humidifiers • Air Conditioning Units • Drying Equipment.

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**United States. National Bureau of standards. Applied mathematics series:**

No. 36 — Tables of circular and hyperbolic sines and cosines for radian arguments.

**United States. National bureau of standards. Miscellaneous publications:**

No. 209 — Report of the thirty-eighth national conference on weights and measures, 1953.

**United States. National research council. Highway research board. Bulletin:**

No. 79 — Travel to commercial centers. (Publication no. 281)

**Wyoming. University. Natural resources research institute. Information circular:**

No. 6 — Proceedings of the third biennial briquetting conference, 1953.

## STANDARDS REVIEWED

**ASTM specifications, American society for testing materials, 1916 Race Street, Philadelphia 3, Pa.**

**ASTM standards on paper and paper products and shipping containers (with related information),** pa., $2.50.

Sponsored by Committee D-6 on Paper and paper products, and Committee D-10 on Shipping containers, this publication brings together the ASTM standard and tentative specifications, test methods, and definitions of terms relating to paper and paper products, and shipping containers.

The six specifications cover absorbent laminating paper for electrical insulating and vulcanized fibre sheets, rods, and tubes used for electrical insulating, filter paper for use in chemical analysis, waterproof paper for curing concrete, quicklime and hydrated lime for cooking of rags in paper manufacture, and quicklime for sulphite pulp manufacture.

Methods of test for paper include tests to show: absorption of water and writing ink by bibulous paper, cellulose, cadmium, zinc, etc., in paper, strength, smoothness, stretch, etc., of paper.

The Appendices list four proposed methods of test. These are for: bacteriological examination of paper and paperboard, smoothness of paper, wax pick test for surface strength of paper, and tensile strength of paraffin wax.

**ASTM standards on petroleum products and lubricants.** Pa. $6.00.

The November 1953 edition of this compilation includes in their latest form, most of the ASTM specifications, test methods, and definitions widely used in this field. (The tests for knock rating of engine fuels and certain standards for measuring and sampling are issued in special manuals and not included in this compilation.).

Prepared by ASTM Committee D-2 on Petroleum products and lubricants, this edition provides in a convenient manner 146 ASTM standards, including 130 test methods, 10 specifications, 1 classification of diesel fuels oils, 3 definitions of terms relating to petroleum, specific gravity, and rheological properties of matter, 2 recommended practices: one for the purchase of uninhibited mineral oil for use in transformers and in oil circuit breakers, and one for designating significant places in specified limiting values, and other material.

Groups of standards cover broad classifications of petroleum products: crude petroleum, butadiene, motor and aviation fuels, petroleum solvents and naphthas, diesel fuels, distillate burner fuels, kerosine and illuminating oils, lubricating oils, turbine oils, electrical insulating oils, plant spray oils and petroleum sulfonates, lubricating greases, and petrolatums and paraffin waxes. Included also are standard specifications for ASTM thermometers and ASTM hydrometers, and test method standardization of etched-stem liquid-in-glass thermometers.

New tentative methods of test are included for: effect of grease on copper, lead in new and used greases, leakage tendencies of automotive wheel bearing greases, water washout characteristics of lubricating greases, sampling liquefied petroleum gases, sulfur in petroleum products and liquefied petroleum gases by the $3O_2$—$O_2$ lamp method, vapor pressure of liquefied petroleum gases, unsaturated light hydro-carbons (silver-mercuric nitrate method) polarographic determination of tetraethy lead in gasoline, API gravity of petroleum and its products (hydrometer method) and specific gravity of petroleum and its products (hydrometer method).

New appendices cover, in addition to report of Committee D-2 on Petroleum products and lubricants, proposed methods of test for functional life of ball bearing greases, chlorine in lubricating oil, sodium in residual fuel oil by flame photometer, weathering test for liquefied petroleum gases, analysis of graphite under consideration by Research Division XII on graphite tests—other items cover recommended practices for applying precision data given in ASTM methods of test for petroleum products and lubricants, and proposed changes in the ASTM Manual of engine test methods for rating fuels (1952 edition) for the elimination of the bouncing pin.

A high percentage of the material included in the earlier edition has been revised and eleven of the methods are new. The specifications and tests that have been revised contain a brief explanation in footnote form of changes incorporated since the previous edition. A new section has been added giving a summary of changes made in ASTM standards on petroleum products and lubricants in 1953.

**ASTM standards on textile materials (with related information)** pa., $5.25.

This 1953 compilation of ASTM standards on textile materials brings together in compact, readily usable form, the ASTM specifications, test methods, and tolerances widely used in this field.

Prepared by ASTM Committee D-13 on Textile materials, this edition gives in their latest form 105 ASTM standards, including 80 test methods, seventeen specifications, two definitions of terms relating to textile materials, three tolerances for filament yarns (acetate—nylon—rayon) three recommended practices: one for interlaboratory testing of textile materials—another for designation of linear density of fibers, yarns, and other textile materials in universal units—and one for designation of yarn construction, and other material.

Groups of standards in this compilation cover: asbestos, bast and leaf fibers, cotton, glass textiles, rayon, acetate and silk, wool, pile fabrics (carpets), felt, and general fibers, fabrics, yarns, threads and cordage. Also identification, qualitative, and quantitative analysis, and resistance to insect pests and microorganisms. General test methods cover testing machines, humidity, and inter-laboratory testing.

New tentative methods of test are included for: average fiber diameter of wool tops by porous plug tester; alkali-solubility of wool; relaxation and felting shrinkage in laundering of stabilized knit wool fabrics, tensile strength of wool fiber bundles, yarns containing wool, recovery of textile fabrics from creasing, using the vertical strip apparatus, maturity of cotton fibers (random sample-sodium hydroxide swelling method); cross-sectional characteristics of cotton fibers; strength of cotton fibers (flat bundle method); number of neps in cotton fibers.

New appendices cover, in addition to report of Committee D-13 on Textile materials, proposed methods of test for: identification of finishes on textiles, and recovery of textile fabrics from creasing using the roller pressure apparatus, another item covers recommendations for the establishment of standard moisture content for wool and its products.

**British standards, British standards institution, 2 Park Street, London, W. 1. British standards are available from the Canadian standards association. National research building. Ottawa. Canada.**

**British standards 1953 yearbook.** 12/6.

The 1953 edition of the above has recently been published and gives a list of the 2,000 British Standards current at the end of March 1953, with a brief description of the subject matter of each. A comprehensive index simplifies reference.

The yearbook gives the usual information on the membership of the General Council, the Divisional Councils and the Industry Standards Committees, together with the names of the representatives on the main Special Committees and Advisory Committees.

For the first time, the Yearbook gives a list of the British Standards under which the Institution's certification trade marks are used, while particulars of the work in hand of all the Industry Standards Committees are also given.

The Yearbook is essential to all those engaged in industry and commerce if they are to keep up-to-date with the increasing momentum of practical standardization and simplification.

**B.S. 1916, Part 4: 1953 — Guide to the selection of fits.** 7/6.

The publication of this Guide to the selection of fits fulfils the promise given in B.S. 1916, Part 1, to provide reliable data in the form of recommended tolerances which can be used for a wide variety of standard applications.

The introduction of a new limits and fits system is inevitably a long-term project and many users, faced with the wide choice of fits in Part 1, might feel that a long period of experiment was necessary before they could decide which tolerances to adopt as standard. Reference to Part 2, with its selection of clearance, transition and interference fits for many typical applications, should go far to solve this problem as well as minimizing the possibility of differing tolerances and allowances being chosen to meet the same design problem.

The guide is fully illustrated and includes much useful information regarding the various grades of fit, the accuracy which can reasonably be expected from various manufacturing processes, etc. It also contains tables of Preferred fractional and decimal inch sizes, the use of which is indispensable to true standardization.

The recommendations given in the guide are based on the results of investiga-

tions carried out with the co-operation of a number of engineering firms and organizations. It is recognized that some requirements are not yet adequately covered and an early revision of the guide to include more material is envisaged.

In order that it may be as practical and helpful as possible, users are earnestly requested to submit to the Institution their comments, criticisms and constructive suggestions for consideration by the responsible committee. Any information supplied will be treated confidentially and will be of great assistance in rendering this guide of real value to industry.

Observations should be addressed to the Director, British Standards Institution.

**B.S. 2051: Part 1: 1953 — Copper and copper alloy capillary and compression tube fittings for engineering purposes.** 3/-.

This is a new British Standard relating to three types of tube fittings for engineering purposes of sizes ranging from 1/8 in. to 1 in. inclusive, for use in conjunction with copper, copper alloy and other suitable tubing, viz:

a. Capillary fittings in which the joint is made by the flow of solder by capillarity along the annular space between the outside of the tube and the inside of the socket of the fitting, the size of this annular space being dimensionally accurate within close limits.

b. Compression fittings, Type 'A', in which the joint is made by the compression of a ring or sleeve or part of the fitting, on to the outside wall of the tube.

c. Compression fittings, Type 'B', in which the joint is made by the compression of a manipulated portion of the tube at or near its end against true faces of the body of the fitting or against a loose ring or sleeve within the fitting.

This standard does not attempt the complete dimensional standardization of any of the types of fittings, since the variety in the designs and methods of production already established by the various manufacturers makes any such attempt impracticable. Without seeking to limit the individual refinements of design, which are the distinctive feature of the proprietary product, this standard does, however, lay down such dimensions and requirements as are essential to ensure satisfactory installation and performance.

The fittings covered by this standard are for use with tubes designated by their outside diameters in inches and fractions of an inch.

**B.S. 2060: 1953 — Copper alloy globe valves for general purposes.** 4/-.

This is the first of a series of British Standards for copper alloy valves for general purposes. It is intended that this series will be followed by others for ferrous valves for general engineering use.

This standard specifics requirements for rating, design and manufacture, materials, dimensions, tests and marking for copper alloy globe, angle and oblique (or 'Y') valves with rising stem, inside or outside screw, with flanged or screwed ends, of Classes 100, 125, 150, 200 and 250 for a range of nominal sizes from ¼ in. to 3 in.

**B.S. 2062: 1953 — Gear hobs.** 5/-.

This British Standard will, it is felt, be of considerable use in the gear industry generally. It has long been recognized that the sizes of hobs for general purposes should be restricted in number and their limits of accuracy closely defined. The present specification covers in Part 1 the range 1 to 50 D.P. for general purpose hobs intended for the production of gears complying with the basic rack tooth profile given as Fig. 5 of B.S. 436: 1940. Three grades of accuracy are specified as follows:—

A. Precision ground hobs
B. Ground hobs
D. Unground hobs

and the tolerances in Table 4 are in close agreement with those of the American Gear Manufacturers' Association.

A useful addition to the specification is given in Appendix B which lists the sizes of hobs with taper bores and of taper arbors in current use in industry.

At the request of manufacturers and users of turbine gears, Part 2 has been added, with Table 5 setting out limits of *accuracy only* for hobs intended for the production of gears complying with B.S. 1807: 1952 Gears for turbines and similar drives, Part 1: Accuracy. This table is based on the specification issued by the Mechanical Engineering Research Laboratory of the Department of Scientific and Industrial Research for the Accuracy of gear cutting hobs for marine turbine and similar drives, and which has been in use for several years.

It must be noted that Part 2 does *not* cover tooth form design.

**B.S. 2066: 1953 — Balata belting.** 2/6.

This standard specifies requirements for balata belting used for power transmission purposes and other load bearing applications, e.g. straps and slings.

This standard also specifies details of the fabric, impregnation, balata content, quality of balata, etc., and includes appendices giving details of methods for testing. Additionally, appendices are included concerning working conditions and information to be given with the enquiry or order.

**B.S. 806: 1954 — Ferrous pipes and piping installations for and in connection with land boilers.** 10/6.

This British Standard supersedes the 1942 edition. It applies to the design and construction of the ferrous pipework connecting a land steam boiler to engine, turbine or industrial plant and all auxiliary pipework in connection therewith, together with the pipes and pipe fittings forming parts of such installations for:

a. pipes of any bore where the pressure exceeds 50 lb./sq. in.
b. pipes over 10 in. bore for steam at pressures up to and including 50 lb./sq. in.

This standard does not apply to the use of carbon steel where the temperature exceeds 900°F., or to the use of alloy steel where the temperature exceeds 975°F.

The scope of this Standard has been extended to provide for developments which have taken place in pipework installation practice, notably in the use of alloy steels.

Material specifications are included for:

Class A —Cold drawn seamless carbon steel pipes.
Class B & C—Hot finished seamless carbon steel pipes.
Class D —Hydraulic lap-welded carbon steel pipes.
Class E —Roll lap-welded carbon steel pipes.
Class F —Butt-welded carbon steel pipes.
Class M—Cold drawn seamless molybdenum steel pipes.
Class P —Cold drawn seamless chromium molybdenum steel pipes.
Class Q —Hot finished seamless chromium molybdenum steel pipes.

Sections deal with:

(i) Design requirements.
(ii) Procedure to be observed in the manipulation and fabrication of alloy steel pipes.
(iii) Construction including the attachment of flanges.

This Standard also contains Appendices covering inter alia:

(i) Young's modulus for steel pipes.
(ii) Percentage elongation on various gauge lengths.
(iii) Diameters and thicknesses of steel pipes applicable to this Standard.
(iv) Pressures in safety valve discharge piping.
(v) Examples of reinforcement of multiple branches.

**Canadian standards, Canadian standards association, National research building, Ottawa, Canada.**

**C.S.A. A123 Series — Asphalt and tar roofing materials.** Set $6.50. Each 50c.

Here gathered into one folder are the sixteen specification in the series on Asphalt and tar roofing materials. These cover asphalt shingles, roofing and siding, coal-tar saturated roofing felt and asbestos felts, coal-tar pitch, and woven cotton fabrics saturated with bituminous substances for use in waterproofing. The final specification lists methods for testing asphalt insulating siding surfaced with mineral granules.

**C.S.A. C68(A)-1953 — Paper-insulated power cable "solid" type,** 2d ed. $2.00.

This second edition replaces that issued in 1940. The first edition was scheduled for revision in 1948 when it was decided that changes should be made so that the specification would represent up-to-date engineering practice.

The specification is intended to apply to all sizes and classes of impregnated, paper-insulated, lead-covered cable, "solid" type, which is to be used for the transmission and distribution of electrical energy, as customarily installed under average conditions. The specification does not cover "Special purpose" cables.

The specification covers rated and operating voltages, conductors, insulation, shielding and sheath. Also described are the various tests for cable: conductor resistance, high voltage insulation resistance, ionization, and bending.

There are fifteen tables included in the specification showing: preferred voltage ratings and conductor sizes, tensile strength, thicknesses of insulating, etc.

The first Appendix gives a table showing maximum conductor temperature for emergency operation. The other two give a high-voltage time test, and tests which may be conducted after installation.

**C.S.A. C22.2 No. 105 — 1953 — Construction and test of electrical equipment for woodworking machinery.** 75 cents.

This Specification applies to electrical equipment used on, or in close connection with, woodworking machinery for general industrial use. It does not cover small machines used for domestic or hobby purposes, certain portable tools which come within the scope of CSA Specification C22.2 No. 71, Portable electric tools, or equipment which is located where it will not be affected by dust or wood chips.

The Specification covers construction requirements, including motors, controls and conductors, marking requirements, and tests.

# Business & Industrial Briefs

## A Digest of Information received by The Editor

## Appointments and Transfers

**Combined Enterprises.**—M. O. Simpson, chairman and president of Combined Enterprises Ltd., announces the purchases by that company of Hamilton Gear and Machine Co., Ltd., Toronto. Mr. Simpson stated that except for certain executive appointments and for representation on the board of directors there would be no major changes in the organization or commercial policies of Hamilton Gear.

**Douglas A. Jones**

The executive appointments of the company are: M. O. Simpson, president; M. O. Simpson Jr., executive vice-president; Frank G. East, general manager; Robt. H. Hoppe, secretary; Hugh C. Hay, treasurer and assistant secretary. The directors of Hamilton Gear are: F. G. East, H. C. Hay, M. O. Simpson Jr., and H. C. Walker, Q.C.

●

**Robertson-Irwin Limited**—The appointments of Douglas A. Jones as manager, contract sales division; and Frank C. Manchee as manager, line sales division; have been announced by T. A. Irwin, president Robertson-Irwin Ltd. The head office of this company is located at Hamilton, Ont.

●

**Wakefield Lighting Limited.** — Ralph A. Yates, Toronto, vice president and general manager of Wakefield Lighting Limited, London, Ont., announces these additions to the company's sales-engineering staff. Pacific Distributing Co. Limited, Vancouver, B.C. will represent Wakefield under the direction of E. W. Thompson, sales manager. A. H. R. Louden, Edmonton, Alberta, will be in charge of that area. J. W. Henson, will represent the company in Toronto. Official opening of the London plant at 395 Wellington Road, South, took place April 27.

●

**Russell Construction Limited.** — The Toronto firm of Russell Construction Company Limited has been purchased by Russell Construction Limited a newly formed subsidiary of Balfour Beatty and Co., (Canada) Ltd. The new firm has taken over a staff of wide experience which includes J. H. Russell, M.E.I.C., head of the marine and foundation department.

The new organization was incorporated on April 1. The board of directors will consist of Colin A. Campbell, president; Andrew B. Sharp, vice-president and managing directors; and Carl C. Graupner, secretary-treasurer.

(*Continued on page 802*)

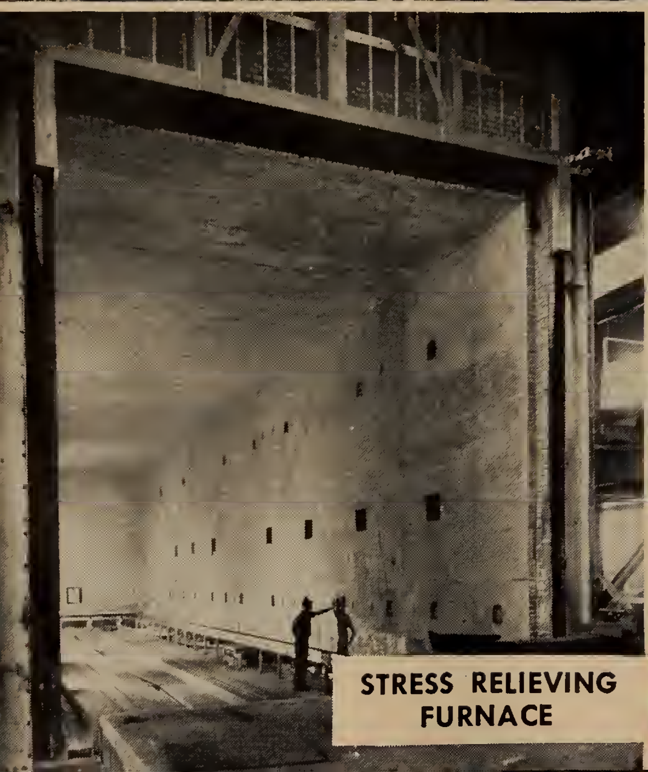
**Frank C. Manchee**

SECTION OF DESIGN OFFICE

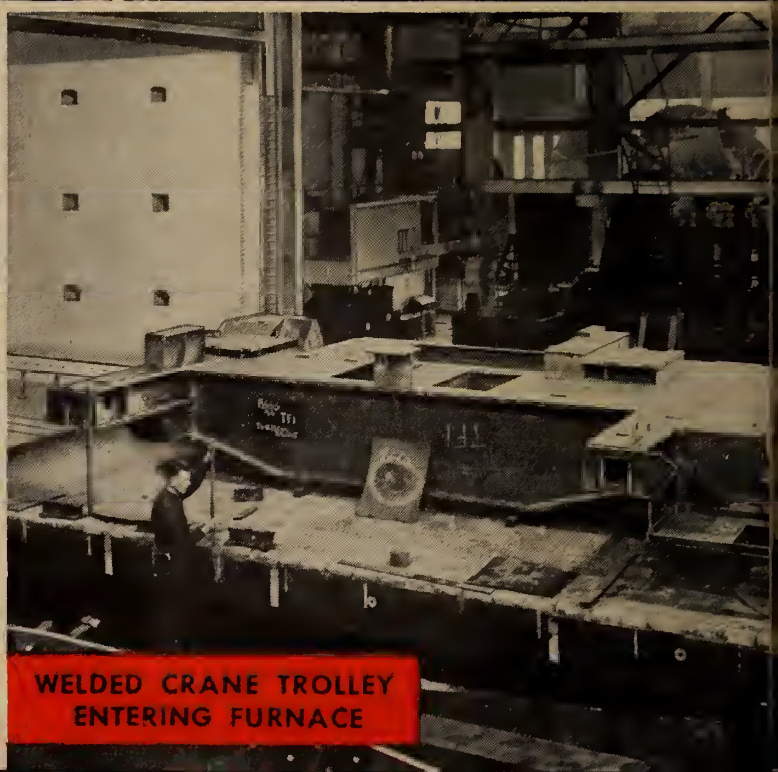
PART OF FORGE SHOP

FOUNDRY

GEAR CUTTING SHOP



STRESS RELIEVING FURNACE



WELDED CRANE TROLLEY ENTERING FURNACE

(*Continued from page 797*)

**A. C. Wickman (Canada) Limited.** — A. C. Wickman (Canada) Ltd., have been appointed Canadian agents for the line of material testing machines and balancing machines manufactured by the European firm of Losenhausenwerk, Dusseldorf.

The best known machines of Losenhausenwerk are the universal testing machines with hydraulic pulsators and the universal fatigue testing machines for testing under fluctuating and alternating loads.

●

**Canadian Westinghouse Company Limited.** — H. H. Rogge, president, Canadian Westinghouse Company, Limited, announces the consolidation of the company's electrical apparatus and consumer division under two administrative executives. J. W. Kerr has been appointed general manager of the apparatus products group, and J. D. Campbell has been appointed general manager of the consumer products group.

The following divisions of the company compose the apparatus products group: the power products division, the industrial products division, and the B. F. Sturtevant Company of Canada Limited. The consumer products group includes the appliance division, the television-radio division, the lamp-tube division, the electronics division, the lighting division, and the Canadian Westinghouse Supply Company Limited.

●

## New Equipment and Developments

**New Plant Operations.** — Dominion Oxygen Company, division of Union Carbide Canada Limited, have commenced operations at their new plant located at Edmonton.

The plant will supply Dominion oxygen and Prest-O-Lite acetylene to the Alberta market.

●

**Catalytic Device for Diesel Exhaust.** — A catalytic muffler that effectively reduces the noxious and irritating components of 4-cycle diesel engine exhausts has been developed by Oxy-Catalyst, Inc., Wayne, Pa.

The new device, called the diesler, attaches directly to the engine exhaust manifold and burns by catalytic action the noxious carbon monoxide and odorous hydrocarbon fumes in exhaust gases. In industries such as mining this will permit more widespread use of 4-cycle diesel equipment underground or in enclosed areas. Now in production, the first model has been operating successfully for over three months.

●

**Mill Bearings.**—Heavy duty roller bearings, especially designed for the severe operating conditions found in steel mills, mines, and foundries have been added to the line of bearings manufactured by Link-Belt. To withstand heavy loads and severe impacts the steel housing has heavy sections, a rugged base and cap, plus large studs, dowels and mating surfaces. Ready inspection of the bearing

(*Continued on page 805*)

(*Continued from page 802*)

is possible by removing the housing cap. Additional information, including dimensions and load ratings, is available in Link-Belt book No. 2565. Requests should be sent to the company at P.O. Box 173, Station "H", Toronto.

●

**Metal-clad Switchgear.**—A new standard line of metal-clad switchgear, ranging in ratings from 2400 to 13,800 volts, 150 to 500 mva, has been announced by the Canadian General Electric Co., Ltd., apparatus division.

The new line offers many new and improved design features, although it retains the same general arrangement of major components.

One of the most important aspects of the new equipment line, is that in introducing the new design improvements, all industry standards have been retained.

One of these new design improvements is in the magne-blast circuit breaker, in which a maximum number of parts are interchangeable among breakers of different ratings. Another feature is that wheels are now an integral part of each circuit breaker, eliminating the need for transfer trucks. In addition, the control relay is now mounted on the breaker.

A new and improved insulating material having excellent flame-retardant, dielectric and anti-hygroscopic properties is used throughout the breaker. Its use serves to localize damage which may occur if abnormal conditions produce breakdowns.

Another design improvement simplifies the breaker elevating mechanism. The new positive-acting mechanical interlocking provide faster raising and lowering of the breaker. All elevating mechanisms are driven by a motor, which is demountable for hand crank operation, and is controlled by a safety interlocked control system. Downward movement of the breaker from vibration is prevented by an anti-creep devise.

Cable entrance facilities are interchangeable from top to bottom entry.

●

## Publications

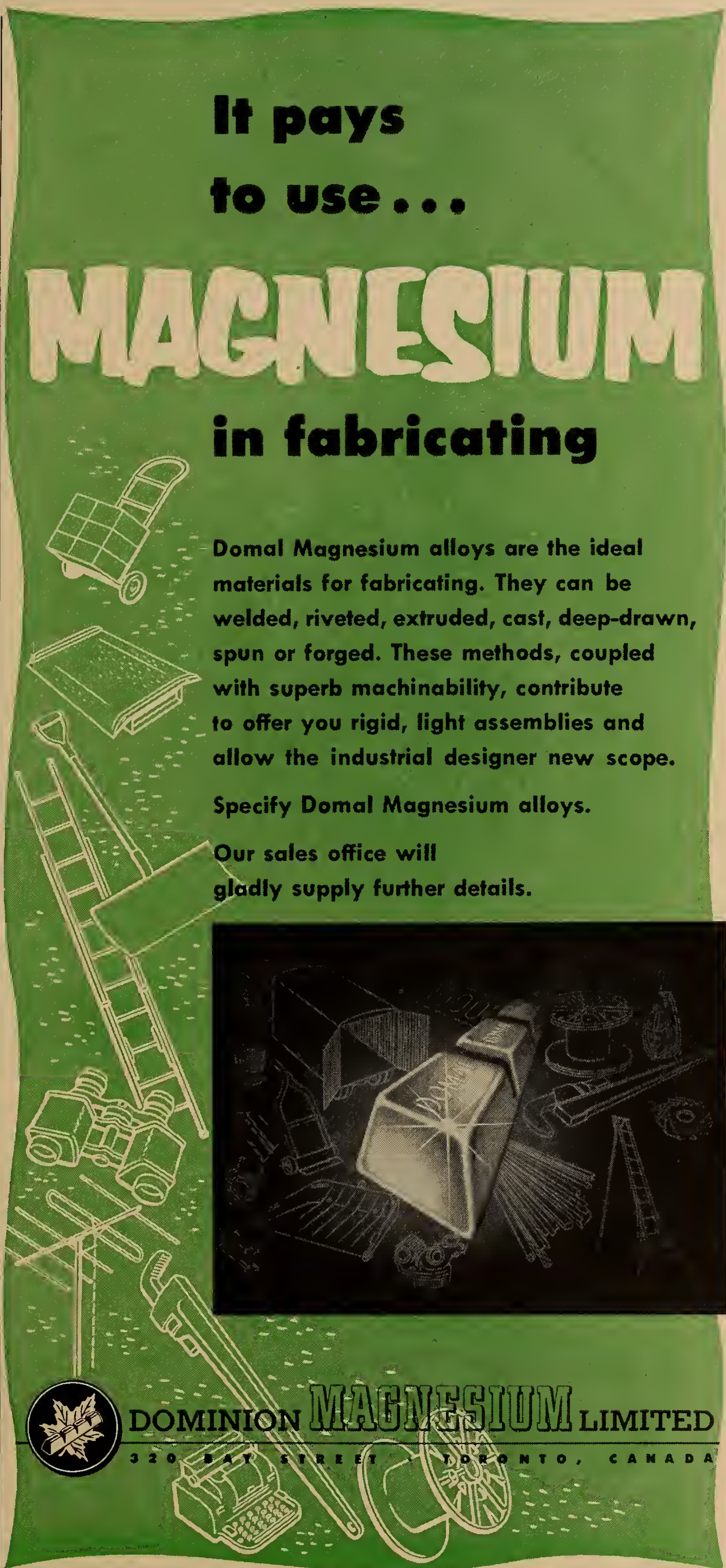
**For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.**

**Please mention *The Engineering Journal* when writing.**

**Road Joint Devices.** — For the first time, information covering a full range of road joint devices for concrete highways and airstrips has been presented in a single comprehensive bulletin by the Richmond Screw Anchor Co. Inc. of 830 Liberty Avenue, Brooklyn 8, N.Y. This new bulletin shows devices to meet all concrete pavement joint needs from the least expensive dowel baskets to the finest complete load transfer assemblies.

Copies of the bulletin and price lists needed by contractors are available by sending a postcard requesting the Road

(*Continued on page 808*)



# Professional Cards

# Professional Cards



(*Continued from page 805*)

Devices Catalogue to the above mentioned company.

**Metallurgy.** — The Metlab Digest is published by Canadian Westinghouse Company's metallurgical laboratories to assist people whose daily work borders on the metals field. This includes electrical engineers, supervisors and foremen and many other classifications of employees. Readers who would be interested in receiving each issue of this monthly booklet may do so by writing to the public relations department at Canadian Westinghouse, Hamilton, Ontario.

**Corrosion-Resistant Cast Alloys.**—Designers of equipment exposed to chemicals and corrosive environments will be interested in obtaining a reprint of the article "Cast High Alloys" by E. A. Schoefer, executive vice-president of the Alloy Casting Institute, Mineola, New York. This article originally appeared in the October 1953 issue of Chemical Engineering, and is now available from ACI headquarters.

In the article, Mr. Schoefer defines corrosion-resistant cast high alloys, designates the types, discusses individual alloy characteristics, compares cast and wrought alloys, and describes the physical and mechanical properties. A table of the ACI corrosion-resistant cast alloy classifications is included, along with tables showing the standard designations, chemical compositions, and physical and mechanical properties.

**Gyratory Crusher Bulletin.**—Engineering features of "Superior" primary and secondary gyratory crushers are described in a new bulletin released by Canadian Allis-Chalmers Limited.

The bulletin tells how the crushers' flexibility permits meeting a broad range of operating conditions.

Included in the bulletin is a performance table, a selection of product curve, a formula for determining horsepower requirements, a table of average work index values according to types of materials and dimension tables for primary and secondary gyratory crushers.

Copies of the bulletin, 07B7870, are available on request from Canadian Allis-Chalmers Limited, Box 37, Montreal, Quebec.

**Painting Specifications.** — A 22-page manual of general painting specifications for the guidance of architects and engineers has been prepared by the paint and varnish division of Canadian Industries Limited.

The first part of the manual deals with the preparation of surfaces that may be encountered in painting interiors and exteriors of industrial and business buildings. In the second section, exact painting specifications are given for each type of surface.

Architects and engineers may obtain the manual from the division's district offices across Canada or by writing the Paint and Varnish Division, P.O. Box 10, Montreal, Que.

**Portable Temperature Indicators.**—A new 8-page Bulletin A-3-3, just issued by The Foxboro Company of Foxboro, Mass., describes two portable temperature indicators, the potentiometer indicator and the resistance thermometer. Described in detail are operating adjustments, features of design, test circuits, measuring elements and instrument specifications.

Copies of the Bulletin A-3-3 will be sent on request from Peacock Brothers, sales agents in Canada, Ville LaSalle, P.Q.

**Steel Roof Decks.**—Westeel Products Limited have just produced a catalogue on their new, improved steel roof deck.

The catalogue contains all essential data on the new deck with safe load table, application and installation details, a section on roof insulation and illustrations of typical installations. A copy of the catalogue may be obtained by sending a request on your letterhead to your nearest Westeel plant or office. Ask for Steel Roof Deck Catalogue No. 42.

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

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"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

*16,200 copies of this issue printed*

# CONTENTS



*Indexed in The Engineering Index*

# Mining Development

and

# Engineering in Quebec

*by*

Jean-Paul Drolet, M.E.I.C.

*Chief, Technical Information Service,*
*Department of Mines of Quebec,*
*Quebec, P.Q.*

*A paper presented at the Annual General and Professional Meeting of the Engineering Institute of Canada, at Quebec City, May 1954.*

Anybody who reads the newspapers knows that mining development in Quebec over the past four or five years has been extensive and that some of the projects are really very large. But not many outside the mining industry itself realize to what extent these developments have called upon the talents of engineers other than those specializing in mining itself. Mr. Drolet's paper gives an up-to-the-minute picture of the more important of these projects. It is published by permission of the deputy minister, Department of Mines, Quebec.

By way of introduction to the topic of this paper it is necessary to present briefly some of the more salient facts relating to the economy of the Province of Quebec, which is now experiencing a period of development proportionate to the wealth of its natural resources.

The province is the largest in Canada, comprising all that part of North America lying east of Hudson Bay, except Newfoundland and the Maritimes. It covers approximately 600,000 square miles, of which more than half constitutes New Quebec, formerly known as Ungava Peninsula, which was annexed to the province in 1912 (Fig. 1).

This vast area has been recognized to consist of three topographic units; the Laurentian Plateau, the Saint Lawrence Lowlands and the Appalachean Region. The first of these, lying entirely within the Canadian Shield, covers more than nine-tenths of the area of Quebec and is occupied by rocks of Precambrian age.

Although the total area of the province may seem impressive, the livelihood of its people, up to 25 years ago, was derived from the long, narrow strip of cultivated lands on either side of the Saint Lawrence River. Quebec's agricultural domain is difficult to estimate, but it is safe to say that, out of its total area of 335 million acres, only approximately 35 million acres are suitable for agriculture, i.e., about 10 per cent of its surface, of which only two thirds are now occupied. Mechanization and electrification of farms and the growing establishment of small industries in rural areas have been the main factors behind the steady upward trend of agricultural production during the last twenty years.

On the other hand, the Province of Quebec has been well compensated for its farming limitations. As far as 52° north latitude there are extensive stands of hard and soft woods. These commercial forests provide an enormous source for the lumber trade and for a large-scale pulp and paper industry, which is the most important in Canada and affords employment for a large proportion of the population. A long established fishing industry along the 2,000 miles of coastline skirting the Gulf of St. Lawrence, especially in the Gaspé peninsula and in the Magdalene Islands, yields revenue and commercial trade for a part of the population.

Quebec's streams (of which, incidentally, there are 23 more than 100 miles long) have an estimated hydro-energy potential of over 17 million horse-power. At the present time, with only a fraction of this energy harnessed (7,700,000 hp., representing 52 per cent. of the total capacity developed in Canada) the province, on the basis of population, possesses electric installations greater than those of any other country.

### Extent of the Mining Industry

Mining is already an imposing industry in Quebec and one of the leading factors in its economy, whether the steadiness of its growth, the widespread nature of its operations or the diversity and value of its production be considered. While many readers are undoubtedly acquainted with the achievements of this industry, this paper will nevertheless review its phenomenal expansion due to the recent discovery and exploitation of new fields and will expound the role of engineering (Fig. 2) in this development.

#### *The Early Days*

Although some small-scale mining ventures date back to the early days of Quebec's history, they were confined to the populated areas, while the more favourable geological formations to the north were unknown except to the occasional trapper, some missionaries and a few prospectors.

At the beginning of this century a little iron was produced from the bog ore deposits near Trois Rivieres, using wood as fuel. Some placer gold was recovered from the streams of the Chandiere Valley south of Quebec City; phosphate, magnesite, graphite, feldspar, mica and talc were quarried in the area north of Ottawa; and asbestos and copper were mined from shallow pits in the Eastern Townships.

In addition to these, small quantities of building materials extracted from quarries situated close to the centres of population were the only mineral substances produced. Prospecting in western Quebec near the Ontario border began later, and farmers established around Lake St. John and in the Gaspé Peninsula reported occurrences of iron and copper minerals. On the north shore of the St. Lawrence, near Natashquan, the heavy black sands were also attracting some attention, (Fig. 3).

### *Past and Present Value*

The total value of this early mineral production was recorded as $2½ million for 1900; this represented about five per cent of the grand total for all Canada. The next twenty-five years saw this figure increase to $25 million and to-day, a quarter of a century later, the annual value of the mineral production is averaging well over a quarter of a billion dollars. Since the beginning of recorded production, the cumulative value for Quebec's mining industry is in excess of $3 billion (Fig. 4).

Important changes are noticeable in the graph. Not so long ago metals represented only a small fraction of the total value, while industrial minerals, mostly asbestos, and building materials made up almost 95 per cent of the total value. The higher production of metals, mostly gold, copper and zinc, has changed this situation, so that in 1953 metals and industrial minerals each represent approximately 40 per cent, while building materials account for 20 per cent of the total (Fig. 5).

The bulk of the mineral production comes from the mining areas of Rouyn, Malartic and Bourlamaque and from the asbestos region of the Eastern Townships. But there are also many other mines in less known localities that make substantial contributions to the province's output. These mines and quarries are located all the way from Calumet Island in the Ottawa River to the Allard Lake area on the north shore of the St. Lawrence. There are also numerous isolated producers, such as the Barvue mine in the Amos district, the Beattie-Duquesne mine in the Duparquet district, the Normetal mine near the Ontario border, the Belleterre mine in the center of Témiscamingue, the Anacon lead mine in the Montauban region, the Ascot and the Weedon mines in the Sherbrooke region, and the Consolidated Candego mine near Marsoui in the Gaspé peninsula.

### *Future Prospects*

It is safe to say that a 50 per cent increase in the value of production will most likely be established in the next five years, as a result of new mining projects now being brought to the production stage. It looks as if the Province of Quebec will record its second quarter of a billion a year of production in but a small fraction of the time which went into the establishing of the first.

Much of this expansion will stem from the New Quebec iron ore development and the Gaspé project, but other ventures also hold considerable promise. Aside from plans


Fig. 1. Geological sketch-map of Quebec.


Fig. 2. Mineral map of Quebec at the beginning of the century.

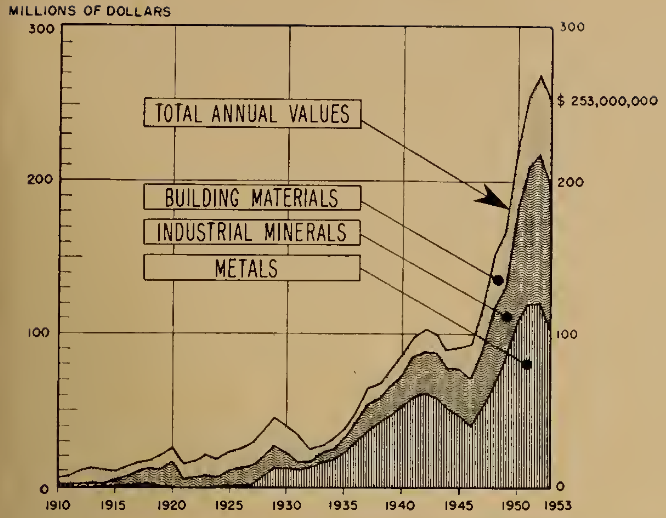



**Fig. 3. Values of Quebec's annual mineral production, 1910-1953.**

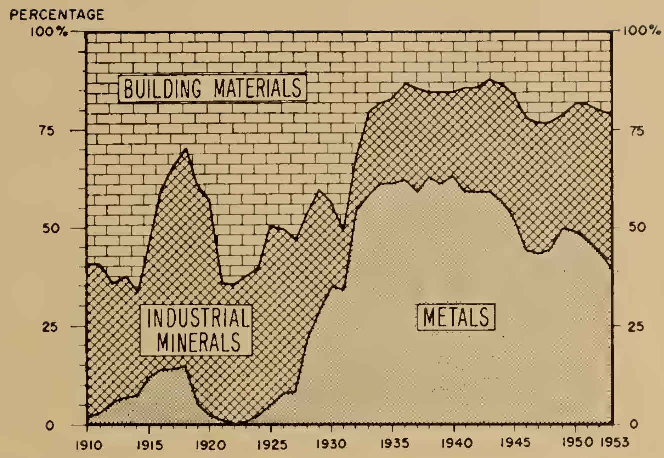



**Fig. 4. Relative values of the three classes of minerals produced in Quebec, 1910-1953.**

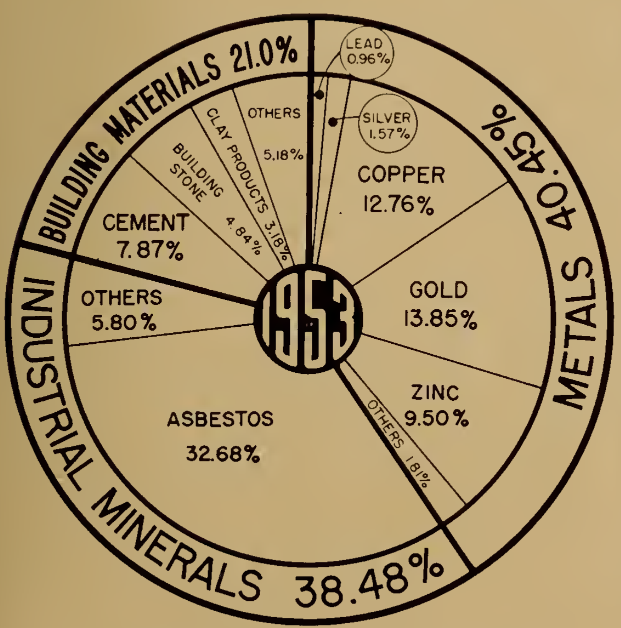
for expanded production and increased output from the already established mining areas, important mining developments are taking place which assure not only higher production figures, but also entail some of the largest engineering projects ever to have taken place in Quebec. Among them are the building of railroads, mine roads and bridges, the harnessing of new hydro-electric power, the establishment of mining villages, even the drainage of a lake and the relocation of a long established city in the heart of a mining center, and much other work necessary to promote the mining industry. These engineering projects contribute greatly to the expansion of the Province and are sometimes proportionally greater than the mine operations themselves.

### Principal Engineering Projects

*New Quebec*

The most important mining and engineering development now in progress is bringing to the production stage the large iron ore deposits of New Quebec (Fig. 6) located in what has been termed by geologists the "Labrador Trough". The greater part of this iron formation, which has been traced for nearly 500 miles with an average width of about 45 miles, lies in New Quebec. Furthermore, it is not in a trough or a depression, so a more appropriate designation for it would be "New Quebec Iron Range".

In one particular section of the range, reserves have been proven to exceed 417 million tons of high-grade iron ore, underlying an over-




| | |
|---|---|
| METALS | $ 102,397,843 |
| INDUSTRIAL MINERALS | $ 97,394,060 |
| BUILDING MATERIALS | $ 53,334,109 |
| TOTAL VALUE | $ 253,126,012 * |

* PRELIMINARY ESTIMATES

**Fig. 5. Distribution of the value of Quebec's 1953 mineral production**


**Fig. 6. Map of New Quebec iron range, showing locations of mining companies.**

Fig. 7. Principal coal, iron ore and steel areas in relation to New Quebec iron deposits.

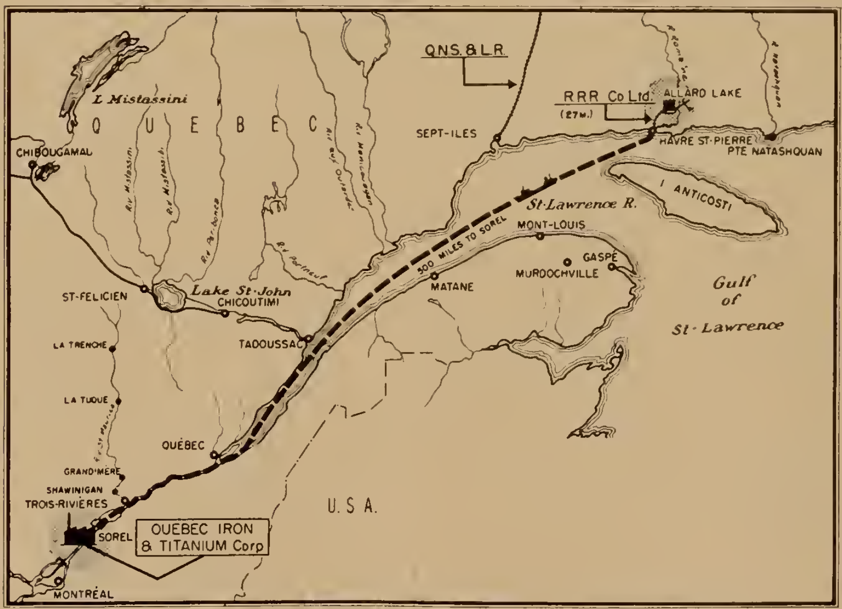


Fig. 8. Index map of ilmenite development, Allard Lake and Sorel.

burden of an average thickness of only eight feet. Mining this ore will be the least difficult of the many problems affecting operations, since all ore will be drawn entirely from open-pits.

Today the entire iron ore production of Canada is from the Bell Island mines of Newfoundland, the Steep Rock range of Northwestern Ontario, the Michipicoten range in the Sault Ste. Marie region of Ontario, and several operations on the British Columbia coast. Within the next three months, however, the Iron Ore Company of Canada will start delivering iron ore from its properties located 360 miles north of Sept Iles.

Although the ballasting of the railroad is not yet complete, the last spike was driven on February 12, 1954, when the continuous line of steel reached Shefferville, the new mining village at Knob Lake. With the final installations of this vital avenue of transportation, one of the largest engineering projects undertaken in North America for many years will be brought to a successful conclusion, according to schedule. The completion of this 360-mile line connecting Shefferville with a port on the St. Lawrence is an important milestone in Quebec's mining development. In a few years, this property alone will be mining and shipping about twice as much iron ore as is presently being produced in Canada (Fig. 7).

Although there will be limited production at the beginning, approximately one million tons during 1954, next year should see five million tons shipped with the rate gradually increasing to ten million by 1957. This tonnage will be maintained until the St. Lawrence Seaway is completed. The recent decision of the Canadian Government to proceed alone with the St. Lawrence Seaway will greatly remedy the acute postwar electric power shortage in Ontario and will supply the final link in the now almost complete navigable chain.[1]

Fear of injury to some branches of Canada's economy from this seaway have been somewhat exaggerated, but there is the strategic factor to be considered. At present the American steel industry is receiving ore from South America, Africa and other lands. Experience has made it clear that sea routes become very hazardous and even completely closed in times of hostilities. In such an event, the economy of Canada and of the United States may have to depend upon steel produced from the ore of mines located in comparatively safe inland sites.

Until the St. Lawrence Seaway is completed, iron ore from New Quebec will move by sea directly to the Philadelphia area (1,370 miles from Sept Iles) and to the Sparrows Point area (1,550 miles), where it will serve both seaboard and inland steel mills. Some ore will also be shipped by water to Contrecoeur, near Montreal, for trans-shipment through the existing canal system to Lake Erie ports (Ashtabula is 480 miles from Montreal), or shipped by rail from Montreal to the Pittsburgh steel centres.

The transportation problem arising from the great distances over which ore must be shipped before reaching market and the shortness of the transportation season constitute almost the only unfavourable factors for the New Quebec deposits. By way of compensation, however, there are many favourable factors. The ore is easily accessible; it occurs in flat, rolling beds at least 300 feet thick, easily worked by open-pit methods for many years to come; moreover, the ore is a high-grade hematite.

In the surrounding country the hydro-electric power facilities are plentiful. The total power necessary for the entire development will be provided from two sources. The first power plant will be ready in time for the movement of ore in August 1954. For the mine operations, the Iron Ore Company of Canada is completing a hydro-electric development at Menihek Rapids on the Ashuanipi River, a tributary of the Hamilton River. The plant, located about 26 miles from the mine, will have an initial capacity of 12,000 hp. in two units, under a 34-foot head, and an ultimate capacity of 24,000 hp. The 110 kv. line, operated initially at 66 kv., will supply the power necessary for the power shovels of the mine and for heating and lighting purposes in the new community, which is expected to have about 500 families in a few years.

At the south end of the railway line, the Ste. Marguerite Power Company is constructing a two-unit hydro-electric plant on the Ste. Marguerite River. Each unit will have a capacity of 8,500 hp. under a head of 98 feet. The plant is located at Sixty-one Falls, seven miles above the mouth of the river, whence a 19-mile, 44-kv. line has been built to Seven Islands, the site of the ore company's dock loading installation. This energy will also be shared by the Gulf Pulp and Paper Company at Clarke City.

### *Ilmenite Development*

On another new frontier, Allard Lake, some 400 miles northeast of

[1] On May 6, 1954, the United States House of Representatives voted the American participation to the Seaway project, as well as to the hydro-electric development of the State of New York.

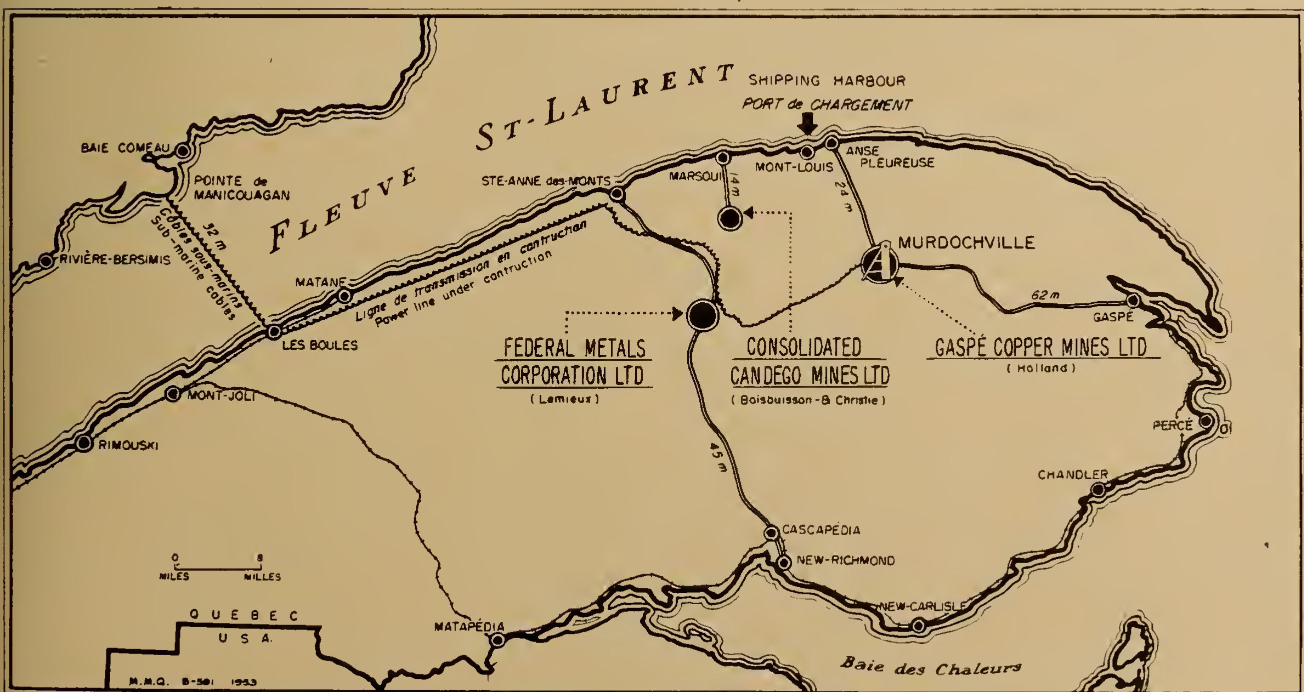



**Fig. 9. Index map of Gaspé mines.**

Quebec City (Fig. 8), a huge program to develop what is probably the world's largest and richest ilmenite deposit has almost been completed. This project includes a 27-mile railway built by the Romaine River Railroad Co., Ltd., to carry ore from Allard Lake to harbour facilities at Havre St. Pierre and the construction by the Quebec Iron and Titanium Corporation of a smelter to treat the ore at Sorel, on the south shore of the St. Lawrence, midway between Trois Rivières and Montreal.

The presence of ilmenite in this district was first reported by the Quebec Department of Mines following a geological reconnaissance survey in 1941. In this report occurrences of anorthosite rocks were mentioned, some very rich in ilmenite, and many prospectors attached much importance to these discoveries. The small showings found at the beginning and the complex metallurgical problems involved in the treatment of the ore discouraged many from further exploration. A development project was then established as a joint venture by the Kennecott Copper Corporation and the New Jersey Zinc Company. Geological and geophysical surveys, exploration and diamond drilling have indicated up to now over 137 million tons of ilmenite, running about 35 per cent titanium oxide and 40 per cent iron.

A new method of electric smelting was then devised to process the ore and a smelter built at Sorel. The 27 miles of railway was pushed through to the ore deposits at Allard Lake and dock and handling facilities were erected both at Havre St. Pierre and at Sorel.

As is the case with the iron deposits in New Quebec, although on a much smaller scale, not only access by rail, but also sources of power had to be provided for this project, particularly at Sorel where large quantities of electrical energy have become necessary. In spite of the great number of water-power sites along the St. Lawrence north shore, diesel electric power is used for all phases of the mining operations. The central station at Havre St. Pierre terminal, equipped with three 375 kva. generators, supplies power to the mine site and to dock facilities, as well as to the village which adjoins the company property at Havre St. Pierre. At the present time, hydro-electric power could be made available in this area only by undertaking a costly new development, an expenditure not warranted on account of the relatively small amount of energy required. Diesel generated power is consequently fairly competitive with hydro power. Furthermore, the mining at Allard Lake is a seasonal operation and oil delivery costs are relatively low. The shipping season extends from the beginning of May to the middle of November.

With an eventual capacity of 350,000 tons of ore per year, the smelter at Sorel will consume large amounts of power in the largest electric furnaces of their type in the world, each being able to treat 300 tons of ore per day. For an adequate power supply, a new 37-mile transmission line across the St. Lawrence direct to the site from its already existing circuits, and a new substation have been constructed by the Shawinigan Water and Power Company for the initial 160,000 hp. necessary. Any additional supply will be procured from the new La Trenche development on the St. Maurice River.

This project of treating ilmenite ore at the Sorel smelter from the world's largest deposits is one of the biggest metallurgical experiments in this country. From this complex ore, two products are obtained; iron and steel ingots and slag containing 70 per cent titanium oxide. With all five furnaces in operation at various capacities and on a variable schedule during 1953, about 300,000 tons of ore were treated for a production of 100,000 tons or iron and steel and over 125,000 tons of titanium oxide slag.

Production of iron presented no great problem, although sulphur elimination required some attention, but the production of the black slag, now in good demand in the pigment industry, has stimulated engineering ingenuity. Although the future potential for titanium metal is enormous, on account of its strength, its light weight and its resistance to corrosion, this project is not concerned with its production. Nonetheless, if an economical process is worked out for producing the metal from ilmenite, the Province of Quebec will obviously be a major producer.[2]

[2]On April 29, 1954, Mr. J. A. Fuller, president of Shawinigan Water and Power Company announced that his company had succeeded in making high grade titanium metal by an electrolytic process, and is now planning to expand this work into a larger, semi-commercial pilot plant as the next step toward fully commercial production. The company believes that, by this electrolytic process, it will be possible to make titanium on a commercial scale at prices substantially lower than have been possible heretofore.

***Gaspé Project***

On the headwaters of the York River in eastern Gaspé, there is another large-scale enterprise under way (Fig. 9). Here, Gaspé Copper Mines, a subsidiary of Noranda Mines, Ltd., has undertaken the development of a copper deposit, ore reserves of which are estimated at 70 million tons grading 1.3 per cent copper, with presumably other large reserves close at hand. Backed by these reserves, Gaspé Copper is developing a new mine, building a concentrating plant with an initial capacity of 6,500 tons a day, the largest initial milling rate ever to be attempted in Canadian mining, and a smelter capable of producing 125 tons of metallic copper daily.

From its inception, the Gaspé project has presented an unusual diversity of engineering problems. It was truly an undertaking started from scratch, so isolated was the site of the workings, so thick the surrounding forest and so rugged the area to be explored. In any terms, this work has been a massive project right from the beginning.

Once more after the prospector had found the first minerals, and the geologist had outlined the favourable formations, drilled the property and determined the extent of the mineralization, the land surveyor and the engineer were called upon to map the terrain and make plans for the many and diversified developments that such a mining enterprise involves. In view of the rapid growth and the permanency of the installations, every problem pertaining to the establishment of this new mining industry and of a community in the middle of the wilderness presented challenges.

Aside from the mining operations themselves and the erection of a modern townsite to meet the needs of the 4,000 people who will reside there, the chief problems confronting Gaspé operators were transportation facilities and the provision of adequate hydro-power.

During 1952, the Quebec Department of Mines completed the 62-mile, all-weather, first-class gravel highway from the town of Gaspé to the site of the mine in Holland township. Since the beginning of operations, this road has been the only serviceable year-round lifeline to Murdochville, the new community. By the time the concentrator starts to operate in October of this year, Murdochville will have another means of access. In co-operation with the interested company, the Department of Mines is completing a new 24-mile road to Anse Pleureuse on the south shore of the St. Lawrence, thus giving a ready access to Mont Louis, four miles west, where a port exists and where wharf facilities will be built by the Federal Government. Although there already exists a harbor with excellent facilities at Gaspé, the Mont Louis site is much nearer to the smelter and its use could do much for the economy of surrounding country. Besides the outgoing anode copper to be shipped to the refinery in Montreal, Mont Louis will be the receiving port for all supplies, especially bunker oil for use in the smelting furnaces. Eventually there will also be concentrates coming in from other mines for customs treatment at the new smelter. There is as yet no railroad servicing this area, since the railway goes only to Matane.

The next demand on the engineer was to make available the necessary power for this mine-smelter project whose needs will be around 12,000 hp. when the smelter starts to operate in March, 1955, and eventually 17,000 hp. when in full operation.

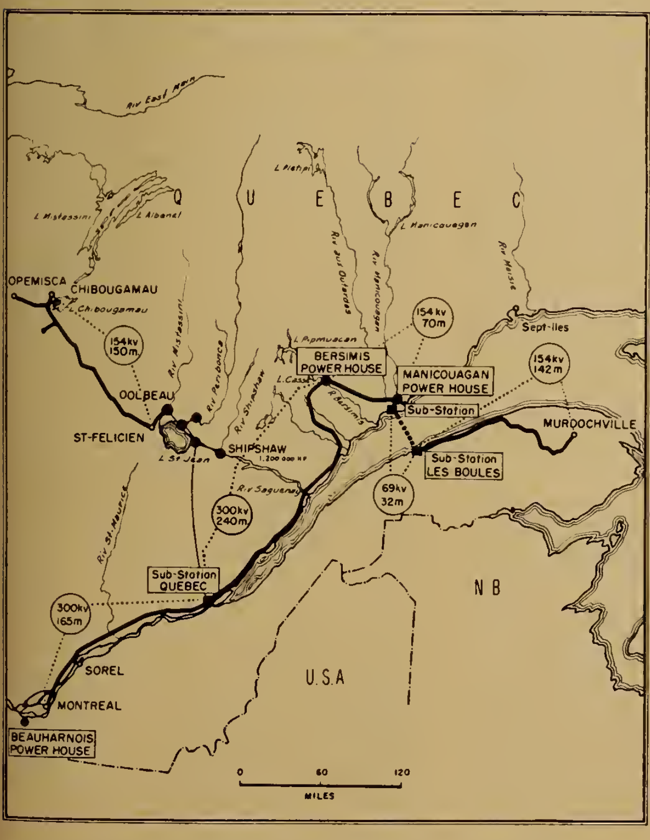
Considering the actual and future needs for this particular region and also for the rest of the province, very few known hydro-power sites in the whole peninsula could be developed to the extent of the Bersimis. The needs of the Gaspé project helped spur the start of this major hydro-electric development by the Quebec Hydroelectric Commission.

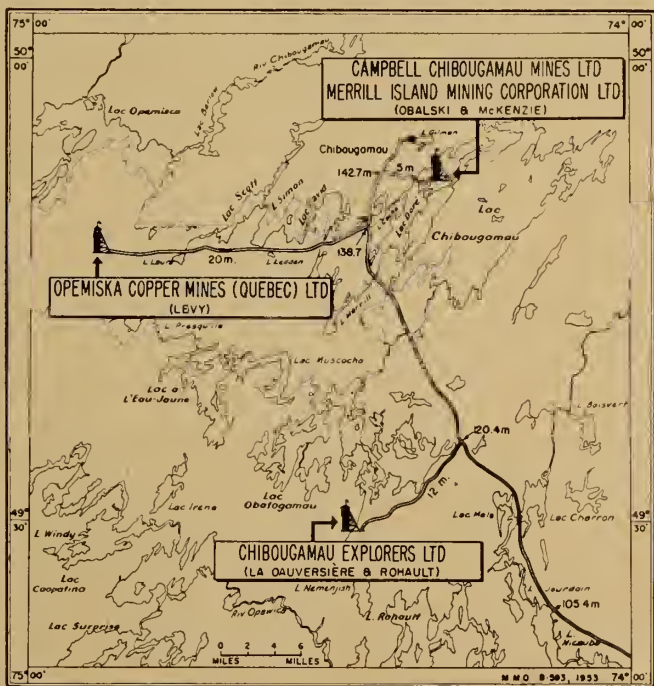
At Lake Cassé, some 90 miles upstream from the mouth of the Bersimis River, on the north shore of the St. Lawrence River, a dam 2,500 feet long and 200 feet high is being erected to form a reservoir comparable in size to the Lake St. John or to the Gouin reservoirs. (Fig. 10). A tunnel, nearly eight miles long and 36 feet in diameter, the second longest tunnel of its kind in the world, will channel the impounded waters to the Bersimis power house, built under a mountain. The head of 875 feet will produce a total of 1,200,000 hp. from eight 150,000-hp. generating units. These will be the most powerful single units in existence and are scheduled to come into operation as follows: two units in 1956 (300,000 hp.), one each in 1957 and 1958, and the remaining four (600,000 hp.) by 1961.

The Bersimis plant will serve industrial, commercial and residential customers in many parts of the province and will also provide substantial additions to Quebec's present grid. One 300,000-volt transmission line will reach the Quebec area, some 240 miles southwest from Bersimis, where the Shawinigan Water and Power Co. will take 400,000 hp., one-third of the Bersimis capacity, for distribution over its widespread system. A second line of the same voltage will continue to Montreal to help serve its highly industrialized area.

A third line will go southeast and reach the lower St. Lawrence and the Gaspé peninsula. This is probably the most difficult part of the distribution project, and for the present, the most directly concerned with the mining industry. It involves the construction of four submarine cables of 69,000 volts capacity, which will cross the St. Lawrence between Pointe aux Outardes and Les Boules, a distance of 32½ miles, the longest underwater gap in the world to be bridged by power. Incidentally, these 4½-inch cables are being manufactured by the Canada Wire and Cable Co., Ltd., a Noranda subsidiary, in a plant specially built for the purpose at Rimouski.

From a tie-in at Les Boules, the new power gateway, a 142-mile transmission line will deliver power to the mining site of Gaspé Copper and to a few other industries of the peninsula through the Lower St. Lawrence Power Company. The power for this line, which will be completed in 1954, will be purchased initially from the Manicouagan Power Co., but will be supplied ultimately from Bersimis.




Left: Fig. 10. Bersimis hydro-electric development in relation to the Gaspé and Chibougamau mining areas.

Right: Fig. 11. Index map of the principal metal mines in the Chibougamau region.

The Gaspé Copper project has also given renewed impetus to many other mineral explorations, besides the producing Consolidated Candego Mines, in the Marsoui area, and the noteworthy prospect of Federal Metals Corporation Limited, in the Cascapedia River area. The establishment of such a large producing mine in a new area is always the incentive to finding and developing other mines. There are many excellent mine-making possibilities in adjacent sections of Gaspé.

*Chibougamau Area*

Probably one of the most active areas in the province during recent years has been the Chibougamau region (Fig. 11), which covers roughly 25,000 square miles in favourable geological formations of similar nature to those encountered in the Abitibi area, located about 150 to 200 miles southwest. According to estimates prepared by interested companies, reserves of the Chibougamau area now amount to ten million tons, having a total value of over $100 million. The development of this new district is a typical example of the difficult operational and economic problems that the mining industry has to face.

One of the earliest mining areas to be investigated, Chibougamau has been subjected to short periods of concentrated attention that rapidly died out, owing for the most part to the high costs of operation resulting from its remote location and the lack of cheap hydro-electric power. In the recent development of Chibougamau, however, both problems were courageously tackled.

A new highway, stretching for 150 miles from St. Félicien, in the Lake St. John district, has changed the situation by solving one problem. This highway, completed in 1950 by the Department of Mines at a cost of $4 million, was built largely on faith in the ability of engineers to cope with mining problems peculiar to the Chibougamau area, as there was no assurance of producing mines at the time the construction was planned or even when it was started.

As an immediate result of this ready means of access, ore bodies have been proven or indicated at many properties, and this new mining district finally achieved its goal of actual production in December, 1953, when the first producer, Opemiska Copper Mines, swung into operation. Three other potential mines at present form the backbone of the district. They are Campbell Chibougamau Mines, Ltd., Merrill Island Mining Corporation and Chibougamau Explorers, Ltd. Because some of these properties are widely separated from one another, secondary roads had to be built linking them to the main Chibougamau highway. All these are standard roads having a 24-foot gravelled roadbed and in one case a causeway of 3,500 feet was built to connect Merrill Island in Doré Lake to the mainland. With all year-round, easy access to Chibougamau, developing companies are finding that costs of operation are in the same range as those experienced in other producing districts of the province.

Another phase of the transportation problem is now under consideration; the Chibougamau railway, a project that has been discussed for many years is getting close to becoming a reality. (Fig. 12) At the present time, considering Opemiska Copper in production with a 400-ton mill and Campbell Chibougamau Mines with a 1,700-ton plant under construction, it seems evident that substantial savings could be made by shipping out concentrates by rail rather than by truck, as is now being done. Freight costs could be reduced by more than one-third. A regular freight volume is gradually building up to make the area attractive for a railway. Two alternative routes are proposed. One would be southeastward, following roughly the present highway to St. Félicien, on Lake St. John, and would provide an inexpensive means of transporting ore concentrates direct to the new nickel-copper smelter and refinery to be built at Chicoutimi by the Eastern Smelting & Refining Company at an estimated cost of $8 to $10 million. This new smelter, with a rated capacity for treating 200 tons of nickel-copper concentrates and 200 tons of copper concentrates daily, will be located in an area where both water and railway transportation and power are readily available.

The other route would go southwestward through a zone of volcanic and sedimentary rocks of the Temiscamian subprovince, which is attractive as a potential area for the occurrences of ore minerals. The railway would then swing south to Beattyville, a distance of about 160 miles from Chibougamau. This latter route would provide the most direct way to the Noranda smelter; this railway, via Beattyville and Barraute, would reduce by one half the distance via Lake St. John.[3]

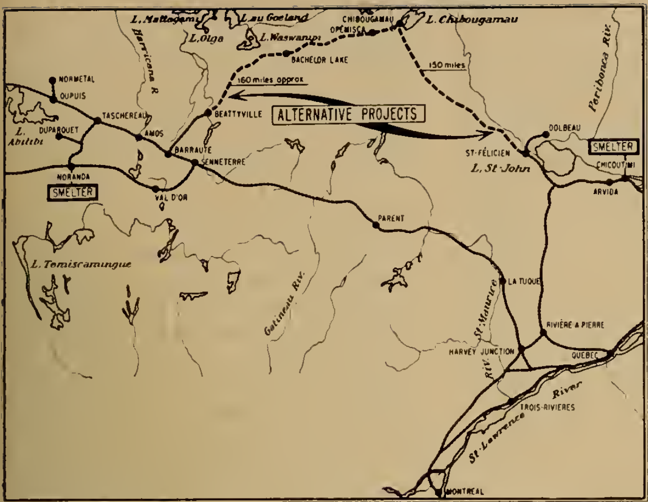
The other problem faced by engineers in Chibougamau has been, and still is, power. According to the plans of the Quebec Hydro, hydro-electric power is expected to reach the Chibougamau area at the beginning of 1955, thereby giving an impetus to mine-making plans, for it will mean costs lower than those of the present diesel-generated supply. Clearing right-of-way for the 154,000-volt transmission line from St. Félicien has already started; it will follow the new 150-mile highway. A tie-in at Dolbeau, already connected with the Saguenay River power system of the Aluminum Co. of Canada, will bring the initial supply to this mining area.

As already mentioned, the Quebec region will be supplied with a 300-kv. line from Bersimis, thus permitting Lake St. John energy (Chute Savane, Chute du Diable, Isle Maligne and Shipshaw) now serving Quebec City area to be used primarily for local needs and the surplus to be diverted to Chibougamau. In other words, the energy now supplied to Quebec by the Lake St. John power system will gradually cease as it is replaced by the new supply from Bersimis. The major engineering project at Bersimis is therefore indirectly responsible for cheaper power in the Chibougamau region.

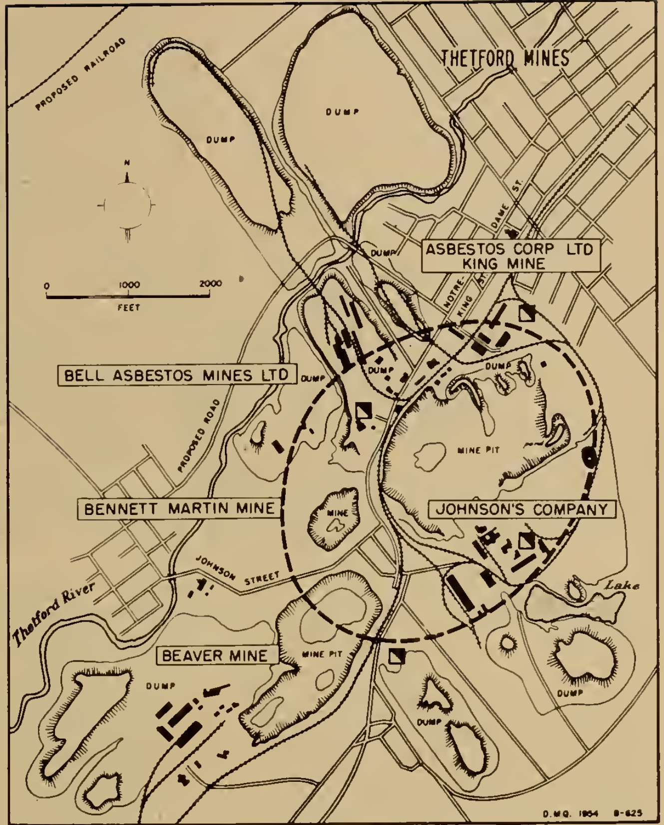
***Thetford Mines—Black Lake Region Relocation at Thetford Mines***

The asbestos mining industry of Quebec is centered about the Thetford-Black Lake and Asbestos districts in the Eastern Townships. These remarkable deposits have been producing asbestos fibre for nearly seventy-five years, and this industrial mineral is the largest single item in the table of Quebec's mineral production. Several million tons of rock are extracted each year with amazing efficiency; in some operations, more than 10,000 tons of rock are mined, transported and treated every day. The average content in Quebec's deposits as now mined is well over 5 per cent of fibre. In round figures, it may be said that approximately 900,000 tons of fibre is shipped yearly at an average value of $90 per ton.

[3]The Canadian Government has announced (the bill authorizing construction was passed on May 11 in the House of Commons) that the Canadian National Railways will proceed immediately with the construction of the 150-mile railroad connecting Caché Lake, near Chibougamau, with Beattyville, in the Barraute area. This railroad should be completed by the summer of 1956. The other route between Chibougamau and St. Felicien will be built later.




**Left: Fig. 12. Alternative railway projects for the Chibougamau area.**




**Right: Fig. 13. Map of the relocation program at Thetford Mines.**

The demand for asbestos depends, of course, almost entirely on world markets. Business conditions in many countries have been more competitive during recent years, especially in the United States, where most of Quebec's production goes, and also in Europe. With the invasion of the market by Russian asbestos shorts, the outlook is for slightly lower production. Never-the less, the long-term picture is bright on account of the numerous industrial uses which are steadily being developed and because of the steady demand in long-established markets.

The picture of the asbestos mining expansion and improvement program underway in Quebec is very impressive. At Asbestos, Canadian Johns-Manville is building a new mill to replace its present plant and is converting its Jeffrey mine, the world's largest, to underground operations; at Vimy Ridge, Asbestos Corporation is readying a new mine and treatment plant with a rated daily capacity of 5,000 tons; in the Black Lake area, Johnson's, Ltd. has completed a 4,000-ton daily capacity plant to replace its old mill, while in the same area, the American Smelting and Refining Company is going ahead with plans to place the properties of United Asbestos Corporation in production at an estimated cost of $25 millions. This project will also involve a great engineering feat, the drainage of Black Lake.

Although open-pit mining is still practised on some of the properties, the economic limit of depth for others has been reached, and an underground method known as "block caving" is now in use, entailing engineering achievements of the highest order. In this block-caving method of mining, no timber supports can be used underground because of the undesirable splinters which wood leaves in the final asbestos product; all underground openings of a permanent nature have to be supported by steel and concrete. Mill tailings are placed as fill over the subsiding, mined-out blocks and, although this fill does prevent sudden collapses of ground, it does not stop a gradual shattering and movement of the rock surrounding the mine workings.

In the Thetford Mines area, the Bell mine, the King mine (Asbestos Corporation) and the Johnson's mine, were operated by open-pit methods until about twenty years ago, when the depth of the workings and the lack of surface space first forced the King mine to go underground. Shortly afterwards, the Johnson's mine was obliged to do likewise. The Bell mine remained as an open-pit operation until 1951, when the differing depths of mining of the three contiguous properties brought about mutual difficulties, because of boundary subsidence of portions of the upper mines into the lower ones. In addition, operations having been carried out to deeper and deeper horizons, a stage had been reached where surface subsidence was also creating much concern, preventing at the same time the mining of big blocks of excellent ore.

It became evident that part of the surface facilities would have to be relocated. Even as far back as 25 years ago, a survey of a relocation project was prepared, but circumstances did not permit its realization until recently. To allow for the co-ordination of mining operations of these three major asbestos producers in Thetford Mines area, a major relocation program has now been undertaken (Fig. 13). The project consists of the clearing away of all surface establishments bordering and covering the area affected by present and planned mining operations of the Bell mine, the King mine (Asbestos Corporation) and the Johnson's mine. The entire cost of the relocation program, which is expected to be well over $5 millions, is to be met by the three companies involved, in proportion to the ore reserves which the project will make available to each.

According to the estimates, the

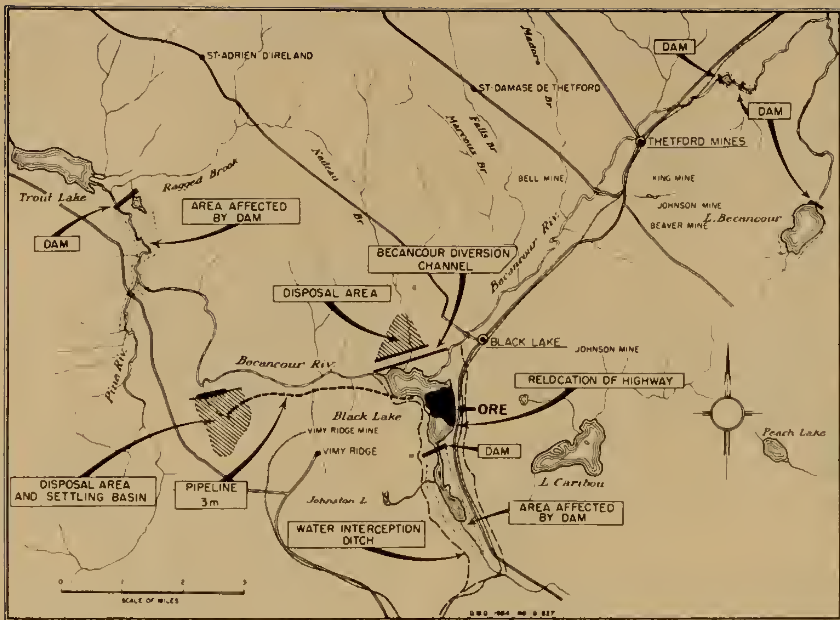



Fig. 14. Black Lake drainage scheme.

whole project will take ten to twelve years to complete, but to date almost 75 per cent is already done; the relocation of railway facilities and city communications, which are by far the most important items of the project, should be completed by 1955. Work was commenced last August, and the new line of the Quebec Central Railway should be opened to traffic by November of this year.

This project comprises a lengthy railway detour and the building of railway bridges, a new station, a freight shed, and a marshalling yard. In addition, two new city streets will have to be opened, new water mains will have to be laid, and sewerage lines will have to be changed. Considerable reorganization is also required for power lines, and telephone and telegraph systems must be modified. About 100 dwellings and business establishments have to be removed and relocated.

This project will eliminate further obstruction and ensure economic mining of this major orebody for many years to come.

### *Drainage of Black Lake*

Among the important engineering projects pertaining to the mining industry, must be mentioned the recent decision of Lake Asbestos of Quebec, Ltd., a subsidiary of the American Smelting and Refining Company, to put into production the United Asbestos Corporation property beneath Black Lake and also provide for the construction of a mill of 4,000 tons daily capacity.

As a result of a substantial amount of underground working and test drilling, positive ore reserves under Black Lake are conservatively estimated at 50 million tons grading 7 per cent of asbestos fibre. Because of the nature of the rock, it is believed that only a small portion of the ore could be mined by underground methods even if the lake were drained and some of the mud were removed.

In order to permit mining operations by open-pit methods, it will be necessary to remove the 30 million cubic yards of clay, sand, gravel and glacial till that are covered by 50 feet of water. This


Fig. 15. Principal mine roads built by the Department of Mines of Quebec.


Fig. 16. Mining villages in Quebec.

mud will be removed by means of hydraulic dredging and pumped through a pipe line to a suitable disposal and settling basin located three miles away.

The project (Fig. 14) calls for the diversion of the Becancour River which empties into the northeast corner of the lake. To take care of streams flowing into the lake a diversion channel, as well as interception ditches around the lake and a dam at the south end, will have to be built. This dam will also serve to accumulate the water necessary for dredging operations and will act as a safety measure for the surrounding interception ditches.

The Sherbrooke-Thetford Mines highway will have to be relocated for a distance of approximately a mile and a quarter on a line between the lake and the railroad, which is about 1,000 feet from the shore.

To compensate in some measure for the loss of the natural regulating effect of Black Lake, a dam will be erected at the east end of Trout Lake and the impounded waters will form a new lake. Other dams will be erected at the discharge of Lake Becancour and on the Becancour river at a point east of Thetford Mines in order to regulate the flow of the river, particularly during flood periods.

Such engineering projects will involve expenditures of many millions of dollars during the next three years, the period estimated as necessary for the completion of the whole undertaking. On the other hand, it will make available a new mineral deposit for the province, one that was discovered by the prospector, developed by geologists and mining men, but brought into operation by the skill of the engineers who have to tackle this intricate, large-scale hydraulic enterprise, whereas the handling of millions of cubic yards of lake bottom silt will bring the civil and soil mechanics engineer prominently into the picture.

#### Other Projects

Among the principal engineering developments in the field of non-metallic industrial minerals in the province must be mentioned the recent completion by Dominion Magnesium, Ltd., of a plant at Beauharnois for the manufacture of ferrosilicon, which in turn is used in the production of metallic magnesium. The Aluminum Company of Canada also produces magnesium by the electrolytic process at its Arvida plant, from brucite drawn from Wakefield, Quebec.

In Villeneuve, east of Quebec City, the St. Lawrence Cement Company is erecting a cement plant with an estimated annual capacity of a million and a half barrels. The tentative operation date is September, 1955.

A new phosphorus plant at Varennes, between Sorel and Montreal on the south shore, built by the Electric Reduction Company, came into production last year. The eventual capacity of the plant will be from 35 to 50 million pounds of phosphorus annually, using imported phosphate rock from Florida as raw material and domestic quartz as flux.

A new sulphur-iron sinter plant is being established in Welland, Ontario, for the treatment of Noranda pyrite, using a new process developed by the company. The reserves of pyritic ore at Noranda mines exceed 100 million tons. Noranda has also decided to put into production the MacDonald mines, where reserves of pyritic ore are estimated at nine million tons. A new 1,500-tons-per-day mill will also be erected at the property.

Canadian Refractories, Ltd., has built a plant at Marelan, 13 miles south of Kilmar, with a daily capacity of 200 tons of refractory bricks. This capacity exceeds that of all such plants in the United Kingdom.

Finally, much could be said about the aluminum industry of this province, which accounts for an annual production of 500,000 tons of metal in the four smelters at Arvida, Ile Maligne, Shawinigan and Beauharnois. Although depending on imported raw materials, this industry has established in Quebec the largest aluminum reduction plant in the world and has served to develop hydro-electric capacity of over 2½ million hp. in the Saguenay valley.

#### Conclusion

And so, everywhere in the province, engineering is closely associated with the finding and the development of new mineral deposits. In this great area, other mines must be sought far afield, or under overburden, or underwater. Accessibility to undeveloped mining areas has for many years been a problem in which the Department of Mines has shown much interest. Major highways, as well as secondary roads or even simple access roads (Fig. 15) have been widely built, while mining villages (Fig. 16) have been established according to the best town planning practice for the welfare of the mining population.

Such is the shape of the economy of the Province of Quebec, a large undeveloped area in which to seek for new natural resources, blessed with abundance of hydropower energy, with favorable rock formations and with a growing manufacturing industry, backed by a competent labor force and the proximity of satisfactory markets.

For its part, the mining industry of Quebec can contemplate its actual accomplishments with satisfaction and look to the future with confidence.

Illustrations for this paper were drawn by Gérard Côté, cartographer, Department of Mines, Quebec. √

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# The Location and Construction of The Quebec North Shore and Labrador Railway

by

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This paper covers the location and construction of the Quebec North Shore and Labrador Railway in the provinces of Quebec and Newfoundland (Labrador). The railway originates at Sept Iles, Quebec, and runs 358 miles almost due north, passing through the western part of Labrador to Schefferville, Quebec. It is a subsidiary of the Iron Ore Company of Canada, formed to develop the rich iron ore deposits in the Knob Lake region of Quebec and Labrador. The railway will transport ore from the mining area to a loading dock at Sept Iles, Quebec.

The project undertaken by the company consists of two hydro electric plants, ore loading and storage facilities, a mooring and loading dock, two townsites, railway maintenance crew facilities, communications and signal installations, the development of the mining area and the building of the railway. The cost of the railway and its rolling stock comprises about half that of the entire project.

> It is a long time since a railway was built from scratch in Canada, but now we have a new one, described in this paper presented at the recent E.I.C. Annual Meeting in Quebec City. The reconnaissance for it has already been discussed in a paper which we published in April 1954, so it is quite fitting that Mr. Monaghan should tell the rest of the story here. Its isolation and the climate of Quebec's north shore made the job not an easy one, yet it was completed well within schedule and without any major difficulties, thanks to skilful planning and management.

Construction of the railway has required the movement of 15,000,000 cu. yd. of material, plus an additional 6,000,000 for tote roads, airports, etc. To build the grade it was necessary to construct 11 temporary airports and install 18 major construction camps. An airlift was inaugurated which in three years completed 15,000,000 ton miles of flying.

Loaded trains will move southbound against a maximum compensated grade of 0.4 per cent and will return northbound empty against a 1.35 per cent grade, compensated. There are 693 curves from 0° 15′ to 8° 0′ of which 450 are less than 3°. The major drainage structures are 19 bridges with a total length of 4,736 ft., of which the Moisie River bridge, of steel lattice-girder construction 705 ft. long and 155 ft. high, is the largest. There are 22 passing sidings and one intermediate yard at Oreway, Mile Post (MP) 186. Trains will be operated under centralized traffic control. The south switch at each siding is power operated and the north switch is spring activated. Empty trains will take the siding.

It is expected that the railway will go into operation in August, 1954, and that 1,500,000 tons of ore will be moved to the sea by December. About 1956 the railway will begin to transport 10,000,000 tons of ore per year. This is three times the present annual production of iron ore in Canada and about one-tenth the present annual production of ore in all North America.

The ore will be transported in trains of 100 cars, each car carrying 85 long tons; four diesel electric locomotives of 1,500 hp. each will supply power. Ten million tons per year will require seven trains per day each way during the ore hauling season, which is expected to last 165 days, from June 1 to November 15. The trains will unload into a stock piling yard in Sept Iles through a car dumper of 8,000 tons per hour capacity into a ship loading dock of 6,000 to 8,000 tons per hour capacity.

The reconnaissance surveys for the route were made in 1945 and 1946 by D. A. Livingston, M.E.I.C., *The Engineering Journal* April 1954. Location surveys were also undertaken by Mr. Livingston in 1947, 1948 and 1949, and completed in 1950. Construction started in the fall of 1950 and was completed in December, 1953. The track reached Schefferville on February 13, 1954.

### Surveys

A railway survey consists of three distinct operations—reconnaissance to determine possible routes, preliminary survey to gather information and to select the proper route, and location survey to lay out the results of the first two surveys on the ground for construction purposes.

#### Reconnaissance

A reconnaissance is a survey of an area, not of a particular route. In making the reconnaissance for the Q.N.S. & L. Ry., Mr. Livingston obtained standard Canadian Government topographic map sheets of the area, each covering 4° of longitude by 2° of latitude, and to a scale of 8 miles to the inch. These maps showed the planimetry of the area and the drainage, but no elevations. What appeared to be the most feasible routes between termini were laid out in these maps for study. By inspection, several were eliminated immediately being either too long or containing poor alignment, or having unfavourable grades. As the country is well drained and contains well defined stream courses, the choice was limited to two or three valleys.

The choice of valley in turn was governed by the established grade limits. The best line is generally available on or along a valley floor, because confluent creeks can be crossed at grade level, eliminating large valley fills, and because the general alignment is usually better. A good argument in favour of such a location is that the flow of water is there and has probably found the best route.

Through the lake and muskeg country the drainage is sluggish, almost eliminating grade as a consideration in the choice of a possible route. Here a line was chosen for its shortness and lack of heavy curvature. The lakes themselves and small rock ridges, which occasionally expose themselves in the muskeg plain of the Labrador plateau, constituted the major natural barriers to be circumvented.

During the conduct of the reconnaissance survey information was secured regarding the elevations of the termini and on ruling grades; barometric or fly levels of all summits, passes and lakes, both in the valleys and in their head waters, were also determined. Elevations of the various streams were taken at frequent intervals, waterfall heights were noted, with their approximate distance from some reference point. Stream profiles were plotted and used for grade determinations.

Descriptions of the various types of terrain and their composition were made as the survey progressed. Different types of materials vary widely in excavation cost and the presence of certain types of material could upset an otherwise sound construction scheme.

Reconnaissance plans and profiles of the various possible routes were plotted when all information was available and the most desirable routes were then picked out. A flight of aerial photographs was taken along w[illegible]as considered the most suitable d[illegible]tion.

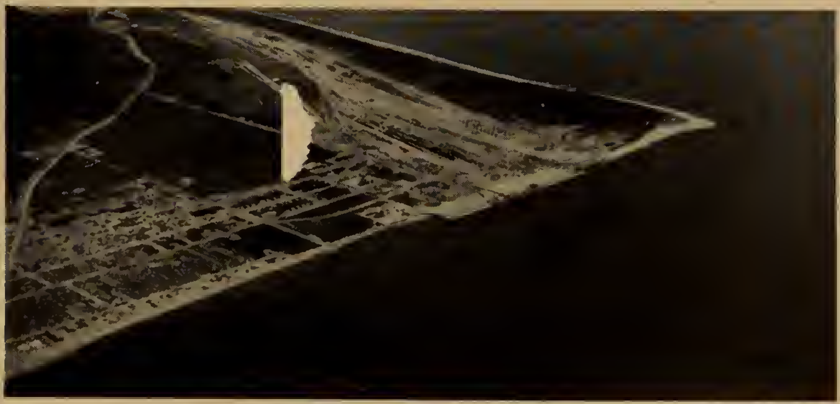
#### Preliminary Survey

Preliminary surveys were started during the summer of 1947. These were run in accordance with standard survey practice to an accuracy of about 1 in 1,000.

The preliminary survey consisted of a series of courses along the proposed route, chained, with stations marked on the ground at chainage pickets each 100 feet and deflection angles taken at each change of direction. This series of courses is usually referred to as "the line". Levels were carried along the line determining the elevations of each station and establishing bench marks at quarter-mile intervals. The leveller in passing took note of the size and location of creeks for culvert size, the average diameter of timber growth in the vicinity and the classification of material which the line passed over. These notes were transferred to a profile of the line.

The topography of a strip three to five hundred feet wide was taken. The topographer's notes were either in the form of slope readings laterally from each station, or as a contoured strip drawn in his

**Rock cut, typical of some of the country through which the railroad passes.**



Sept Iles Terminal area.

field notebook. He located the position of all primary topographical features adjacent to the route and defined lake shores, stream courses, etc. with respect to the line.

Each day as the field information was assembled a field draftsman plotted the line by means of latitudes and departures. The topography was sketched in and details gathered as the field work progressed were added. Projections of the possible routes could then be plotted on this plan, conforming to specifications as to grade, curvature and alignment. Depending on the accuracy of the survey, a profile taken from this projection represented closely what would be obtained in the matter of excavation quantities, size of structures, etc., should the route in question be used.

Profiles of the line were plotted to a scale of 1 in. to 400 ft. horizontally and 1 in. to 20 ft. vertically. Plans were plotted to a scale of 200 ft. to the in., with a contour interval of 5 ft. in relatively smooth sections and 10 ft. in the more precipitous areas.

#### Final Location Survey

The preliminary survey provided the basis for location planning. As the survey advanced, various trial lines were laid out on the plans and profiles taken off to determine the most economical route. When the most favourable location had been determined on paper, the line was run in on the ground. Some revisions in this line were frequently necessary. If time permitted, the locating engineer made these corrections, if not, the resident engineer on construction made them when laying out the centre line for clearing.

#### Specifications for Final Location

The specifications to which the survey of the Q.N.S. & L. Ry. were run called for a minimum compensated grade southbound of 0.4 per cent and a maximum compensated grade northbound of 1.35 per cent. 8° curves were the maximum allowed.

The first surveys of the railway route were run on a maximum grade basis of 0.4 per cent southbound and 1.9 per cent northbound, both grades compensated for curvature. At this time steam power was contemplated as the prime mover and the use of the 1.90 per cent grade was to take full advantage of the pusher service required in a short section of the Wacouno River territory. The minimum grade available in this valley south of M.P. 75 exceeded that which could be negotiated by a train returning empty with its full complement of cars.

It was decided in 1949 to use deisel-electric power on the railway. This power could move the northbound empty 100-car trains over the 1.9 per cent grade satisfactorily, but the braking capacity of a loaded train was found to be such that a 1.35 per cent compensated grade was the maximum that it could descend safely.

The maximum degree of curvature was established in view of the fact that a train moving around an 8° curve at 35 m.p.h. requires 4 in. of super elevation. Milage 0 to 165 was located on the principle of curvature and grade versus yardage, and miles 166 to 358 on the principles of distance versus yardage.

The grade rises to el. 300 above sea level in the first 55 miles and to el. 1,600 in the next 41 miles. Most of the heavy grading and all the curvature over 6° are contained in this section. The summit, el .2,056, is reached at M.P. 149. Across the Labrador Plateau elevations vary from 2,056 to 1,550 and at the south end of Knob Lake, where the line crosses the Quebec boundary, the elevation is 1,665.

#### Survey Methods

The survey work was done during 1947 to 1950, inclusive. Generally two field parties were used, both summer and winter, with a short tie-up at break-up in the spring and freeze-up in the fall.

The distinct types of topography —the precipitous, well-drained Moisic River watershed and the northern Labrador plateau—made it possible to divide the survey into two types of operation, summer and winter, and to make full use of the advantages of each. The crews equipped for summer operation generally moved by canoe or by boat on the larger lakes, while crews on winter operation depended on dog teams for their transportation. Thus it was possible to do the river sections in the summertime with canoe service. The muskeg section, difficult to manoeuvre upon in the summertime, when frozen over provided an

One of the airstrips in service during 1952. Mile 163 construction camp and grade, left foreground.

excellent surface for dog team operation.

### Field Crews

The field parties, usually two in number, operated continuously regardless of weather changes, modifying their equipment to suit seasonal requirements. Each party consisted of from 18 to 24 men. A typical field party was organized into a working unit with personnel as follows:

- Locating engineer.
- Transitman.
- Leveller
- Draftsman
- 2 Topographers and rodmen.
- Head chainman.
- Rear chainman.
- Stakeman.
- 2 Axemen.
- Cook and assistant.
- 3 Canoemen.

During the winter the canoemen became dog-drivers, and a woodcutter and a night fireman were added to the crew. Living quarters for a crew of this size were canvas tents of either the "A" or pyramid types, with preference for the pyramid tent, because of ease of erection and uniform heating; it also requires only one pole, a factor especially appreciated in this land of short, heavy spruce.

With a well balanced party as listed, the survey can proceed in an integrated manner, such that each day's work is completed by the end of that day, leaving no overlap. On a preliminary survey this means that all angles and courses have been measured and checked, and levels and topographic coverage of the line completed. On a location survey the curves will also have been run in.

Considerable effort must be expended on co-ordination of the various sections of the crew in order that work may proceed without stoppages. An experienced crew can complete the survey over all the line cleared in a day through a moderate growth of timber. On preliminary line it is necessary that the locating engineer keep his local reconnaissance far enough ahead so that there is no delay from that source. The field notes should be plotted each night and on the following day by the draftsman. A continuous contour plan and profile, showing all topographic features relative to the line, are kept as already mentioned.

Fortunately the two definite types of terrain encountered in this project allowed field work to be organized to accommodate seasonal differences. The precipitous river valleys adjacent to the St. Lawrence were easier to contend with in summer—snow covered slopes are difficult to work on—but the relatively flat lake country lent itself to both summer and winter work.

A hindrance in the lake regions was the prevalence of strong northwest winds which made canoe travel difficult and sometimes impossible, leaving men marooned for two or three days at a time. To overcome this obstacle large flat bottom boats built of plywood were used. These were constructed in sections at Sept Iles, flown in to the lakes and erected. They were from 36 to 43 ft. long and 5 or 6 ft. wide. Each could carry a load of about four tons with a one-foot draft. They were powered by standard 8 and 10 hp. outboard motors, and averaged about 7 m.p.h. loaded. With these boats, two to a party, it was possible to move a complete camp and food supply in one trip, requiring a minimum of men released from line duties.

During the winters dog teams were used with sleighs or "comatiks", as they are known locally. Four dogs were hitched as a team to each sleigh, Eskimo fashion, and on hard packed trails were expected to pull a 400-pound load.

Camp moving equipment in the winter consisted of 30 dogs and 7 sleighs. These were supplemented by five 9 ft. toboggans drawn by hand. The tents, baggage and food supply weighed about three tons.

**Laying tracks on the bridge at Mile 12. The largest between Moisie River and Knob Lake.**

This load was usually divided so that part of it could be moved before or after the main move day.

Mail and supplies arrived each week from Sept Iles by aircraft. At least a week's reserve of food was maintained which sufficed to cover any period of bad weather or mechanical delay in aircraft service. This safety cache was moved ahead periodically when the airplane was available.

Two full-sized crews were used summer and winter, with a smaller crew doing special work where required. During the summer of 1950, ten crews were put in the field to check and complete remaining location for the contract estimate.

Daily production of the field crews varied considerably. In the steep river valleys a half-mile to a mile a day was considered good work. On the Labrador plateau crews averaged two miles per day in the field. A total of 1,507 miles of line was run from 1949 to 1952.

### Geology

The line as constructed follows the valleys of the Moisie, Nipissis and Wacouno Rivers to M.P. 130, where it crosses to the headwaters of the Magpie River, which it follows to M.P. 150. From M.P. 150 it follows the east sides of Ashuanipi and Menihek Lakes to M.P. 330, where it crosses the Menihek Rapids, thence across the grain of the country to M.P. 358 at Schefferville.

The Sept Iles yard and the first ten miles of the railway are located on a portion of the Champlain plain. Starting at M.P. 10, the railway crosses a series of low marine terraces just prior to reaching the rugged Laurentian uplands at M.P. 12. Here it crosses the Moisie River and follows its east side to its junction with the Nipissis River at M.P. 28. There it follows the east side of the Nipissis to M.P. 56, where it enters the Wacouno River gorge, which it follows to its head at M.P. 130.

The rock in these river valleys is composed of an ancient gneiss complex of early Precambrian age, which has been intruded by igneous rocks varying in composition from acidic to basic. The rocks are largely granite gneiss and are part of the oldest exposures on the earth's surface. These valleys have been heavily glaciated and, particularly in their lower courses, have wide, graded bottoms floored with Champlain sea silts and sands in the Moisie and lower Nipissis and sands of glacial origin in the upper Nipissis and Wacouno. Where possible the line follows the bottoms of these valleys, but frequently in the narrow rugged stretches it clings to the valley sides high above the river.

North of M.P. 150 the route enters the Labrador plateau and follows the east side of the north-draining Ashuanipi and Menihek Lake chains to M.P. 330. Near M.P. 258 the right-of-way enters a great geological unit known as the "Labrador Trough". The Labrador Trough is made up of a variety of highly-folded and faulted sediments and volcanics of late Precambrian age which have been intruded by rocks varying in composition from granites to serpentinites. The bedrock along the right-of-way between M.P. 258 and M.P. 265 has been interpreted to consist of shales and quartzites which have been intruded by gabbro. Between M.P. 265 and the Howells River, approximately M.P. 338, the bedrock consists entirely of shales and slates. North of M.P. 338 into Knob Lake the right-of-way crosses a great variety of sediments, including dolomites, chert breccia, quartzites, iron formation, shales and slates. A few minor diabase dikes are known to cut these sediments.

### Aerial Photographs

A single flight of aerial photographs was taken along the reconnoitered proposed route of the railway during the summer of 1945. An individual photograph of this flight covered approximately six miles east and west and three miles north and south. Extensive use was made of these photographs in locating the line on the ground and in planning survey operations. Inasmuch as the majority of the locating work had to be done on the ground, contoured plans were not drawn from these photographs. Two attempts were made to use aerial photography for location surveys in the Wacouno and Moisie River sections, but, due to ruggedness of terrain and unsatisfactory control, these failed. It is the author's opinion that, had a topographic strip map along the proposed right-of-way been prepared, including an area ten miles each side of the centre line, to be used for preliminary investigations, considerable costly grief could have been saved the field parties. The aerial photographs were particularly useful in the muskeg section, where differentiation among the various types of coverage determined, within limits, where the line was to be located. During the construction period they were most useful in determining the location of borrow and ballast pits.

### Construction

The contract for the construction of the railway was awarded to a group of contractors, Cartier-McNamara-Mannix-Morrison-Knudsen, familiarily known as "C.M.M.-M.K.", on September 21, 1950. The completion date for grading was set for June 20, 1954. This was later advanced to December 31, 1953.

The main items in the contract specified the movement of 15,000,000 cu. yd. of material; building 19 bridges, 5 of steel and 14 timber trestles; and excavating two tunnels, one 2,206 ft. long and the other 761 ft. long; the laying of 440 miles of rail; and spreading of 2,200,000 cu. yd. of ballast. The steel bridges were fabricated and erected under a subcontract.

The contract provided that the railway would purchase all materials and equipment for construction of the project and would provide air transportation for these materials

**TABLE I: Cubic Yards of Material Moved in Construction of Q.N.S. & L. Railway and Terminals**

| Mile Post to Mile Post | 1951 | 1952 | 1953 | Total |
|---|---|---|---|---|
| 2-40 | 4,152,415 | 436,935 | | 4,589,350 |
| 40-100 | 588,320 | 2,243,276 | | 2,831,596 |
| 100-150 | 74,250 | 674,977 | 299,288 | 1,048,515 |
| 150-200 | | 800,000 | 1,222,869 | 2,022,869 |
| 200-250 | | | 1,384,269 | 1,384,269 |
| 250-300 | | | 1,572,233 | 1,572,233 |
| 300-358 | 1,235,868 | | 308,967 | 1,544,835 |
| Sept Iles Terminal | 435,000 | | 88,500 | 523,500 |
| Knob Lake Terminal | | | 180,881 | 180,881 |
| Airports & Tote Roads | 1,315,000 | 2,030,000 | 2,655,000 | 6,000,000 |
| Total | 7,800,853 | 6,185,188 | 7,712,007 | 21,698,048 |
| Grade Track Miles Completed | 103 | 106 | 231 | 440 |

and personnel where necessary; the contractor would furnish men and supervision, do all grading, etc., lay the track and ballast it. For this he was to be paid a fixed fee.

The contractor's program for construction was as follows:

1950—Buy and move equipment into place; commence construction of grade on south end and excavation of tunnel at M.P. 12.

1951—Construct grade to M.P. 70, complete tunnel and Moisie River bridge and lay rail to about M.P. 50.

1952—Complete grading on 85 per cent of line and lay track to M.P. 190.

1953—Complete grading and track laying and 500 lift-miles of ballasting.

1954—Complete ballasting and clean up work necessary for safe operation.

Table I shows how well this program was followed.

Construction progress was controlled by the speed at which men, machines and supplies could be moved into place. Airports and tote roads were built to facilitate this movement. A winter tote road to Knob Lake was opened during the winters of 1952 and 1953. Tractor trains and trucks moved freight along this road. Their cargo was made up of piling both steel and wood, bridge timber and ties, fabricated steel sections for the Menihek power project, equipment for the Knob Lake development and any other material unsuitable for handling by air. The cost of winter maintenance and the heavy snowfall made winter haulage as expensive as flying. A comparatively small tonnage was moved this way.

As sections of the railway between airstrips were completed, freight was staged from Sept Isles to airport by train for delivery by aircraft to final destination. As construction advanced, so did the base at which the aircraft were loaded.

North of M.P. 200 the right-of-way follows the Ashuanipi, Whitman, Molson and Menihek Lakes for 130 miles. These stretches of water were used to transport fuel and supplies, using open boats built on the site. The total tonnage of freight moved by this operation during 1953 was 165,527 tons.

In all there were 13 airstrips in operation along the right-of-way, including the ones at Sept Isles and Knob Lake. Douglas DC3's were the major type of aircraft used, with a Lancaster and a Fairchild C119 Packet used for short period only. In 1953, 18 planes, including bush aircraft, and two helicopters were fully employed in the transportation of men and materials. In addition, some contract flying was used for transportation of steel and cement. As much as 6,000 tons of air freight was handled in a single month. The helicopters were used for supervision and ambulance work.

**TABLE II: Volume of Passengers and Freight Handled During Construction by Airlift.**

| Year | No. of freight aircraft | Passengers | Freight ton-miles flown |
|---|---|---|---|
| 1950 | 2 | 1,686 | 606,280 |
| 1951 | 6 | 22,246 | 2,425,547 |
| 1952 | 8 | 45,178 | 5,691,581 |
| 1953 | 10 | 69,590 | 6,539,782 |
| TOTAL | | 138,700 | 15,263,190 |

### Air Lift

Supplies and equipment were brought in by boat from Montreal during the open season on the St. Lawrence from April 15 to December 15, or later. All bulky materials were scheduled to arrive so that full use was made of water shipping. A total of 482,000 net tons were moved into Sept Iles by boat from 1950 to 1952. Requirements during the winter were shipped to Mont Joli by rail and flown from there to Sept Iles and north. Mont Joli and Sept Iles are 145 air miles apart.

Seven pounds of camp supplies and food per day were required to keep a man in the field.

### Equipment

The equipment used on the project was limited in size by transportation requirements. As types of earthwork and excavation varied

**Break through at south portal of tunnel at Mile 12.**

along the line, it was necessary to buy many different types of machines for the different jobs. A compromise was reached between size for transportation and type for work.

The major pieces of equipment on the job during 1953 were as follows:—

58 shovels
31 tractor drawn scrapers, 6 to 22 cu. yd. capacity
21 self-propelled scrapers, 10 cu. yd. capacity
180 tractors
200 trucks, 4 to 30 cu. yd. capacity
33 dumptors.

The above list does not include small machines, jeeps, automobiles, etc., and many other odd pieces of essential equipment. The cost of equipment in use by 1953 totalled $9,800,000 owned and about $1,000,000 rented.

#### Winter Overhaul

During 1951 and 1952 most of the heavy earth moving machinery was used at inaccessible points north of Sept Iles. For this reason, when December, 1952, came around, a lot of heavy repairs were required on these machines. To accomplish this work two large sheds, to be used ultimately for winter storage of the diesel locomotives, were converted to tractor, truck and dumptor repair shops. An assembly line operation was established and each unit was taken down and completely rebuilt. The shovel unit repairs were made in the future locomotive repair shop.

Equipment was brought to the end of steel on the winter tote road and then by rail to Sept Iles. A rapid turn around on the machinery brought in for repairs was required, in order that it might arrive back on the job before the spring breakup ruined the tote roads.

Minor repairs were made in the field by special crews. When engine or transmission changes were necessary, complete assemblies were shipped out from Sept Iles and the old unit returned there.

During the summer of 1953 the overhaul base was moved to M.P. 224, where machine, motor repair and welding shops were constructed.

#### Earth Moving

Aside from minor special construction problems, two main types of work were carried out to complete the job. The first was the construction of the line through the Moisie, Nippisso and Wacouno River valleys, where considerable yardage of solid rock had to be moved. The second was over the muskeg section from M.P. 150 to M.P. 345, where fill material and borrow were scarce and difficult to find. The most difficult situation faced was construction through the muskeg. This was considerably accentuated because of its distance from the source of supply of construction materials.

#### Rock Work

Rock work was completed during 1951 and 1952, using shovels for loading and short haul equipment, such as dumptors and trucks, for moving. The major portion of this work lay between M.P. 12 and M.P. 17. More than 1,000,000 cu. yd. of solid rock were excavated in this section. Compressors, jack hammers, wagon drills and dynamite were used to open the cuts. A total of 600 tons of dynamite was used on the project for rock excavation. As this section was located at the south end of the project, it was a bottle neck around which everything going north had to be moved. Near this end airports were built at M.P. 22, 28, 35, 55, 80 and 134 during the winter and summer of 1951. A summer tote road was also built to M.P. 17 via the west side of the Moisie River, but, as this was located on silty and clay formations, considerable difficulty was encountered in maintaining it through the summer season.

#### Clays and Silts

Although the area through which the railway is built is made up primarily of crystalline Canadian Shield rocks, surface materials to a depth of several feet have been deposited by glaciation and marine invasion. Frequently, throughout the first 100 miles the grade encounters these deposits. Fortunately, the majority of these deposits is made up of sand or of coarse, gravelly material, but some are marine clays and silts. These were difficult to work in. In the presence of water they become fluid and unstable. The excavated material was unsuitable for fill and had to be wasted.

A severe break through of silty material occurred at M.P. 12, when a portion of the roof of the south portal of the tunnel gave way. Approximately 60,000 cu. yd. flowed down through the opening and out the south portal at the time of the break and an additional 40,000 cu. yd. were moved by means of hydraulic jetting to clean the hole out well enough to install a concrete cap.

These same silts have caused some difficulty in track maintenance. Alternate freezing and thawing force moisture into the material and considerable flow occurs on the cut faces. This flow moves out under the track or mingles with the ballast and frost heave occurs. The drainage ditches through these cuts must be cleaned frequently.

While the rock excavation was a job concentrated in a relatively short section of the grade and requiring heavy excavation machinery, the muskeg operation was spread out over 200 miles and required the use of light mobile equipment mounted on mats.

#### Muskeg

Much of the land area of the Labrador region is covered with organic deposits known as "muskeg". It varies in depth from a few inches to 10 to 12 feet. In places it may go deeper, but the average soundings recorded during the location of the route were three to four

Finished track; rock ballast to be placed later.

feet. The line was relocated where depths of over four feet were found. The texture of the muskeg over which the railway was built varied considerably. Generally, all the organic materials were unsuitable for construction purposes.

A typical muskeg cross section consisted of a layer of moss two or three inches thick, overlaying a root-filled, woody, fibrous layer 6 to 8 inches thick lying on a layer of black muck. The muck layer varied from a matter of inches to two or three feet. Underlying this much glacial till matrix is found. Generally, this is a tightly packed formation of sand or gravelly sand with the occasional occurrence of silt.

In constructing the grade over this section of the country it was found that excavating the organic covering where the ditches were to be, and then piling up the material from the till base, gave sufficient material for the base of the grade. This provided a haul surface for the scrapers and trucks to work on to build the remainder of the fills. This in effect is what the construction program turned out to be.

Crews, especially trained, worked ahead of the main construction force with ditching dynamite, opening up a drainage pattern to allow the excess water to move off. The sticks of dynamite were planted in the organic surface and exploded by propagation. A total of about 68 tons of dynamite was used to open up 90,000 ft. of ditch. Later, small draglines piled the sandy gravel material from the ditch bottoms on the grade centre line. After draining, this material was spread by a bulldozer and then the scrapers, DW 10's and trucks moved into complete the grade.

### Track Laying

As successive sections of the grade were completed, track laying forces brought the rail up close behind the grading forces, at times so close that a keen rivalry developed between the two crews.

The track laying machine consisted of a burro crane distributing the rails from specially built truck cars. These cars were made of regular railway trucks supporting a frame constructed of rails, with a coupling arrangement at both ends. This allowed them to be taken down rapidly when their rail load was distributed, and to be set off to the side to allow the next car in line to move up behind the crane. These cars carried about 54 rails each. They were picked up each night when the track laying train was ready to return to its home siding for reloading.

**TABLE III: Track Laying and Ballast Schedule**

| Year | Track laid—Miles | | | Ballast lifting |
|---|---|---|---|---|
| | Main line | Yards, spurs, sidings | Total | |
| 1950 | | 5.0 | 5.0 | |
| 1951 | 11.0 | 5.3 | 16.3 | |
| 1952 | 97.2 | 15.6 | 112.8 | 76 |
| 1953 | 222.9 | 29.5 | 252.4 | 264 |
| 1954 | 25.4 | 8.0 | 33.4 | |
| *1954 | | 20.1 | 20.1 | 387 |
| TOTAL | 356.5 | 83.5 | 440.0 | 727 |

*To be completed 1954.

Enough ties to hold the rail in place were spread at night from the tie cars by dumptors over the estimated length of the following day's laying. A minimum of track fastenings and bridle rods were also laid out. The remainder of the ties and the plates were distributed from the work train following the burro. These were put in place by crews following the train. Spiking was done with air hammers and the joints were tightened with gasoline driven bolting machines.

Track laying was completed to Knob Lake in February, 1954.

### Ballasting

Ballasting operations were commenced in 1951, but, since little track was laid, distribution was limited. During the summer of 1952 ballasting operations were carried out from pits at M.P. 22 and 48; 76 lift miles were completed. 1953 saw considerable expansion in the ballast operation. Pits at M.P. 48, 85 and 134 were operated continuously from May to October. A total of 264 lift-miles were distributed. Ballasting was commenced again in January from a pit at Mile 290 and an average of about 75 cars a day was distributed up to the end of March.

Suitable deposits of material in convenient locations for ballasting were found, occurring in eskers at various points along the route. Most of it was suitable as found for first and second lifts. Three crushers with a combined capacity of 600 cu. yd. per hour, or the theoretical equivalent of 150 cars per 10-hour shift, are being installed to provide uniform material for the final ballast lift. First and second ballast lifts will be completed this year. The rock ballast finish will be placed over a five-year period.

### Drainage Openings

Galvanized culvert pipe fabricated by a subcontractor was used in all drainage openings, except where bridges were required. This pipe was rolled by a portable mill, and supplied on location in the 24-, 36- and 48-in. diameter sizes. The pipe sheets and rivets were moved into the main construction camps by air, rolled and assembled into various lengths and moved out onto the grade as required. Where larger diameter pipe—60-, 84-, 96-, 108-, 140- and 144-inch—were necessary, multiplate type culverts were installed. Multiplate pipe was supplied in ready rolled sheets forming segments of the circumference of the pipe and was bolted together in the field.

Using this system of assembling culverts on the site, considerable shipping space on aircraft and boats was saved and handling of the materials in unassembled form was speedier and more efficient than trying to move ready rolled pipe.

A total length of 16.5 miles of pipe was installed in the grade during construction.

### Climate

One of the most difficult obstacles to overcome was the weather. Summer temperatures may reach +100°F., winter temperatures may go down to —55°F. The annual precipitation in the Sept Iles region averages about 44 inches. This varies as one moves northward. The annual precipitation on the Labrador Plateau averages 36 inches, slightly less than on the sea coast. The annual snowfall in the interior averages about 48 in., lying undisturbed in the forest.

The summer rainfall in Labrador is not unusual in quantity, but the number of days on which there is some rain is numerous. During the summer season of 1949 of 126 days there were 91 days on which rain fell.

Construction crews building grade with earth that was wet when excavated experienced considerable trouble in getting the grade stabilized. In most sections of the country the grade was the only road available for the movement of machines, materials and men; as a result a great deal of work was required to maintain the grade after it was built.

#### Communications

Communications played an important part in expediting the work of construction. This service was supplied by the subsidiary flying company at each airstrip, where a radio control tower was installed. In addition to the airports, each construction camp was equipped with a radio capable of reaching the main substation. As the rail head moved north, teletype service followed and was usually available at the airstrip closest to the north end of steel.

#### Yardage Reports

Engineering records of the work done were compiled daily, transmitted to Sept Iles and assembled in the chief engineer's office. These reports listed the equipment in operation; if not in operation, gave the reason; and, using a rated production for the machines, gave the yardage moved for the day. At the end of each week the resident engineers measured the actual yardage moved and submitted this figure in the form of a report. The rated capacity of the machines in use was checked by these measurements.

In addition to the daily and weekly reports, a report was returned at the end of each month, covering all work done on the grade, and including culvert materials, bridge materials, timber, etc., used in grade structures. The monthly report only was used in the distribution of construction costs.

#### Engineering

The engineering on grade construction was handled by a chief engineer, an assistant chief engineer, four district engineers and resident engineers as required, usually about twelve.

Each resident's crew was made up of a transitman, two levelmen, two rodmen, two chainmen and an axeman. Crews working ahead of the construction force were equipped with cook and camp facilities. Jeeps, canoes and boats were used for transportation. The district engineers often used float equipped aircraft to move from camp to camp. A resident's territory varied in length from five to twelve miles.

Resident engineers staked out the work to be done as construction advanced. First, the centre line was established for the clearing crews. When clearing was completed, slope stakes for grading were set. If drainage openings were required, culvert invert stakes, or bridge abutment stakes, were set. When construction was complete, the grade was restaked and final grade stakes were put in for the top finish.

As grading in each residency was completed the centre line was re-established for the track laying crew. An engineer and crew were supplied with the track laying gangs to establish centre line for them daily. This was necessary because a grader was used to refinish grade just ahead of track laying.

For future reference, hubs were driven into the grade well beneath the surface at beginnings and ends of curves and at points along the tangents.

Ballast lift stakes were supplied to the ballasting crews by the engineering forces. The stakes were planted at every station (100 feet) on tangent and at half-station intervals around the curves. These stakes showed present track level, first-lift level and second-lift level.

#### Conclusion

The Quebec North Shore and Labrador Railway has now been completed. In August, 1954, a new industry on the shores of the St. Lawrence will come to life when iron ore starts to move from New Quebec and Labrador down the railway to Sept Iles and out to blast furnaces in Canada, the United States and Europe. This railway will move the frontier of civilization across the north land of Quebec and Labrador as the Canadian Pacific Railway did across the west more than half a century ago.

#### Acknowledgements

The author wishes to express his sincere appreciation for the help and the constructive criticisms offered by Messrs. W. H. Durrell, C. E. McManus, J. W. Burford, J. A. Little and R. A. Sharwood, who made the writing of this paper possible and to Messrs. D. A. Livingston, M.E.I.C., and F. C. Wardwell, Drs. A. E. Moss, J. Gustafson and E. Henderson and Professor K. B. Woods, who supplied much of the information.

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# Discussion

W. M. Treadgold, M.E.I.C.[1]

Mr. Monaghan is to be congratulated on the presentation of the excellent paper on the railroad construction in Labrador and Quebec. This railroad has been constructed for a distance of 360 miles into an unknown country, for the purpose of developing the natural resources, on a scale and high standard that has not been surpassed by any other railroad at any time. The project has involved not only the construction of the railway but also building of hydro-electric plants, ore loading and storage facilities, mooring and loading dock, townsites and signal installations, all completed in record time. Hitherto in opening up undeveloped areas the practice was to construct a railroad as cheaply as possible when finances were limited in order to meet operation expenses and fixed charges. Then as traffic increased, improvements in line, grade and operations could be effected with the increased earnings. This first class railway has been constructed in record time and will operate to capacity for many long years and be financially secure—something that has not characterized many of the railways in this or other countries.

[1] Department of Civil Engineering, University of Toronto.

The line has been constructed with an operating season of 165 days, and with an ultimate capacity of 10,000,000 tons of ore, handled by 7 trains of 100 85-ton cars per day each way operated by diesel electric locomotives and centralized traffic control. Maximum grades are all compensated for curvature which does not exceed 8° with half the curvature being under 3°.

As to actual construction, one is struck by the amount of heavy equipment used and transported into a wilderness and the methods employed in dealing with drainage and with muskeg which was very severe. The opening up of drainage ditches and the use of drag lines to make up the grade, the use of galvanized culvert pipe rolled and fabricated on the ground, multiple and multiplate culverts, thus saving shipping space on aircraft and boats, are all very interesting phases of the work, apart from the heavy tunnel and bridge construction amid severe weather conditions.

As the writer suggests, a greater use of aerial photographs to be used for preliminary investigations would have helped greatly and facilitated subsequent work in the final location of the line, giving much infor-

*(Continued on page 830)*

# Industry, Engineers and The First Five Years of Professional Development

*by*

Dr. L. F. Grant, Hon.M.E.I.C.

I feel honoured by being invited to give the opening address to this conference.

As I am here in the capacity of chairman of the Engineers' Council for Professional Development, which I shall hereafter refer to as "ECPD", I shall confine myself to a discussion of *The First Five Years of Professional Development,* commonly known as the Monteith Report, and, as it is expected that out of this meeting will grow one of the courses which that report contemplates, I think it well to tell you something of its history.

The ECPD was formed with the idea of developing the engineer in successive phases, and not of developing the profession. The first of its objects was to give adequate counselling in schools to boys who were considering entering engineering colleges; the second was to examine and accredit the various curricula offered throughout the country to see whether they were thoroughly efficient. Now, having dealt with the boy before he goes to college, and having tried so far as is possible to make sure that the young man's college course is a satisfactory one, we come to the third of the ECPD objects, and this is the one with which we are concerned today, which is development after graduation. In this for a long time we made no progress. I myself was chairman of a committee working to this end in Canada and for several years did my utmost to try to find out what the profession can do for the young engineer, entirely without success.

What does he want? He wants a better job, and by that I do not, of course, mean simply more pay, but work that will constantly be a challenge to the best that is in him, that will call upon him to improve his professional knowledge, his outlook on affairs outside of the profession, and he wants to increase his usefulness to society in general and to his employer in particular. Obviously, for any organization to help him along such lines is a difficult task. When in the course of time I became the Canadian representative on the ECPD committee in charge of this project, I found that, whereas I had been trying for three or four years in Canada to effect some result and had got nowhere, the ECPD, had been trying for a much longer time and had got to exactly the same place.

Finally in 1949, the then chairman of the ECPD, Mr. James Parker of your own Detroit-Edison, said that he was tired of talking about this plan, that he would have a survey and a report made from which a program could be designed and implemented, and that if it were not possible to implement this program, the ECPD should throw in its hand and decide that the project was beyond its powers.

The engineer who was chosen to make the survey and report was Dr. A. C. Monteith of Westinghouse. Dr. Monteith assembled a very competent committee of men who, as the foreword states, "were active engineers, busy in their fields of endeavour, but anxious to help the rising generation attain full professional stature". Could one give any finer tribute to a group of engineers than those words? I am glad to have this opportunity of expressing my admiration for and gratitude to them for the work they did. The report was a voluminous one as you can see.

The headings under which the *First Five Years of Professional Development* are discussed, are:

1. Orientation and training;
2. Continued education of graduate engineers;
3. Integrating the young engineer into his community;
4. Registration of the young engineer;
5. Self-appraisal methods for evaluating characteristics in engineering;
6. Reading list.

Dr. Grant, the chairman of the Engineers' Council for Professional Development, was the keynote speaker at E.C.P.D.'s College-Industry Conference in Detroit, January, 1954.

He is the field secretary, and a past-president of the Engineering Institute.

In order to produce this report a systematic survey was made of the training given by 54 companies in the United States, which the committee classified as:

(a) Small: those which normally employ five new young engineers every year;
(b) Medium: those which normally employ from five to twenty-five;
(c) Large: those which normally employ more than twenty-five new graduates, running in some cases into the hundreds.

Beside these 54 companies the committee surveyed a number of others, though less completely.

In nearly every case the big companies have some sort of formalized course, given in the company's time and at the company's expense. Some of the medium class are doing the same, but very few of the smaller ones are. It must be remembered, however, that in the small concern the young engineer will often obtain personal advice and direction, which may well be as valuable as the more systematic courses which the larger companies are able to undertake. But obviously there are many young engineers who do not have the opportunity of receiving any such beneficial training.

From the beginning it was realized that the project must have the support and co-operation of industrial leaders as well as of educationalists. It is a pleasure to say that every assistance possible was given Dr. Monteith's committee by the industries interviewed, that this assistance has since been continued, especially in Cincinnati where the first course is now being held, and that the presence of so many industrialists here today gives further evidence that industry recognizes the need for further training of engineers if they are to make the most of themselves, not only for their own benefit, but for that of their employer.

The report recognizes that all too many young men, when they graduate, fall into what has been called "the post-college slump", as a result of being removed from the affectionate care and sympathetic encouragement which they receive, especially at examination time, from us professors, and being then pitchforked into employment, where the employer has the peculiar and heretical notion that the young man ought to be able to do something for himself. Some effort is needed at this stage to remind him that education is a continuing process — I apologize for using this shop-worn cliché, but we do not seem to be able to get away from it — and that he has at least part of the responsibility for making himself more useful to his employer if he is to advance in professional responsibility and achievement.

Training thus becomes a triple partnership among industry, education, and of course, the young man himself. The constant support and the constructive and helpful criticism which the ECPD receives from industry is most encouraging.

When the Monteith Report was presented to the annual meeting of the ECPD at Cleveland in October, 1950, it met with unanimous approval; the question then became, "How is it to be implemented?" The main difficulty was to obtain a competent director. After some delay the Council was very fortunate in obtaining the services of Professor Cornelius Wandmacher of the University of Cincinnati, who, after two years of hard preliminary work, inaugurated the first course in October, 1953. The details of that program will be explained later, so I am going to touch on only two or three points.

The studies which are proposed are *mainly* those of engineering, and they may, if pursued long enough, lead to a master's degree. Even if the student does not want to go so far as that, he will be able to refresh and extend his engineering knowledge and to do some work on a post graduate level. This part of the project is necessarily the responsibility of engineering teachers.

Now what can engineers in industry, and industrialists in general do to help in this program? Well, they are, so to speak, the ultimate consumers of the product of engineering colleges, a product which to the industrialist is only raw material, or at least only partially processed material. You industrial men can teach the young engineer what industry expects of him; you can show him how his university education must be implemented by application and by practical experience, and you can give him that knowledge of industrial problems and their solution, which the college cannot do. How welcome such instruction will be is illustrated by the remark of one young man who was a member of a group for whom I arranged a somewhat similar course. He said to me, "We have been listening to professors for four years, now we should like to hear from the man who is actually doing the work", for which admirable opinion I congratulated him warmly.

The study of labour relations, of company finance and management, of the many problems with which industry is faced, must also form part of such a course, and here industrialists are best fitted to give instruction.

Again, the young engineer does not always appreciate his duties to his profession and to the community, and this is recognized by the Monteith Report in Points 3 and 4, *Integrating the Young Engineer into his Community*, and *Registration for the Young Engineer.*

Finally, it was found that nearly every company gave in its training something outside of engineering, something which had as its object the development of the young engineer as a man, or to use an old-fashioned expression of which I am very fond, "a man of parts", by giving him some of those things which he did not get at college, or which, if he did, he was inclined to disregard as not being exactly engineering. Included may be such things as a better mastery of the spoken and written word; a knowledge of current affairs, both national and international; political economy; possibly, as we have tried in Canada, some introduction to the appreciation of philosophy, of art, of music, and of literature, or even of the social graces.

The young men who participate in a course such as is proposed, both on its technical and non-technical sides, will, I am sure, develop professionally as engineers, as citizens and as men of parts, so that they may in time attain to Bacon's splendid ideal as expressed in the preface to his "*Maxims of the Law*", in those rolling Elizabethan periods of which he was such a master:

> I hold every man a debtor to his profession; from the which as men of course do seek to receive countenance and profit, so ought they of duty to endeavour themselves by way of amends to be a help and ornament thereunto. √

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## LABRADOR RAILWAY — Discussion

(*Continued from page 828*)

mation about the area to be traversed.

Railroad construction is very necessary in opening up undeveloped sections of this country and making the natural resources available, and will not likely be replaced by other forms of transportation. This is shown by such presently contemplated construction as the I.C.O. Railway—360 miles, Chibougamau —300 miles, Lynn Lake—160 miles Kitimat Development—100 miles.

These roads are all being constructed on the basis of high grade construction and operation. Canadian railways are now offering courses covering construction and maintenance as they are extremely anxious to get technical men. Evidently these men are not available and it seems too bad that courses in railroad engineering are being neglected by the various universities and that the possibilities of the many phases of railroad construction and operation are not emphasized in the courses open to the student.

The paper by Mr. Monaghan will be read with much interest and study by members of the Institute and should be an eye opener to all engineers as to methods and extent of work in opening up new country for development. √

# "Progress of Engineering Science" Part 4

From the London Quarterly Review, October, 1863

ART I.—1. *Lives of British Engineers*. By Samuel Smiles, 3 vols. 8 vo. London, 1862.
2. *Proceedings of the Institute of Civil Engineers*, 1842 to 1863.
3. *Sir W. Armstrong's Address delivered at the Meeting of the British Association at Newcastle*, 1863.

October, 1863 — Queen Victoria has recently celebrated the twenty-fifth anniversary of her accession, the American civil war is at its height, Confederation is nearly four years from birth, and the "London Quarterly Review" publishes an article on the "Progress of Engineering Science" by an unknown author.

At first, we thought of trying to digest this article, with frequent quotations, but have come to the conclusion that the flavour of the original would be wholly lost by any interference with its continuity and so have decided to publish it in full in four instalments. We hope our readers may enjoy as much as we have the relaxing rhythm of the writer's Victorian prose, the profundities of his rhetoric, his prophesies — right and wrong — his comments on current engineering projects and his breathless admiration for the engineers of his day.

To turn the author's pounds sterling into 1953 Canadian dollars, multiply by fourteen.

Part 1 of this item appeared in the November 1953 issue; Part II, December 1953; Part III, March 1954; Part IV is the conclusion.

In the early ages of engineering experience, tunnels seemed far more formidable undertakings than bridges. Men could face what they saw, and undertake what they could calculate; but it was another thing to burrow into the bowels of the earth to encounter rocks or quicksands, or it might be springs and moving clays, and all this in darkness, and in ignorance of what might come next. All these things are now become perfectly understood, and the mode of making them settled. There have, in fact, been more than eighty miles of tunnels excavated for railways in this kingdom alone under every variety of circumstances and difficulty, and at an average cost of only 15*l.* per foot forward. The experience so gained has been such that were it now proposed to execute a new tunnel under the Thames, there are twenty contractors who would be ready to undertake it, and could carry it through. The first, indeed, would hardly have been found so difficult of execution, had it not been carried too near the bottom of the river, where the soil was only recent sediment and rubbish.

We have become so familiar with these wonders that it is curious to look back on the interest and excitement caused by an attempt to carry a roadway under the Thames, and still more to turn to what occurred less than one hundred years ago (in 1766), and mark the incredulity and the ridicule which were displayed when Brindley proposed to cut the Harecastle Tunnel in Staffordshire. Yet this was only nine feet wide by twelve feet high, and 2,880 yards long; and as the highest summit of the hill through which it was cut is only 190 feet above the tunnel, it could be and was worked by means of fifteen shafts from above. Even this tunnel took eleven years to execute, and at times its daring projector almost despaired of success, nor did he live to see it completed. Compare this with the great tunnel under Mount Cenis, nearly five times its length,* and at a depth of an English mile (1,600 metres) below the summit, so that shafts being impossible it has to be worked wholly from the ends, and so far as can be ascertained, through hard rock the whole way; yet there is no reason to suppose that it will take longer than Brindley's tunnel to execute. But the remarkable fact is that no one seems to doubt the success of the undertaking, and any one attempting to ridicule its projectors would only render himself ridiculous. Yet though none doubt the practicability many doubt the expediency of the undertaking; the truth being that since it was commenced railway engineering has made such progress it is by no means clear that it would not have been better to keep on the surface of the earth and climb the pass, steep though it might be, than to excavate a tunnel so unavoidably expensive as this one must prove.

It may appear a strange assertion, but it is nevertheless true, that timidity is the cause which has hitherto most retarded the progress of railways. Men hesitated long in employing them, because they were afraid that the smooth wheels would not have sufficient hold on the smooth rails to enable them to draw. They were afraid to join their rails for fear the expansion would cause them to rise and twist; but the most curious thing is that long after the introduction of the present system they were afraid the locomotive could not climb gradients so steep as 1 in 100. The consequence was that ropes with stationary engines were employed—engineers wasted their time and their shareholders' money in inventing atmospheric traction and fifty other devices to get over this difficulty. At last they tried—and now any one may see the locomotive coming from Oldham to Manchester, dragging very heavy trains up an incline of 1 in 27, which is about the slope of Ludgate Hill; and in America, in some of the mountain passes of Virginia, they rise 1 in 17 and 1 in 20, the latter being the slope of

* The tunnel is to be as nearly as may be 40,000 feet long, and is estimated to cost 50*l.* per foot forwards, or two millions sterling.

Holborn Hill, which tasks our local traffic so severely; more even than this, it is asserted that the locomotive has actually scaled an incline of 1 in 10 with a load greater than its own weight.* This is probably a steeper slope than any turnpike road we have. Whether it is an expedient or economical mode of employing engines to use them in dragging loads up such steep slopes is another question, not so easily answered;† but it proves that the capabilities of the railway system for extension are unlimited. For though on all main lines where the traffic is great and the trains heavy and frequent, no expense should be spared to obtain easy gradients, still on branch and local lines, where loads are light and trains few, any gradient that will do for carriage traffic will do for the rail. It is also found that where the country undulates and the inclines are not long, there is really no great expenditure of power in working them, the ease with which the downward slope is descended going far to compensate for the exertion required in ascending. It is when the slope is long and continuous that the powers of the engine are most severely tasked; yet even in that case, great things may be accomplished.

One of the first great lines on which this discovery was utilized was the line over the Semmering pass in the Noric Alps on the line joining Vienna and Trieste. The ascent on the north side is 13¼ miles long, in the course of which 1,325 feet are ascended on an average of 1 in 47, and in one place the gradient is 1 in 40, and in addition to this the curves are so sharp and the construction of so expensive a nature that to work it and keep it in repair absorbs the whole profits of the line. The descent on the other side to Murzuschlag is on the back of the slope, nearly straight, and with a uniform gradient of 1 in 50 is worked with facility and without great additional expense.

The Bhore Ghât incline, which has just been completed on the line from Bombay to Central India, is a more formidable and more extraordinary piece of engineering than even this. It is 15¾ miles in length, and the height surmounted is 1,831 feet, so that the average is 1 in 48, or about the same as the Semmering; but for one mile and a half it is 1 in 37, and for 8 miles 1 in 40. The amount of tunnelling, bridging, and embanking on the Indian line is such that the cost was 1,100,000*l.*, or upwards of 68,000*l.* per mile, which is as near as may be the cost of the other. This railway has one advantage over its Alpine competitor—that all the heavy traffic is down the incline, and the trains may go up the Ghât either empty or only partially laden, whereas on the Austrian line the heavy traffic is towards the port and up the incline.

As before mentioned, the Americans work some inclines with a steeper gradient than even these, but never so long or of so permanent a character. But it is now proposed to cross the Simplon by a railway, and before long Innspruck will be connected with Verona—so that it can hardly be said that any mountain chain which has been traversed by roads is inaccessible to the steam horse. Even the Himalayas might be so traversed; and if a hundred years hence some unborn Brunel be called upon to make designs for the Lahore and Ladak Junction Railway, and find himself forced to tunnel through the ridge—it will not be that the engine could not climb a pass even 18,000 feet above the level of the sea, but that the perennial snows of those regions would form so unsuitable and so unsatisfactory a foundation for his permanent way.

No very recent statistics have been published which would enable us to state precisely what number of miles of railway are made or making, or what they have cost, but it is certainly no exaggeration to say that a sum larger than our National Debt has been spent on these undertakings in the Old World during the last thirty years; and there is no reason to suppose that that sum will not be doubled during the next thirty, if peace continues and commercial prosperity advances with the same rapid strides that it has been taking latterly. Already almost every capital in Europe is united directly or indirectly with every other, except Constantinople; and even the stolid indifference of the Turk cannot long save "old Stamboul's walls" from being profaned by the scream of the railway whistle.

When Russia has completed the junction of the Baltic with the Black Sea and the Caspian, which she is now engaged upon, there will remain two great enterprises which the next few years will probably see undertaken, if not accomplished. As soon as the Americans are tired of fighting, they will set about connecting the Pacific with the Mississippi; and, notwithstanding the immense tracts of prairie that separate the two, they will no doubt accomplish it. The task of the Old World is to join the Indian lines with those of Europe. Political difficulties and the ignorant bigotry of the three great Mahomedan states of Afghanistan, Persia, and Turkey may retard this; but whether it is done through Turkey or Russia, there are no engineering difficulties that could not be easily overcome, nor would the capital be long wanting if the way were only open. Even if this were done, it is probable that the heavy goods traffic would still follow the route by the Cape; but it would be a revolution the importance of which we can hardly guess at, if the stream of commercial intercourse were again turned into the channels in which it flowed from the time of Alexander the Great to the downfall of the Roman empire.

As might be expected, the conception of these great works soon led to a corresponding increase of dimensions in the stations and all the minor adjuncts of railway traffic. Twenty years ago we looked with wonder at the great halls of Padua and Westminster, though the former is only eighty-four feet span, and the latter sixty-eight, and were astonished at the boldness of their construction. But now we regard with indifference two such halls as those which compose the station of the Great Northern Railway at King's Cross, 105 feet wide, 800 long, and 91 high; and even such a roof as that of the Lime-street station at Liverpool, 152 feet wide, does not excite astonishment. Even now it is only the engineer who knows how difficult the task is—or rather was—that sees anything to be surprised at in the great roof of the station at Birmingham, 864 feet long, and at one end 212 feet wide, without any internal supports. Yet this roof, which is perfectly stable, was erected at a cost of 1*l.* 8*s.* 6*d.* per square yard, and promises to answer for many a long day all the purposes for which it was intended. As a general rule these works have been carried out in too great haste to allow of careful artistic elaboration, and with too much of a feeling that even the largest were only suited to present wants, and would require extension hereafter. They are thus

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* 'Minutes of Proceedings of Institute of Civil Engineers,' vol. xviii. p. 51.

† At 36 miles per hour the resistance in rising 1 foot in 100 is doubled thus: —
Resistance in dead level 224 lbs. to ton of load
" 1 in 100 448 lbs.
or, in other words, an engine that can drag 200 tons at a certain speed on a level, can only draw 100 tons at 1 in 100, and so on in proportion.

open to adverse criticism: but it is an immense gain to have conquered space; to know that there is no practical limit to the extent of our roofs, and consequently that a largeness of parts may be introduced into our buildings, which cannot fail to have a beneficial effect on the art of design.

While this splendid career has been opening for railways, their elder sisters, the canals, have been falling into neglect and decay. Yet it is only a century ago that the success which attended Brindley's first effort in this direction excited as much enthusiasm, and gave rise to as much controversy, as the railway projects of George Stephenson did in our day. They were nearly as successful then, and answered perfectly the purposes for which they were designed. But it is curious to mark how little the means of communication which then existed between the countries even of Europe sufficed to bring the nations together. The Canal of Languedoc, 148 miles in length, uniting the Mediterranean and the Atlantic, had been commenced in 1661, and completed in twenty years, nearly a century before Brindley put forward his modest schemes. Yet both in the Parliament and out of doors these were treated as visionary and impossible; and no one seems to have known how much greater works had been executed in France before his day. Now, on the other hand, if a form of bridge or of chair is invented in America, or introduced in India or Australia, it is discussed in Great George-street within a month of its application, and is either rejected or added to the stock of engineering knowledge.

Had railways been invented a century earlier, it is probable that nine-tenths of our canals would never have been excavated; though they do possess qualities that railways cannot compete with, and in flat countries, where water is abundant, they will probably always hold their own. They get rid of friction to even a greater extent than the rail; and the lifting is done by water-power—very simply and economically applied in locks—never by the tractive power, the canal being always a dead level. But, on the other hand, a boat passing through a canal has to displace a quantity of water equal to her own immersed section every time she moves her own length; and, unless this is done very slowly and gradually, the expenditure of power becomes enormous. The locks too are an inevitable cause of delay, and in an active age, where time is so valuable, this inherent vice of slowness is fatal to the system, in all but exceptional cases.

Notwithstanding this the French are now busily engaged in one of the greatest canal undertakings ever attempted. They are occupied in piercing the Isthmus of Suez, by a ship-canal, 190 feet at the surface in the narrowest part, and 28 feet in depth. Properly speaking, however, it can hardly be called a canal —it is, as the French call it, "Un Bosphore"; an extension, in fact, of the Red Sea to the Mediterranean without any locks. Now that Mr. Hawkshaw has ascertained that the shores of the Mediterranean are firm enough to support the piers of Port Said, it is shown that there is no engineering difficulty to prevent its execution; and there seems no reason for doubting the dictum of so competent an authority that it can be executed in five years from this time, at an expense of ten millions sterling. Whether it will pay or not is another question. Few, except perhaps the projectors, fancy it will: but it is the realization of an idea of the Great Napoleon, it is believed to be a wound in the cuirass of England, and it gives the French a footing in Egypt; which, in their eyes, may be more valuable objects than dividends to shareholders. Perhaps they are right, but it is not the mode to encourage the investment of capital in similar undertakings. This, and the manifest absurdity of digging canals to accommodate steam-boat traffic, have probably shelved for ever the cutting of the Isthmus of Panama, which used long to be looked upon as a sister project. The progress of the railway system is making it every day more apparent that one or two good railways will amply suffice for the class of traffic that will come across the American, as well as the African Isthmus, and at one-tenth part of the expense; while the improvements in sailing and steam-vessels are daily rendering the voyage round the Southern capes less and less objectionable. One railroad has already been constructed to connect the Atlantic with the Pacific, and there will no doubt be others before long. These will answer the purposes of all the traffic we can now foresee at a far less expense, and with far more certainty and rapidity than a ship-canal, even supposing that a ship-canal could be executed at the same expense as the Suez Folly. The science and skill of modern engineers could, no doubt, conquer the difficulties of this route as easily as that of Suez if it were worth while, but it is probable that the one would be of as little advantage to commerce as the other, and it therefore will hardly be attempted.

Generally speaking the aqueduct bridges that carry canals are not graceful structures, the depth of the trough of the canal rendering the superstructures too heavy for the arches. Almost the only exception is the Pont-Cysylltau, on the Chester and Ellesmere canal, where the water is carried in an iron trough on upright piers; and this form might be made even more pleasing if it were ever to be employed again, though the opportunity will hardly be now afforded for trying it

A more pleasing form of aqueduct was that which the old Romans used for conveying drinking or irrigation water. The invention of cast-iron pipes has nearly abolished this form in modern times, though one very large but very ungraceful specimen of the class has been built across the Manhattan river, to bring water into New York; and the French have erected the finest modern specimen of the class at Roquefavour, to bring the waters of the Durance to Marseilles and its neighbourhood. The modern bridge is avowedly a copy, but with greatly increased dimensions, of the old Roman Pont du Gard, built for the same purpose in its immediate neighbourhood. The modern bridge is 1289 feet long, the ancient only 882, and 265 feet high, as against 137. Both are in three tiers of arches, one above the other, but there is a largeness of parts in the old example that goes far to restore the equilibrium. The central arch in the Roman bridge is 80 feet, that in the French only 49; and the whole design shows that though the Romans might be our inferiors in constructive skill, they were our masters in all that related to architectural conception. The Roquefavour aqueduct is only a pretty screen stretching across an opening in the hills. The Pont du Gard is a grand mass, worthily uniting the two sides of a rocky valley. But so it is with almost all our works. The constructive and the artistic branches of the profession are divorced from one another, and practised by different sets of men calling themselves by different names, and fancying they belong to different professions and have different objects in view. Till they unite, and work harmoniously together, we cannot hope to see beauty united with the grandeur we have just been describing.

Wonderful as many of the things are which have been alluded to above, perhaps the most wonderful thing of all is the electric telegraph. And it seems destined to have about as much influence in bringing the ends of the world together as even steam-navigation or the rail. It is however, the youngest of engineering inventions, and consequently the least perfect.

Hardly more than twenty years have elapsed since the first little experimental line from London to Slough forced itself into notice by assisting in the capture of the murderer Tawell, and since then what progress has been made ? Not only is it easy to converse with every important place in England, but messages can be sent to every capital in Europe, and answers received in an incredibly short space of time. Once it was possible to communicate with America, and it probably will be so again before the year 1864 changes its index. Already the Atlantic Telegraph Company have received tenders from eight different firms, any one of whom is competent to the task, and some of these tenders are so favourable that one of them will, no doubt, be accepted; if so, London and New York may be within speaking distance again before twelve months are over, and this time with every chance of their connexion being permanent, so great has been the improvement in the manufacture of submarine cables, and so extensive the experience of the mode of laying them. While this is being debated, a cable has left England which is destined to unite Calcutta with London, and which in all probability will accomplish this object ere long. But communication with any point in the North American coast must embrace also New Orleans, and the whole of that continent; our communication with Calcutta extends by an easy link to Singapore, and from Singapore to Canton and Batavia; and from the latter place there is no difficulty in reaching the Australian continent. It may thus be that before many years are over we may see recorded in the morning's 'Times' events that happened at Sidney, or Shanghae, or San Francisco on the previous day. Surely this is a wonder and a triumph of scientific skill if anything ever was; and surely the men who do these things are giants!

Mr. Smiles has profoundly studied, and has happily delineated in his lucid and instructive biographies, that remarkable succession of gifted minds which has, not by lucky guesses, but by incessant labour and by lifelong thought, gradually erected that noble example of the dominion of man over the earth—the science of Engineering: and we are proud to know that there are men yet among us who can wield the arms of "the invincible knights of old," and who will leave no meaner memory behind them.

Beside the admiration which the works of our great engineers excite from the grandeur of their conception or the mechanical skill displayed in their execution, they have still another merit as worthy of the attention of the philosophical inquirer as either of these. They are the best and most complete examples that exist in modern times of an art carried out on scientific principles, and according to those processes by which alone success has hitherto been, or, so far as we can see, ever will be achieved in any art. From the days of old Sir Hugh Myddelton to the present time the only question with an engineer, after mastering the conditions of the problem put before him, was how he could most efficiently carry out the work with the most suitable materials, and within the limits of the means at his command. In doing this the engineers have eagerly appropriated every scientific discovery, and availed themselves of every new invention. They have always used the materials best adapted for their purposes, and in the mode in which most work could be got out of them. They have never looked backwards to the exploded forms of ancient days, but always acknowledged the age in which they lived, trying to outstep even its rate of progress.

In this respect the engineers contrast singularly with the architects, who form the other branch of one and the same profession. The latter, instead of following out principles, are content to copy forms, rarely thinking of what is really best under the circumstances. It is sufficient for them to know that a thing was done by some other people in some bygone day, and without thinking how social circumstances may have changed or the arts progressed since that time; if it has been done before, it ought, according to their creed, to be done again. They aim at restoring an artistic heptarchy in the midst of the progress of the nineteenth century.

The principles which the engineers are following out are indentical with those which taught the Egyptians how to erect the wondrous temples which still adorn the banks of the Nile, by the use of which the Greeks perfected their architecture, and which enabled the masons in the Middle Ages to erect those cathedrals and castles which we still admire so much. In all other ages but this the principles of architecture were as well understood and as fixed as those of engineering. They were, in fact, identical; and it was just as easy to ascertain then what was the best design for a cathedral or a mansion, as it is now to know what is the best form of a ship or the best mode of building a bridge.

The consequence of this divergence of principle is that the architects are quarrelling over Greek mouldings and Gothic pinnacles, and dreaming of reproducing the elegance of classical times, or the blundering enthusiasm of the Middle Ages, while the engineers are spanning our rivers with structures such as the world never saw before—bridging our valleys with viaducts, arching under our mountains, and roofing acres for stations. They are, in fact, executing a series of works that throw everything hitherto done into the shade: but all this, unfortunately, without that touch of higher art which is alone wanted for perfection; and this simply because the building profession is divided against itself. Because its two branches are conducted on different principles they cannot work together. The engineers cannot forego theirs because they are the only principles which men of common sense can follow; so, unless the architects will consent to forego some of their archæological fancies, and work harmoniously with the engineers, we may be condemned to live in the midst of ugliness for ever. It is only this reunion that is wanted to perfect the works described above, and it ought to be easy of accomplishment. The architects themselves would delight in the change. It is the public who are their employers who do not see the necessity for it, and cannot understand its bearing. When once the fact is appreciated we shall surpass all preceding ages in architecture, as we have done in engineering; and if the engineers can only force this fact on public attention they will have done a greater service than in bridging the Menai Straits, or in tunnelling through the Alps. To call architecture back within the domain of logic and of common sense is what is most wanted on the part of the engineers to complete the services which they have rendered and are rendering to mankind. √

Branch Officers Conference.

# 68th

# Annual General Meeting

### Convened at the Chateau Frontenac, Quebec, P.Q., May 12, 1954

## THE BUSINESS MEETING

The Sixty-Eighth Annual General Meeting of The Engineering Institute of Canada was convened in the Ball Room of the Chateau Frontenac, Quebec, on Wednesday, May 12, 1954, at ten thirty a.m., with president R. L. Dobbin in the chair.

The minutes of the Sixty-Seventh Annual General Meeting, as published on pages 866 to 870 in the July 1953 *Journal*, were taken as read and approved.

#### Nominating Committee 1954

The general secretary announced the membership of the Nominating Committee of the Institute for the year 1954 as follows:

*Chairman:* C. M. Anson, Sydney, N.S.

| *Branch* | *Representative* |
|---|---|
| Amherst | C. L. Archibald |
| Belleville | F. D. Adsett |
| Border Cities | C. G. R. Armstrong |
| Brockville | ............ |
| Calgary | C. E. McNevin |
| Cape Breton | C. N. Murray |
| Central British Columbia | R. L. Bigg |
| Corner Brook | J. L. Barron |
| Cornwall | H. E. Meadd |
| Eastern Townships Branch | Geo M. Dick |
| Edmonton | B. Willson |
| Fredericton | Horace G. Hughson |
| Halifax | M. L. Baker |
| Hamilton | W. E. Brown |
| Huronia | B. C. Lamble |
| Kingston | J. W. Brooks |
| Kitchener | M. A. Montgomery |
| Kootenay | E. L. Baird |
| Lakehead | A. J. Mickelson |
| Lethbridge | N. H. Bradley |
| London | D. D. C. McGeachy |
| Lower St. Lawrence | Roger Thomas |
| Moncton | M. T. K. Leighton |
| Montreal | E. B. Jubien |
| Newfoundland | D. L. Cooper |
| North Nova Scotia | Clyde F. Cameron |
| Niagara Peninsula | C. G. Cline |
| Nipissing and Upper Ottawa | T. C. MacNabb |
| North Eastern Ontario | G. M. Lyon |
| Northern New Brunswick | F. H. B. Chisholm |
| Ottawa | W. R. Meredith |
| Peterborough | B. Ottewell |
| Port Hope | E. M. Wynn |
| Prince Edward Island | H. R. Miller |
| Quebec | C. H. Boisvert |
| Saguenay | P. Schopflocher |
| Saint John | H. S. McCleave |
| St. Maurice Valley | M. Eaton |
| Sarnia | J. E. Harris |
| Saskatchewan | Edward J. Durnin |
| Sault Ste Marie | R. A. Campbell |
| Sudbury | R. H. Moore |
| Toronto | J. F. MacLaren |
| Vancouver | Hugh T. Libby |
| Vancouver Island | H. D. Dawson |
| Winnipeg | T. E. Storey |
| Yukon | H. W. Love |

#### Honorary Memberships

The general secretary reported that the following had been elected to honorary membership in the Institute and that certificates would be presented at the annual banquet or on some appropriate later occasion:

LeRoy Fraser Grant, B.Sc., D.Sc., formerly associate professor of engineering, Queen's University, and at present field secretary for the Institute.

Lewis Ketcham Sillcox, D.Sc., D.Eng., LL.D., Vice-chairman, Board of Directors, New York Air Brake Company, and at present, President, American Society of Mechanical Engineers, New York.

Omond McKillop Solandt, O.B.E. M.A., D.Sc., LL.D., Chairman, Defence Research Board, Ottawa.

#### Awards of Medals and Prizes

The general secretary announced the various awards of the Institute as follows stating that the formal presentation of these would be made

**Presentations of honors and medals: Upper Left: D. S. Ellis receives a Julian C. Smith Medal; right: The president presents the Gzowski Medal to E. M. Rensaa. Lower left: The Leonard Medal is awarded to C. M. Anson; right: L. K. Sillcox receives his certificate of honorary membership.**

at the annual banquet of the Institute on May 14:

*Julian C. Smith Medals*—"For achievement in the development of Canada" to—Richard Ellard Carden Chadwick, Chairman of the Board, Foundation Company of Canada, Montreal, Que. and to Douglas Stewart Ellis, Dean of the Faculty of Applied Science and Professor of Civil Engineering, Queen's University, Kingston, Ont.

*Gzowski Medal*—"For papers on a civil engineering subject" to—E. M. Rensaa, Edmonton, Alta., for his paper "The Cracking Problem in Reinforced Concrete Buildings".

*Duggan Medal and Prize*—"For papers dealing with the use of metals for structural or mechanical purposes". to—L. Schenker, Ann Arbor, Michigan for his paper "Analysis of Building Frames by Limit Design".

*Leonard Medal*—"For papers on mining subjects" to—C. M. Anson, Sydney, N.S. and C. B. Archibald, Sydney, N.S. for their paper "Treasure under the Atlantic".

*Plummer Medal*—"For papers on chemical and metallurgical subjects" to—J. S. Moloney, Sarnia, Ont. for his paper "Fluid-Borne Solid Particles with Particular Reference to Solid Fuel for Internal Combustions Engines".

*Ross Medal*—"For papers on electrical engineering subjects" to—M. Eaton, Shawinigan Falls for his paper "Improvements in Electrode Boilers".

*Prizes to Juniors*—"For papers presented by Juniors of the Institute in the vice-presidential zones".

*John Galbraith Prize* (Province of Ontario) to—F. S. Gue, Hamilton, Ont. for his paper "Moral Responsibilities of the Engineer."

### Report of Council, Report of Finance Committee, Financial Statement and Treasurer's Report

On the motion of P. C. Ahern, seconded by M. McMurray, it was resolved that the report of Council, the report of the Finance Committee, the financial statement and the treasurer's report be accepted and approved.

### Reports of Committees

On the motion of R. F. Shaw, seconded by J. A. McCrory, it was resolved that the reports of the following committees be taken as read and accepted: Employment Conditions, Legislation, Publications, Papers, Library and House, Board of Examiners, Membership, Admissions, Library Report, Employment Service, Prairie Water Problems, Professional Interests, The Young Engineer, Report of Field Secretary, Life Members Committee, Canadian Chamber of Commerce, Canadian Standards Association.

### Branch Reports

On the motion of W. O. Horwood, seconded by M. L. Baker, it was resolved that the reports of the various branches be taken as read and approved.

### Amendments to the By-laws

On the motion E. D. Gray-Donald, seconded by R. E. Hayes, it was resolved that in accordance with By-law No. 81, the proposed revisions to the by-laws for purposes of clarification and simplification, which have already been approved by a majority of the Council, by a majority of the branch executives and published in the December 1953 *Journal*, be approved by this annual general meeting.

### Committee on Confederation

The president stated that at the meeting of the Council and the branch officers conference there had been a long discussion on the work of the recently appointed Committee on Confederation. He stated that the discussion was related principally to the personnel of the committee and the matter of timing. Mr. Dobbin announced that a meeting of the committee would take place on Friday, May 14, in Salon 1, at twelve thirty p.m. Mr. Heartz, the chairman, would be present to handle the meeting.

The president stated further that copies of the report which set out the terms of reference and the personnel of the committee were available throughout the hall and requested that members should avail themselves of a copy.

Later, at the request of Mr. Coke, the president asked the general secretary to read to the meeting the entire report of the nominating committee. This was done.

At the conclusion of the reading of the report, Mr. Paterson referred to a resolution which had been passed by the Council meeting and which appears in the minutes of that meeting. This was noted. (See pages 703 and 704 of the June 1954 *Journal* for report on Committee on Confederation).

**Retiring President Dobbin welcomes the incoming president D. M. Stephens.**

### Election of Officers

The general secretary presented the list of the newly elected officers of the Institute as follows:

*President*

D. M. Stephens, Winnipeg, Man.

*Vice-Presidents*

| | |
|---|---|
| Province of Ontario | B. G. Ballard, Ottawa, Ont. |
| Province of Quebec | J. O. Martineau, Quebec, Que. |
| Maritime Provinces | N. B. Eagles, Moncton, N.B. |

*Councillors*

| | |
|---|---|
| Vancouver Branch | S. H. deJong |
| Calgary Branch | H. R. Hayes |
| Edmonton Branch | N. J. Allison |
| Lethbridge Branch | J. M. Campbell |
| Saskatchewan Branch | Junius Jonsson |
| Winnipeg Branch | C. P. Haltalin |
| Sault Ste. Marie Branch | D. C. Holgate |
| Northeastern Ontario Branch | C. W. Boast |
| Huronia Branch | F. A. Alport |
| Sarnia Branch | E. W. Dill |
| Hamilton Branch | N. A. Eager |
| Kitchener Branch | W. R. Roberts |

**Left: L. F. Grant receives his certificate of honorary membership. Right: R. E. C. Chadwick receives his Julian C. Smith Medal.**

The Panels. Left "Air Pollution Control": Left to right: Dr. Morris Katz, Dr. E. A. Watkinson, Prof. E. A. Allcut, R. L. Broad, J. G. Hall. Right: The Management Panel. Left to right: J. B. White, Dr. Lillian M. Gilbreth, C. A. Peachey, A. M. MacKenzie, E. A. Perry.

| | |
|---|---|
| Niagara Peninsula Branch | P. E. Buss |
| Toronto Branch | J. G. Hall |
| Peterborough Branch | A. R. T. Hailey |
| Ottawa Branch | J. J. Green |
| Cornwall Branch | D. Ross-Ross |
| Montreal Branch | G. N. Martin |
| | R. B. Wotherspoon |
| Quebec Branch | George Demers |
| Northern New Brunswick Branch | E. C. Bannerman |
| Moncton Branch | W. D. G. Stratton |
| Halifax Branch | J. W. MacDonald |
| North Nova Scotia Branch | J. L. Cavanagh |
| Cape Breton Branch | H. A. Marshall |

### Vote of Thanks to Quebec Branch

On the motion of G. M. Dick, seconded by E. R. Smallhorn, it was unanimously resolved that a hearty vote of thanks be extended to the members and officers of the Quebec Branch in recognition of their hospitality and activity in connection with the sixty-eighth annual general meeting.

### Vote of Thanks to Retiring Officers

On the motion of G. Dionne, seconded by E. F. Carson, it was unanimously resolved that a hearty vote of thanks be extended to the retiring president and members of Council in appreciation of the work they have done for the Institute during the past year.

The meeting adjourned at 11.30 a.m.

# The Professional Meeting

On May 12, 13, and 14 engineers from across Canada met in Quebec City for the 68th Annual Meeting of The Engineering Institute. A full technical and business program coupled with the hospitality of French-Canada made this meeting a remarkable success. The meeting now takes its place among the "bigger and better" in Institute history; indicative of our growing country.

Registration began slowly on Tuesday but by Friday afternoon it had reached an all-time high with a total of 1,000 registrations. This included 700 members. Junior representation at the meeting was practi-

The A.S.M.E.—E.I.C. International Council: Standing: T. Chandler, vice-president A.S.M.E., D. D. Panabaker, chairman of the Ontario section A.S.M.E.; L. Austin Wright, general secretary E.I.C., J. G. Hall, councillor, Toronto Branch E.I.C., C. E. Davies, secretary A.S.M.E. Seated: L. K. Sillcox, president A.S.M.E., D. M. Stephens, president E.I.C., G. N. Martin, secretary A.S.M.E.—E.I.C. International Council.

At the President's Dinner. J. B. Stirling, F. P. Shearwood, A. J. Grant, R. L. Dobbin, A. R. Decary, J. A. Vance, L. F. Grant, President-elect D. M. Stephens.

cally double that for the previous year while student attendance was four times that in 1953.

The Annual General Meeting on Wednesday morning officially opened the program. "Muriel's Room" opened the reception before the dinner on Wednesday evening. The dinner was an event which literally filled the Ball Room to overflowing. Gilles E. Sarault, chairman of the Quebec Branch acted as chairman at this function and his skilful use of both languages was admired by all. The speaker of the evening was Ross L. Dobbin, retiring president of the Institute.

**Past-president A. J. Grant, Hon.M.E.I.C., receives a birthday cake from President Dobbin at the dinner on Wednesday.**

**J. M. Hector Cimon, M.E.I.C., signing the golden book of Laval University after receiving an honorary degree of Doctor of Science from the University. Witnessing the signing are Archbishop Maurice Roy, Chancellor of the University and Abbé Jacques Garneau, assistant secretary of the University.**

A very special event was observed at this dinner. Past President (1930: 31) Alex J. Grant, Hon. M.E.I.C., was presented with a birthday cake in recognition of his 91st birthday. Mr. Grant could well be called "Mr. Engineering Institute" since he has been an active member for 63 years.

A boat trip and plant visit to Davie Shipbuilding Limited on Thursday afternoon gave everybody a pleasant break from the business and technical part of the meeting. "Muriel" and music-makers accompanied the merry-makers and an old-fashioned square dance stole the show. As the boat passed under the famed Quebec Bridge a truck and train were passing over the bridge, and in a clear sky an aeroplane made its way westward. By coincidence or design, a fitting tribute.

On Thursday evening Laval University held a special convocation to confer an honorary degree of Doctor of Science on J. M. Hector Cimon, M.E.I.C. Again the dual culture of our country was evident and added to the solemnity of the occasion.

Following the convocation weird sounds emitted from the Ball Room. Dr. H. LeCaine of the National Research Council gave a demonstration lecture on electronic music. The audience, though interested, were thankful that this was only a demonstration because in the words of Dr. LeCaine music can reach an "all time low" with the electronic "thing". Talking robots and the never never land of the comic strip may not be too far in the future.

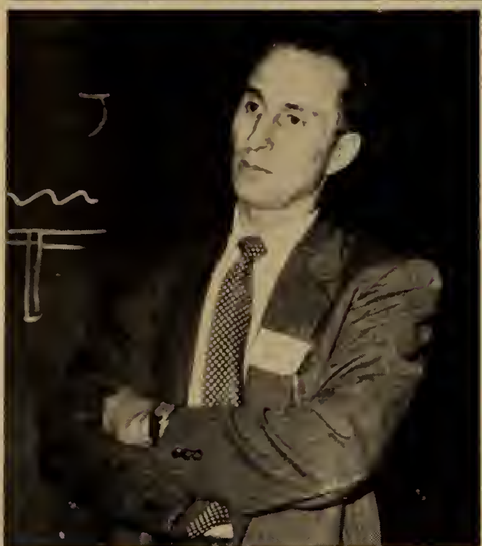
The banquet on Friday evening was the highlight of that day and of the meeting. A novel and pleasant addition to the hospitality shown by the local committee was the presentation of corsages to all "out-of-town" ladies. Sincere thanks to the local committee for its good work. The committee was made up of:

| | |
|---|---|
| Gilles E. Sarault | Chairman |
| Guillame Piette | Vice-Chairman |
| Roger Desjardins | Secretary |
| P. A. Duchastel | Entertainment |
| P. E. A. Vincent | Finance |
| J. H. R. Rioux | Information |
| L. P. Bonneau | Meeting Arrangements |
| Louis Trudel | |
| B. O. Baker | "Muriel's Room" |
| J. P. Drolet | Publicity |
| J. St. Jacques | Reception |
| L. P. Bonneau | Technical Papers |
| G. Galibois | Transportation |
| A. C. deLery | Visits |
| Mme. G. E. Sarault | Ladies (Engineers' Wives Association) |







BASE
COLLECTOR





**Speakers at the technical sessions: Left to right: P. A. Redhead, F. H. Keast, W. A. Messervey.**

### The Technical Program

The technical program was the largest presented at any meeting of the Institute. It included a total of 28 technical papers and two panel discussions, and agreed with the policy of emphasizing subjects pertinent to the area in which the meeting is held. The program nevertheless was national in its coverage of interesting engineering achievements and developments.

Though the program appeared to be well received it must be noted here that the technical sessions were not as well attended as in previous years.

Most of the papers presented have already been prepared for printing in the *Engineering Journal.* Some have appeared in the April, May, and June issues. The others will follow in future issues of the *Journal.*

Two subjects were placed before panels for open discussion. The first, "Air Pollution Control", had on the panel Dr. E. A. Watkinson, Dr. Morris Katz, M.E.I.C., J. G. Hall, M.E.I.C., and R. L. Broad, M.E.I.C. Professor E. A. Allcut, M.E.I.C., presided. The second subject was "Management Techniques — How Can They be Used to Better Advantage?" The members of this panel were Dr. Lillian M. Gilbreth, Hon. M.E.I.C., A. M. MacKenzie, M.E.I.C., E. A. Perry, M.C.I.M., and J. B. White. The chairman was C. A. Peachey, M.E.I.C.

### The Banquet

As usual the banquet and dance on Friday night was the feature event of the meeting. Some 800 people attended. This, together with the presentation of prizes and medals made the banquet a huge success.

The guest speaker, Dr. C. J. MacKenzie, Hon. M.E.I.C., opened his address with this sentence. "Engineers do not think or reflect much about age and our profession is relatively young in mere years, but in our corporate life span there have occurred most of those great discoveries and movements which have shaped the material world of today, and engineers have been either responsible or intimately involved in all phases of this progress." He then traced the history of engineering as a profession from the time of the first recognized Civilian engineer to our present complex set-up, and pointed out what this change has meant to our country. In closing he said "We need not apologize for the heritage we are passing on to the next generation, but I for one cannot help envying them the opportunities for high adventure which the last half of the 20th century will offer to the enterprising young engineers of tomorrow." The induction of the new president, Donald McGregor Stephens, concluded the program.

Guests at the head table are identified in the photographs on page 842 of this issue.

### The Reception and Dance

The reception by the president after the banquet was informal.

**On the opposite page. Speakers at the technical sessions. Top row left to right: J. Y. Doran, Jean-Paul Drolet, B. M. Monaghan, J. G. Inglis. 2nd row left to right: Hans Ulmann, R. L. Dunsmore introducing W. H. White and R. W. McGilvray, J. E. Sproule. 3rd row left to right: J. L. de Stein, Capt. H. Ross Smyth, J. L. Van Camp. 4th row left to right: R. B. Steel, A. G. Lester, C. G. Kingsmill, L. A. W. East, R. A. Fairburn, Bernard Ulrich.**

**Dr. C. J. MacKenzie, guest speaker at the Banquet.**

**Head table at the Banquet; Left to right: D. M. Stephens, president elect, The Engineering Institute of Canada; G. E. Sarault, chairman, Annual Meeting Committee; Mrs. J. M. Lamb; J. F. McDougall, registrar, Association of Professional Engineers of Alberta; Group Captain C. L. Ingles, Royal Canadian Air Force; Mrs. A. T. Hurter; Georges Demers, president, Corporation of Professional Engineers of Quebec; A. Turner Bone, vice-president, Canadian Construction Association; Mrs. C. L. Ingles; R. E. Jamieson, president, Canadian Standards Association; L. F. Grant, chairman, Engineers' Council of Professional Development. Second row, left to right; Madame Y. R. Tasse; Wilfrid Hamel, His Worship the Mayor of Quebec; G. D. Floyd, vice-president, American Institute of Electrical Engineers; Mrs. W. L. Sagar; Irving R. Tait, vice-president, The Engineering Institute of Canada; Madame Onesime Gagnon; Lewis K. Sillcox, president, American Society of Mechanical Engineers; C. J. Mackenzie, president, Atomic Energy Control Board; The President, R. L. Dobbin. Third row, left to right: D. V. Terrell, president, American Society of Civil Engineers; Mrs. Lewis K. Sillcox; Msgr. Ferdinand Vandry, Rector Magnificus, Laval University; Mrs. D. M. Stephens; The Hon. Oncsime Gagnon, Minister of Finance, Province of Quebec; B. F. Dodge, vice-president, American Institute of Chemical Engineers; Mrs. L. F. Grant; C. C. Huston, president, Canadian Institute of Mining and Metallurgy; Madame Georges Demers; R. M. Hardy, president, Dominion Council of Professional Engineers. Fourth row, left to right: A. T. Hurter, president, Association of Consulting Engineers of Canada; Madame G. E. Sarault; Captain J. Deane, Royal Canadian Navy; W. L. Sagar, president, Association of Professional Engineers of Ontario; Mrs. I. R. Tait; J. M. Lamb, president, Association of Professional Engineers of New Brunswick; Mrs. J. F. McDougall; Colonel W. A. Capelle, Canadian Army; Max L. Baker, vice-president, Association of Professional Engineers of Nova Scotia; Y. R. Tasse, president, Chamber of Commerce of Quebec.**

This way of receiving was inaugurated in Vancouver two years ago and because of its success has been continued. The incoming president, Mr. Stephens, and his wife; and the outgoing president, Mr. Dobbin, were there. Mr. Sarault, chairman of the Quebec Branch, and Mrs. Sarault were also present.

Immediately after the banquet "Muriel's Room" was opened to all guests and the Ball Room was cleared for the dance. The evening was thoroughly enjoyed by everybody, including some two hundred young people who arrived after the banquet for the dance.

### The President's Dinner

The president's dinner was held at the Garrison Club on the evening of Tuesday, May 11. This annual occasion allows the president to bring together those officers who have held office during the year. President Dobbin thanked them for the kindnesses extended during the presidential tour.

Past-Presidents A. R. Decarie ('27), F. P. Shearwood ('34), L. F. Grant ('47), J. A. Vance ('50), and J. B. Stirling ('53) spoke about various phases of Institute development and the importance of it to the engineer. Dr. Stirling presented the retiring president with the book "Half Hours with Famous Scientists". The introduction of president-elect D. M. Stephens concluded the dinner.

### Students' Conference

The ninth Conference of Students met all day Tuesday, May 11. These are delegates from the degree granting universities in Canada, and R.M.C., who are brought together annually as guests of the Institute. In this way the Institute seeks to maintain contact with engineers of the future. D. C. MacCallum presided.

Among the resolutions passed by this conference were: "That the E.I.C. be requested to continue distributing one free copy of the *Journal* to all students in one undergraduate year; and in order to stimulate interest in the Institute, the conference recommends that this issue contain material of student interest such as the counselling service, loan fund, and scholarships."

"That in order to create a better understanding between Canadian cultures, the conference recommends to the E.I.C. that more French language papers be published in the *Journal.*"

These interesting resolutions are indicative of the work that is done by the students. Delegates present were:

Carl R. Johnson, University of British Columbia.

James Tod, University of Alberta.

Baine A. Holmlund, University of Saskatchewan.

M. P. Schioler, University of Manitoba.

Grant E. Sims, University of Manitoba (Observer).

J. N. Rossall, University of Toronto.

W. C. Moffatt, Royal Military College.

J. D. Fowler, Queen's University.

R. L. Wright, McGill University.

Pierre DeGuise, Ecole Polytechnique.

Claude Pouliot, Laval University.

Eric C. MacNearney, Nova Scotia Technical College.

C. C. Atkinson, University of New Brunswick.

### Council Meetings

Council met twice during the week. The "old" council met in the Jacques Cartier Room on Tuesday, May 11. There were 42 councillors and guests present representing 22 branches. Mr. Dobbin presided at this meeting.

The second meeting, traditionally known as the first meeting of the "new" Council, was held on the morning of Thursday, May 13. There were 40 present representing 25 branches.

Mr. Stephens, in taking over his first meeting of the Council, expressed his appreciation to the councillors and members of the Institute for appointing him to this high office. To his mind the Engineering Institute and engineers were synonymous and the progress of Canada was closely allied to the work of the engineer.

Council expressed its appreciation to the members of the Quebec Branch for the interest taken in setting up and carrying out a program that met the needs of everyone.

### Branch Officers' Conference

The Branch Officers' Conference was held on Tuesday, May 11. R. L. Dunsmore, chairman of the Montreal Branch presided and R. J. Harvey, Montreal branch secretary, did the secretarial duties.

The conference began in the morning and continued in the afternoon with a joint meeting of council and branch officers. The purpose of this was to thoroughly discuss "Confederation". A progress report about confederation appeared in the Month to Month section of the June issue of the *Journal.*

**At the dinner on Wednesday. Left to right: R. L. Dobbin, G. E. Sarault, the Hon. Onesime Gagnon, Dr. Lillian M. Gilbreth.**

**The ladies enjoy morning coffee.**

# Canadian Engineers

# at

# Work

*Address of the retiring president, Ross L. Dobbin, delivered at the 68th Annual General and Professional Meeting of the Engineering Institute of Canada at Quebec City, May, 1954.*

In the last year the Engineering Institute of Canada has given me a wonderful opportunity to observe Canadian engineers at work in all sections of the Dominion.

I have spent my time travelling through Canada from coast to coast and even to the Arctic Circle, by air, rail, motor, steamship and even by dogsled. Of all the visits I made the highlight was the trip to England to represent the Institute at the Coronation of Her Gracious Majesty Queen Elizabeth the Second. My reception by the engineers of England was indeed a wonderful experience. The distance covered was tremendous—a total of 35,000 miles. It would scarcely be fair, however, to give you the impression that this has been all work, for I have enjoyed a round of banquets, entertainment, the meeting of people from all walks of life and the making of new friends. It is at this point, then, that I want to thank all those who have extended their hospitality to me in so many different ways. They have made my term in office a pleasant and a memorable one.

The people I visited belonged to every branch of the Institute and to many unofficial groups as well. They include the engineering students in every university in Canada, and students in many pre-engineering colleges. During my visits with them I discovered that the engineers of Canada are very socially-minded; I enjoyed meeting both the members and their ladies—especially the ladies. As an observant bachelor I was amazed by

Karsh, Ottawa

**Ross L. Dobbin, M.E.I.C.**

their attractiveness and the excellence of their dress, no matter how rough the living conditions might be on that particular project. Canadian engineers are a lucky group of men.

### Size and Problems

My travels have impressed me with the size of our country, and even more with the problems such size has created for us. Our Institute is a widespread society, and close cohesion is necessary to promote the strength it needs. To some extent the problem is overcome by liaison between headquarters and the branches, coupled with frequent visits by the president and other officials, but greater unity is needed if Canadian engineers are going to make the best of the opportunities available to them. The Institute is growing stronger in activities and relations with the general public, and thus enjoys great prestige. All these conditions lead me to believe that the Institute must consider carefully and sympathetically the proposals for greater co-operation.

I have referred to the opportunities and problems before Canadian engineers. One of the most important factors is the extent of Canada's natural resources. At the risk of labouring the obvious, I shall remind you of them. Within the borders, this country has untold and unknown quantities of all base metals: iron, copper, lead and uranium, not to mention the huge deposits of oil and natural gas in the West. The world is hungry for these resources, and their wise development is a task for our engineers. For too long we have left their development to engineers of other countries. Here is our opportunity—and our challenge.

### Progress

It is encouraging to find Canadian engineers and engineering contractors everywhere in the Dominion, not only producing raw materials but adapting them for the use of mankind as well. Having seen every major construction project in Canada, I can say, with considerable pride, that these same Canadians have made a success of the projects they have undertaken. It is gratifying to add that most of these engineering developments have been staffed by Canadian engineers and built by Canadian engineering contractors — a significant sign of our progress both as a profession and as a nation. We have been overly modest in the past; it is evident that Canadian engineers rank with the best in the world and are capable of any kind of work, particularly the work to be done in Canada.

Perhaps a quick survey of some of the developments from coast to coast will be of more value to you than further generalizations on the vague subject of "opportunity".

*Newfoundland*

In Newfoundland, for example, the newest province is taking its proper place in the Dominion as a producer. At present Newfoundland has two main industries: pulp and paper, represented by the largest mill of this type in the world, and also the famous iron ore mine on Bell Island. In the years immediately ahead, Newfoundland will be one of the leading producers of raw materials for the world, for it has within its boundaries all types of base metals as well as the pulp and paper products already mentioned.

*Labrador*

At Knob Lake in Labrador I found new iron mines situated in a most barren part of the country. One of its greatest problems, naturally, is that of transport, but a large number of Canadian engineers are engaged, not only in operating the mines, but also in pushing three hundred and fifty miles of railroad through unexplored and unmapped country. This is a major project of tremendous importance, but hard and dangerous labour is necessary for its ultimate success.

*Nova Scotia and New Brunswick*

In Nova Scotia, our engineers are using their skill and ingenuity to help the coal mines produce at a much lower cost, thus providing a larger market for their product. The most outstanding improvement I noticed was the mechanization of operations, including the ingenious mechanical miner, designed and built by Canadians.

In New Brunswick, too, recent discoveries of almost all the base metals have greatly increased the activity of engineers, and provide a promising field for future development.

*Quebec and Ontario*

The largest project in Quebec, is the Birsimis power development, now well under way. When it is finished, it will supply over one million kilowatts of electrical power to a large area of northern Quebec, and also by cable across the St. Lawrence to cities on the south bank of the river. The giant power plants of northeastern Quebec are supplying the industries in the province with the power they need to produce even greater quantities of aluminum and associated products. The Quebec of small villages and an agricultural economy is giving way to a highly industrialized province.

The Hydro Electric Power Commission of Ontario has an immense project nearing completion at Niagara Falls, but it is the northern part of Ontario with which I was most impressed. This section is well-known for its mines, but a major industry is now developing in uranium, and the pulp and paper industry is continuing to expand.

*Manitoba and Saskatchewan*

Winnipeg is rapidly becoming one of the largest industrial concentrations in Canada. Manitoba has developed power plants in response to the demand, and another factor has been introduced. Oil in the south-west corner of the province is having a great effect on the provincial economy, and the arrival of natural gas from Alberta will undoubtedly boost the province even more.

Saskatchewan, as yet, has little to offer in the line of engineering developments. It is still an agricultural province with no large industrial projects in operation, but here too, oil will play a great part shortly.

*Alberta*

Alberta tells a startling story. Of all the provinces in our Dominion this one is forging ahead most rapidly. The discovery of oil and natural gas, and their subsequent development is nothing short of phenomenal.

Gazing from an upstairs window of the Macdonald Hotel in Edmonton, I could see sprawling oil refineries everywhere, and the beginning of the long pipe line which delivers oil to Ontario. At luncheons and in the lobby of the hotel, I heard many interesting discussions on the possibilities of exporting natural gas from this province, 2,500 miles east of Ontario. Such an undertaking would be immense in its nature and provide endless scope for engineering talent.

*British Columbia*

Kemano and Kitimat are the largest construction projects in British Columbia. The former is remarkable for its unique underground power house and penstock—a new technique which is a great contribution to the sciences of power plant construction. At Kitimat a vast plant is being constructed to produce aluminum, while the plan of the city built to house the plant workers is in itself a remarkable achievement. In a survey of British Columbia, Trail cannot go unmentioned. Here there are new power developments and a steady expansion in smelting and manufacturing capacities. It is of itself an industrial empire.

*Yukon*

Development is going on in the Yukon territories as well. Engineers are busy maintaining and improving the Alcan highway, its artery to the south, and also developing mines in the far north which will use the highway to transport their products to markets all over Canada and North America. It is in this section in particular that new opportunities exist, for the immense resources of northern Alberta and the Yukon are as yet almost untouched. Here countless hundreds of engineers will find a suitable background for their professional careers.

**Unity is Strength**

From coast to coast a challenge exists for Canadian engineering, a challenge to take over completely the industrial resources of our country and develop them both wisely and fully. Canada is bursting at the seams with potentialities, and men of courage and vision are needed to see that these potentials are realized. Our Institute is the focal point of our profession, and as such can be a source of strength, not only to ourselves, but to our country. Its greatest problem is this: to ensure the full development of our nation, The Engineering Institute of Canada must aid in welding together the various groups of engineers throughout the Dominion into only one large body. Already steps have been taken in this direction, but final realization will depend on patience, intelligence, and a spirit of compromise. The problem is complicated but not insoluble. In unity there is strength, and that strength is needed, not alone for the engineering profession, but also for the good of the nation in whose destiny we play such an important role.

# From Month To Month

**Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers**

## Third Commonwealth Conference

The Conference of Engineering Institutions of the British Commonwealth, meets every four years. The third meeting was held in London, England, from May 24 to June 4. The president and the general secretary were present to represent the Engineering Institute.

All the nations of the Commonwealth were represented and the list included: New Zealand which was represented by the president, R. S. Maunder, and past-president P. R. Angus of the New Zealand Institution of Engineers; Australia, represented by the president, C. W. Candy, and the secretary C. H. D. Harper of the Institution of Engineers; India by president Major-General H. Williams and Prof. M. S. Thacker of the Institution of Engineers; South Africa by C. W. J. A. Sandrock, president of the South African Institution of Civil Engineers; L. T. Campbell Pitt, president of the South African Institution of Mechanical Engineers; Prof. G. R. Bozzoli, vice-president the South Africa Institute of Electrical Engineers, and A. J. Adams secretary of both the electricals and the mechanicals.

The three "home" institutions, had presidents and past-presidents to represent them, on various occasions. For the Civils there was W. P. Shepherd-Barron, president, and A. S. Quartermaine, V. A. M. Robertson and the newly appointed secretary A. McDonald.

The Institution of Mechanical Engineers were represented by R. W. Bailey, president, A. C. Hartley, past-president and the secretary Brian Robbins.

The Institution of Electrical Engineers had as their representatives Harold Bishop, president, J. Eccles, a past-president, B. H. Leeson, vice-president, and W. K. Brasher, secretary.

For the first time North and South Rhodesia were represented by an observer, T. W. Longridge, and at the conclusion of the long agenda the Rhodesian Institution of Engineers was admitted to membership in the Conference.

In all, between delegates and alternates there were 28 participants in the business sessions with many more added for the social events.

The business sessions took place alternately in the beautiful council rooms of the three home institutions. In fact all the arrangements were in competent hands of the officers of these organizations. Every detail was determined in advance and carried out precisely as planned—much to everyone's enjoyment and satisfaction.

A weekend in the country which included a visit to Oxford and a stay in the Shakespearean country was the outstanding social event. Lunches and dinners were held every day at world famous restaurants, hotels and clubs. Cambridge University also was on the itinerary for a one-day visit.

The concluding event was a formal dinner at the Savoy Hotel, which gave the leaders of delegations an opportunity to thank their hosts.

When the location for the 1958 conference was up for consideration, Mr. Stephens urged upon the group the advantages of coming to Canada, but Australia also held out an attractive picture. Eventually it was agreed unanimously that Australia be selected. Consideration of currency problems for those in the Sterling areas was an important factor in reaching the decision. "Hard" dollars are still hard to get, and finally Canada agreed reluctantly that Australia should be chosen.

The business matters discussed and conclusions reached are subject to approval of the various councils before being announced, but they included relations with UNESCO, and engineering conferences in Europe, United States and South America; training in the United Kingdom for overseas graduates; trade union activities; registration for engineers in countries where it is not now in operation; the requirements of the Commonwealth for engineers; the need of stimulating in the minds of young men an interest in an engineering education; conservation of natural resources;

## Cover Picture

The cover picture is from the Quebec annual meeting. Delegates were on hand from the Canadian Universities, to present and discuss the views of the engineering student. Front row, left to right: Pierre De Guise, Ecole Polytechnique; Carl R. Johnson, British Columbia; Claude Pouliot, Laval; Eric C. MacNearney, N.S.T.C.; back row: Baine A. Holmlund, Saskatchewan; C. C. Atkinson, New Brunswick; Grant E. Sims, Manitoba; J. N. Rossall, Toronto; M. P. Schioler, Manitoba; R. L. Wright, McGill; W. C. Moffatt, R.M.C.; James Tod, Alberta; and J. D. Fowler, Queen's.

A meeting of the Third British Commonwealth Conference in session. W. P. Shepherd-Barron, presiding, with G. V. Burns at his left. Seated, from left counter clockwise around the table: T. W. Longridge, P. R. Angus, R. S. Maunder, G. R. Bozzoli, L. T. Campbell Pitt, A. J. Adams, C. W. J. A. Sandrock, A. S. Quartermaine, V. A. M. Robertson, W. K. Brasher, H. Bishop, B. G. Robbins, R. W. Bailey, M. S. Thacker, H. Williams, L. Austin Wright, D. M. Stephens, C. H. D. Harper, C. W. Candy. Mr. F. Jervis Smith is seated at centre table, with a reporter at his left.

public relations; professional recognition; reciprocal privileges for members of all institutions; education and the need of more uniform standards between universities and countries; training of apprentices and technicians as aides to engineers; relationship with non-professional organizations; abstracting services; the work of technical committees; codes of practice; and so on. It was a long agenda which required 12 half-day sessions to settle (or nearly settle) all the points.

Conferences such as this are of great significance for the development of the profession and in the promotion of good international relations. Leadership is required urgently today in world affairs. The usefulness and strength of the British Commonwealth of Nations was never more needed than now, and in such matters the engineer must accept a great responsibility. It is the belief of those who followed this conference for two weeks, that much was accomplished that will contribute to these worthy objectives.

Details of resolutions and recommendations will be published in the *Journal* after their approval by the Council of the Institute.

# Consulting Engineers' Meeting

Embarking on a new policy of holding a meeting and dinner coincident with the annual meeting of the Engineering Institute of Canada, the Canadian Association of Consulting Engineers had Dean D. V. Terrell of Lexington, Ky., as guest speaker at their dinner on May 13 at the Chateau Frontenac, Quebec City. Dean Terrell proved to be most entertaining and reminded one of the late Will Rogers. He is dean of the college of engineering at the University of Kentucky and the president of the American Society of Civil Engineers. It was his first visit to Quebec and he shared the enjoyment of the ex-

Part of the head table at the Consulting Engineers' dinner: Left to right, E. A. Cross, R. L. Dobbin, Dean D. V. Terrell, the speaker, A. T. Hurter, D. M. Stephens and J. A. Friedman.

perience with a large audience of members who were also present for the Institute meeting.

Just prior to the dinner a well-attended general meeting was held, with President R. T. Hurter in the chair. The Association's full program of work was discussed and plans made to carry it out.

During the course of the dinner, Life Membership was bestowed on five surviving Charter Members of the Association, in recognition of their valuable work as founders of the organization.

The Association's aim is principally the promotion of excellent business relations of its members and their clients, sound engineering practice, maintenance of a high professional standard, interchange of information and business experience, and promotion of cordial relations with architects, and with federal, provincial and municipal bodies.

Membership in the Association is limited and has strict requirements. Eligibility is determined by age (over 35), membership in good standing in the Engineering Institute of Canada and in the Corporation or the provincial Associations of Professional Engineers, occupation in the independent practice of the profession and attainment of a high reputation.

# Athlone Fellows, 1954

It is a yearly pleasure for the Institute to congratulate the young Canadian engineers fortunate enough to have been chosen Athlone Fellows.

These young men will spend the next two years in Great Britain, either at a university (Group A) or in industry (Group B). They will have a splendid opportunity to contribute something toward bringing the engineers of Great Britain and of Canada still closer together, while adding to their own competence, an opportunity of which it is certain they will make the most. It is even rumoured that some of them make the closest possible connections abroad by marrying British girls.

This year twenty-eight 1954 graduates will make up Group A; ten less recent graduates are included in Group B. Twenty-four of the total are Students or Juniors of the Institute; to them the Institute offers its very special felicitations here. It has also written each of them to convey its congratulations individually and to call attention to some privileges in the British Institutions which are theirs by virtue of their membership in the Institute.

There is no doubt but that this group will measure up to the high standards set by its predecessors. Equally, there is no doubt but that these young Canadian engineers will come back to us with minds broadened by two years of immersion in the stream of civilization as it flows in Britain, perhaps no better than our own, but different. Even if they do not acquire one atom of additional technical ability —which is unthinkable—they will still be better engineers for their experiences, and more likely to develop into the kind of citizens this country needs, as does all the world.

This is the list of the 1954 Athlone Fellows and the institutions from which they graduated:

### Group "A"

Anthony Hector Roy, S.E.I.C., B.E. (mechanical), Nova Scotia Technical College; Ronald Stanwood Butcher, S.E.I.C., B.E. (mechanical), Nova Scotia Technical College; Richard Charles Ballanse, S.E.I.C., B.SC. (civil engineering), University of New Brunswick; Earl Joseph Grant, S.E.I.C., B.SC. (civil engineering), University of New Brunswick; Michel Gendron, S.E.I.C., B.SC. (civil engineering), Laval University; J. M. Dessureault, B.A.SC. (engineering metallurgy), Laval University; L. Z. Rousseau, B.A.SC., Laval University; Jacques E. Marleau, S.E.I.C., B.A.SC. (engineering metallurgy), Ecole Polytechnique; Jean Paul Cossette, S.E.I.C., B.Eng. (electrical and mechanical), Ecole Polytechnique; J. J. Jonas, B.SC. (engineering metallurgy), McGill University; Charles E. Brabant, S.E.I.C., B.SC., B.Eng. (engineering physics), McGill University; George Zames, S.E.I.C., B.SC. (engineering physics), McGill University.

J. L. Eyre, B.A.SC. (mechanical engineering), University of Toronto; R. T. Rhodes, B.A.SC. (engineering and business), University of Toronto; D. S. Shaw, B.A.SC. (engineering and business), University of Toronto; Ian Joseph MacDonald, S.E.I.C., B.SC. (mechanical engineering), Queen's University; John Gibson Pike, S.E.I.C., B.SC. (mechanical engineering), Queen's University; John Laurence Seychuk, S.E.I.C., B.SC. (civil engineering), University of Manitoba; John William Godfrey, S.E.I.C., B.SC. (electrical engineering), University of Manitoba; Roy Allen McDougald, S.E.I.C., B.SC. (mechanical engineering), University of Manitoba; Barclay George Jones, S.E.I.C., B.SC. (mechanical engineering), University of Saskatchewan; P. M. Wright, B.SC. (civil engineering), University of Saskatchewan; G. C. Oates, B.A.SC. (mechanical engineering), University of British Columbia; Norman George Davies, S.E.I.C., B.A.SC. (engineering physics), University of British Columbia; J. A. McNish, B.A.SC. (electrical engineering), University of British Columbia; G. V. Ward, B.A.SC. (electrical engineering), University of British Columbia; W. W. Klingbeil, B.SC. (civil engineering), University of Alberta; David Gilmour Dawson, S.E.I.C., B.SC. (electrical engineering), University of Alberta;

### Group "B"

Maurice Poupard, S.E.I.C., B.A.SC. 1953 (mechanical engineering), Ecole Polytechnique; Robert Russel Elliot, JR.E.I.C., B.Eng. 1951 (electrical), McGill University; Francis Maguire Corbett, JR.E.I.C., B.Eng. 1949 (electrical), McGill University; Earl Lundy Pearson, S.E.I.C., B.SC. 1953 (mechanical engineering), University of Manitoba; J. R. B. Steacie, B.Eng. 1951 (electrical), McGill University; L. R. Turner, B.SC. 1953 (chemical engineering), Queen's University; John Stewart Ellis, JR.E.I.C., B.SC. 1948, Queen's University, M.Eng. 1949 (civil), McGill University; David Lindsay Stewart Bate, JR.E.I.C., B.A.SC. 1948 (engineering physics), University of Toronto; Philip James Dowling, JR.E.I.C., B.A.SC. 1951 (civil engineering), University of Toronto; H. C. Pettigrew, B.A.SC. 1952, University of Toronto.

# Work Habits

In 1931, when our President was an undergraduate at the University of Manitoba, he had a hand in starting *The Slide Rule*, designed to be the voice of the student engineers there. Apparently this publication, like a good many student activities that necessarily suffer from lack of continuity of management, has had its ups and downs. The number before us is Volume 20, Number 1, and we gather that it is the first issue that has appeared in four years.

This issue should be of special interest to Institute members because it contains an article by President D. M. Stephens discussing work habits, which contains a good deal of common sense and which could be read with profit by every engineering student and, indeed, by a good many engineers who have left student days long behind them.

After agreeing that to do well in an engineering course of study is not easy, Mr. Stephens goes on to say:

"The chap to whom all subjects come most easily at university is sometimes a disappointment to himself and his friends after he leaves the university. The student who finds it necessary to work hard is frequently found to do rather well in the profession. While it would be dangerous to oversimplify this sort of thing, I think sometimes you can find the explanation in the fact that one man could do well at the university in spite of poor work habits and that the other had been forced to form good ones. A less brilliant, but systematic, worker will often surpass the brilliant dawdler . . . Of course, when you have the chap with the brilliant mind *and* the good work habits, then you really have something!

"Your professors will tell you that it is practically impossible to *teach* good work habits. I think they are right in this and that these habits of work must be *learned* rather than taught. I have noticed a few things about the men whose work habits I have most admired and which will bear passing on. They seldom *half* work. They work while they are at it. They seem to carry their work to some logical resting place before they stop . . . When they get on the right track they are hard to stop . . . If there is some particular angle of a subject which they do not quite understand . . . they go out and meet that particular angle or subject head on and master it . . . While they may start one job, or perhaps several, before they finish one that had been started earlier, you will find that they follow a rule that calls for each job to be completed according to some sort of timetable . . . They like a good stiff pace and they seem to have more spring in their mental stride on that account. Other folk like the briskness of these people and that same springing mental stride and so they often select them as leaders. You will find these same work habits showing up in their play . . . or in the social or professional functions which they organize.

"Some of the men of whom I am thinking are not too conscious of their particular work habits and so they might find it difficult to tell us just when and where they had formed them. My own guess would be that most engineers who have these work habits formed them in a basic sort of way during their undergraduate days. They became good students then and have remained so ever since."

# Resources Conference

The important Resources Conference, which took place in Ottawa April 22-23, 1954, is attracting much attention in its follow-up stages, according to J. L. Van Camp, general manager of the Canadian Forestry Association, and secretary of the Resources Conference Committee.

This meeting, announced in the *Journal's* March issue, gained the desired co-operation of press, radio and television, and the great interest of the Canadian public. A statement has been issued by the Canadian Forestry Association, which is a summary and evaluation of the conference:

### Summary of Conclusions

***Objectives:***

The Conference was called to focus attention upon the need for the best possible planning, toward the full use and perpetuation of all Canada's renewable natural resources. It was also intended to provide accurate informative documents prepared by leaders in each group, to be made available to delegate organizations for distribution to their membership. We hope that you will take advantage of this material whenever questions are raised by your membership regarding conservation and use of renewable resources.

This first general Conference on all renewable resources dealt with principles, objectives and needs. It is expected that action for implementation of the principles will come from subsequent conferences, where action is not already being taken.

***Accomplishments:***

The Conference brought together over 200 high-level delegates from responsible national organizations and government departments. The information available to delegates was mutually helpful in broadening their knowledge of Conservation.

Presentation of carefully considered statements, and discussions on forestry, agriculture, wildlife and recreation by outstanding leaders from every section of Canada, brought out new suggestions and useful comment.

***Plans Resulting from the Conference:***

That the Conference should be a focal point for dissemination of information on a national scale was strongly approved by the delegates. It was also strongly urged that definite accomplishments be attempted, in line with suggestions made to the Conference.

Present plans for release of information by the sponsoring organizations include:

1. this informal summary
2. distribution of mimeographed copies of the summary papers (presented on the afternoon of April 23rd) and
3. printed publication of the full papers and discussion from Conference sessions.

Practical action to be investigated, on suggestions made to the Conference, include a proposal for re-establishment of a National Commission of Conservation; implementation of the Canada Forestry Act for forest fire protection; a full scale Federal Department of Forestry, extension of present national agricultural programs into new areas, and improved research and action on wildlife and recreational programs.

A continuing Committee will investigate and report progress on actions favoured by the Conference.

The final Conference record will be read with interest. As Mr. Van Camp wrote in the June issue of "Forest and Outdoors", "this record should be a valuable milestone in the consideration of Canadian Resources as they now are, and as they should be in the eyes of these leaders of business and industry and representatives of the educational and public service organizations and their hundreds of thousands of members."

The *Journal* will be printing more about the Conference and about the permanent benefits derived from this review of Canada's renewable resources. With the C.F.A. and the E.I.C., the sponsoring bodies were the Agricultural Institute of Canada, the Canadian Chambers of Commerce and the Canadian Institute of Forestry.

# Canadian Standards Association Meeting at Vancouver

The annual meeting of the Canadian Standards Association was held in Vancouver on April 14. General Manager W. R. McCaffrey reported that membership, including individual, co-opted, associated and honorary members, now stood at 1536. Sustaining memberships, which include industrial and technical associations, provincial departments, municipalities and commissions, now totalled 930, an increase of 85 during the past year.

Revenues for the year included the annual grant from National Research Council of $20,000, sums from sustaining members totalling $60,450 and $40,732 from sales of CSA publications, he said. The combined budget of the Association and its two subsidiaries, the CSA Approvals Division and the Canadian Welding Bureau was close to 1¼ million dollars during the past year, or six times what it was in 1939, a figure outstanding in the matter of budgets of national standardization organizations throughout the world.

Addressing the meeting, Dean R. E. Jamieson, president of the Association, told members that organizations such as CSA strengthen the bonds across Canada. The CSA is not a government organization. It is a completely autonomous body incorporated under the Dominion Companies Act, he pointed out.

Its specification committees are Canada-wide in scope, and an endeavour is made to keep their memberships truly representative industrially and geographically. The formulation of a standard specification calls for close co-operation, with much give-and-take. Such co-operation is the backbone of all CSA work in achieving acceptable national standards.

In connection with the wood products and lumber industry, he continued, representatives from all over Canada had produced some of the most important publications in the list. The CSA Standard on Douglas Fir plywood, published in 1953, already had a circulation of over 13,000 copies. Publications relating to the electrical industry and electrical inspection services, the manufacture and inspection of boilers, the safety codes for elevators and the operation of woodworking machinery were other projects of wide application all across the country.

Codes for control of radio interference, safety regulations for power line crossings, design and construction standards for bridges and steel and concrete buildings, have found qualified committeemen ready to lend a hand in developing specifications. When it is remembered that these specifications depend for their success on voluntary acceptance and adoption, it is evident that their value lies in the extent to which they enjoy distribution and use, he added.

The CSA is the Canadian member of ISO, the International Organization for Standardization, and of IEC, the International Electrotechnical Commission. Members of ISO are the national standards bodies of thirty-four nations, some of them behind the iron curtain. In addition, CSA maintains close contact with the national standards bodies of the British Commonwealth, and maintains active liaison with many committees of ASA, ASTM, ASME, AIEE and other United States organizations.

The CSA Approvals Division at Toronto is receiving more than twice as many applications for testing and certification as it did four years ago. Its growth has been such that construction has been commenced on a new building in the outskirts of Toronto for its accommodation. The Canadian Welding Bureau, also at Toronto, certifies welding operators, supervisors and shops as meeting the requirements of the Association's various welding Codes. An important feature is the correspondence courses it operates for instruction in the principles, practice and supervision of welding.

A year ago, a new set of by-laws for the Association had been adopted. Their basic feature is that the work of administering CSA policy and business is placed in the hands of a board of directors, while technical procedure leading to adoption of standards is placed under a technical council. These by-laws extend full voting privileges to all CSA members resident in Canada and make them elegible for election as directors. Elections are held every two years, the next to be held in 1955.

In conclusion, Dean Jamieson emphasized that the successful operation of CSA has always depended, and will continue to depend, on co-operation from industry, governments, and by scientific bodies and educational institutions. The roots and the life of its specification work lie in its specification committees, who originate the drafts, come to an agreement on their clauses, and produce the specifications. The Association, and the people of Canada, he said, owe a great debt to this body of men.

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# Ontario Division

The Ontario Division of the Engineering Institute of Canada recently elected a new slate of officers to continue the work of co-ordinating the Institute's activity in Ontario.

Dr. A. E. Berry, Toronto, is the chairman; G. R. Henderson, Sarnia, vice-chairman; Major-General G. R. Turner, Ottawa, treasurer; G. H. Rogers, Toronto, secretary.

C. D. Carruthers, Toronto, was chairman of the Nominating Committee.

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# Correspondence

***Foundation Studies***

Editor,
Engineering Journal

In the paper on Recent Studies of Foundation Behaviour by Dr. G. G. Meyerhof, M.E.I.C., in your February issue, the following statement appears: "Where piers or piles pass through clay and rest in underlying cohesionless material, the adhesion of the clay to the shaft can be added to the toe resistance corresponding to the embedment of the toe in the cohesionless soil".

It is not clear just what this means but if it is intended to imply that the supporting power of the pile is the combined effort of the point resistance in the non-cohesive soil and the frictional resistance of the shaft in the clay, then as an unqualified statement it is incorrect.

Due to the very large difference in the modulus of elasticity of the pile and of the surrounding soil unless there can be an appreciable movement of the "toe" of the pile the skin friction cannot be mobilized. In the case of end bearing piles when the point rests on rock or some other firm stratum no friction should be taken into account. Even a dense sand is sufficient to prevent the necessary incipient movement to mobilize the skin friction. For sand in the loose state, it is possible that some friction might be mobilized.

On the other hand, when piles are driven through some water-saturated clays which are structure sensitive, the clay in the vicinity of the pile is remolded. This causes an increase in the rate of consolidation which in turn produces a downward drag on the pile so that the point resistance has not only to support the load at the top of the pile but also the weight of the immediately surrounding soil. In such cases the friction between the soil and the pile is downward. An effect which accompanies this phenomenon is that a space is produced below the sole of the footing. If this space be not filled with water, wooden piles have been known to rot at the top. They should of course be treated to prevent this type of failure.

I. F. Morrison, M.E.I.C.,
Prof. of Applied Mechanics,
University of Alberta,
Edmonton.

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Dear Mr. Editor:

In thanking Prof. I. F. Morrison for his interest in the author's paper, Dr. G. G. Meyerhof would like to point out that the ultimate load bearing capacity of foundations (including piers and piles) depends mainly on the strength properties of the soil and not on the deformation characteristics of the soil and foundation. The ultimate bearing capacity can thus for all practical purposes be estimated from the theory of plasticity (limit design) irrespective of the deformation characteristics, and the theoretical maximum résistance of piles is the sum of point resistance and skin friction. [1, 2]

The results of numerous pile loading tests in uniform soils are in agreement with this theory[2] and they show that the full skin friction is mobilized at about one-quarter to one-half of the penetration required for the maximum point resistance. Since even in soft clays the full skin friction of piles is mobilized at a penetration of an inch or so, while in a dense sand the maximum point resistance requires a penetration of several inches[3] and on rock a penetration of about an inch[4], it follows that in practice the skin friction is always fully mobilized before the point resistance.

It is well known that when piles are driven into sensitive clays, a negative (downward acting) skin friction is produced temporarily, which decreases the allowable load governed by settlement considerations but does not affect the ultimate bearing capacity. This is shown by pile loading tests on such clays[2] and would be expected because the downward movement of the soil is negligible compared with the downward movement of the pile under the superimposed ultimate load.

Dr. Meyerhof considers therefore that the statement, to which Professor Morrison refers is correct on both theoretical and practical grounds as far as the ultimate bearing capacity of piers and piles is concerned.


(1) Terzaghi, K. "Theoretical Soil Mechanics". J. Wiley, New York, 1943, p. 136.
(2) Meyerhof, G. G. "The Ultimate Bearing Capacity of Foundations". Geotechnique, 1951, vol. 2, p. 301.
(3) Meyerhof, G. G. "An Investigation for the Foundations of a Bridge on Dense Sand". Proc. Third Int. Conf. Soil Mechanics 1953, vol. 2, p. 66.
(4) Meyerhof, G. G. "The Bearing Capacity of Concrete and Rock". Magazine of Concrete Research, 1953, vol. 4, p. 107.



Dr. G. G. Meyerhof, M.E.I.C.
Supervising Engineer,
Foundation of Canada Engineering Corporation Limited.


# N.R.C. Holds "Open House"

Marking the recent opening of the new building for the Division of Radio and Electrical Engineering, an event which had brought a new phase in the life of N.R.C., a three-day period of "Open House" was held at its Montreal Road site, four miles east of Ottawa by the National Research Council, May 26 to 28, 1954.

Founded in 1917, N.R.C. has two functions; to stimulate all phases of scientific research in Canada, and to link science with industry. In 1925 small scale laboratory work was started, while larger scale research began in 1932 on Sussex Street with four divisions; Physics and Engineering, Biology and Agriculture, Chemistry, and Research Information. In 1936 the Division of Mechanical Engineering was established, and in 1939 a new building site for it was acquired on the Montreal Road.

In 1947 the Division of Building Research was established, and in 1953 a new building to house this division was opened. A separate Division of Applied Chemistry was also established, and a new building for it was opened in 1952. In 1947 the Division of Radio and Electrical Engineering was set up, and this year a new building was opened for it on a new 250 acre site across the road from the site of the other engineering buildings.

On each of the three days the various Division buildings were open to visitors for inspection for periods of some six hours. To those who attended with a view to obtaining an overall view of N.R.C. activities, only a superficial examination of each project was possible within the time allotted. Those interested in certain particular phases would of course spend more time on them.

While space permits only a brief synopsis of the research projects being carried out by each division, a few of the more outstanding or spectacular exhibits seen in each should be mentioned.

### Division of Mechanical Engineering

The Division of Mechanical Engineering is concerned with work on mechanics and structures, thermodynamics, aerodynamics, hydrodynamics, naval architecture, and also with combustion and lubrication. In its various laboratories, this division has on display samples of the kinds of work it is doing.

The post war development of aviation in Canada and the general world situation produced an urgent need for increased effort in aeronautical research for defence, and a co-ordinated plan for the improvement of facilities available for such work. To meet this need the National Aeronautical Establishment was organized in 1950, comprising the aeronautical laboratories of the Division of Mechanical Engineering and increased flight research facilities at Uplands. The Establishment provides for a closer integration of the requirements for military and civil aeronautical research and development.

Here visitors could observe tests of aircraft models in wind tunnels, to determine stability and carrying capacity of aircraft; structural tests on airframes and components; operation of airborne recorders, gyroscopes, de-icing control systems; shops where aircraft models are made; displays of the principles of the jet engine and jet engine icing.

Demonstrations were given in the High Speed Aerodynamics Laboratory of models in the supersonic wind tunnel, simulating speeds of 3,000 miles per hour; formation of shock waves at the speed of sound and measurement of forces acting on missiles at speeds up to 1,000 miles per hour. Equipment was on exhibit for wing de-icing, for determining ash deposits on jet engine blades and for starting tests on jet engines at high altitudes.

In the Low Temperature Laboratory, behaviour of Arctic vehicles, clothing and equipment under extreme sub-zero temperatures could be observed. Tests in the Fuels and Lubricants Laboratory of viscosity of 10° motor oil at normal and extreme low temperatures, showed that at −40° to −60° even this lighter oil becomes as thick as grease.

Other exhibits included one for rain-making by the seeding of vapour clouds with dry ice, and tests to determine the best materials for low-friction dog-sled runners. Compressors for creating cold air for these tests are rated at 950 horsepower, sufficient to make 70 tons of ice daily at −85°.

In the Hydraulic Laboratory, the model testing basin assists naval architects on problems of hull and propeller design. The basin, 450 ft. long and 25 ft. wide, is equipped to test models and full scale ships, to determine their characteristics. Investigations of problems arising in the design of harbours, river training works, navigation locks, log chutes and spillways are carried out. Currently a model of the Cornwall Island section of the St. Lawrence Seaway is under construction.

#### Division of Applied Chemistry

The major function of this division is long-term research on the development of Canadian natural resources. Investigations of more immediate practical bearing include: chemical engineering studies, research on textiles, the chemistry and corrosion of metals, development of more efficient processes for producing chemicals from natural gas, the properties and uses of natural and synthetic polymers, the applications of colloid chemistry and uses of rain repellents.

Demonstrations were being carried out on refining of ethylene; cleaning dust from wheat; drying grain and sawdust; a pilot plant for extracting oil from Alberta tarsands; on fundamental rubber research; spectrometry of gases; spectrography of metals; measurement of corrosion and pitting; demonstrations of rain repellents for aircraft windshields; mixing, vulcanizing, and testing of rubber and preparation of foam rubber; metallurgical chemistry; and catalysts, to mention only a few.

#### Division of Building Research

This Division is aimed at providing research services for the Canadian building industry. Projects are in progress on heating, building materials, soil mechanics, snow mechanics, and fire research. Work has been done on heating and ventilating buildings in the north, on the Winnipeg flood damage, the construction of the Toronto Subway, house foundations on permafrost in the Mackenzie River Valley, and the revision of the National Building Code.

The building contains a very complete laboratory for all tests, on materials such as cement, concrete mortar, bricks, sand, and on corrosion, electrical resistance and sound reflection. Tests on dwelling insulation were being conducted with test huts, and on basementless houses, as well as structural loading tests on house frames.

Demonstrations of the behaviour of quicksand as a foundation material were being given, and of loading tests on building frames. A fire research truck was on exhibit equipped with fire resistant clothing, resuscitation equipment and various instruments for determining causes of fires. Displays of air photos of Northern Canada, of Divisional publications and of the National Building Code were presented.

#### Division of Radio and Electrical Engineering

This Division is normally devoted to a broad program of basic research and engineering development. A large part of the effort is devoted to defence projects. The remainder of the Division's program comprises chiefly vacuum tube research, dielectric research, electrical engineering and servomechanism studies, radio astronomy, electro-medical research, and the application of radar techniques to navigational problems.

Aside from the periodical lectures and demonstrations in the auditorium and balcony of various electrical phenomena, museums of early telegraph, telephone and radio equipment were on display. Demonstrations of radio-astronomy and determination of the sources of experiments for determining and preventing grain dust explosions; high frequency heating for bonding layers of plywood; and for h.f. coils used in diathermy and for sterilizing beer. An exhibit and explanation of the manufacture and use of transistors were presented.

Various applications of radar, such as echo-sounders, navigation, fog alarm control, flight computers, beacon receivers, were explained. Exhibits of electromedical devices, frequency measuring equipment, electronic measuring apparatus and electronic music were also on display.

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## International Science Centers Established

*This information provided by the Co-operative Research Foundation*

Each year increasing numbers of scientific visitors have been coming to the United States to pursue academic studies, to participate in research projects being carried out in institutional or industrial laboratories, or to survey technical projects of U.S. industry.

Many visiting scientists do not have long established contacts with United States scientists and scientific institutions. In order to meet this need for contacts, the Cooperative Research Foundation, with the cooperation of the National Academy of Sciences-National Research Council, has evolved a program to establish and operate international science centers which will serve visiting scientists and engineers in those areas of the United States where there is a concentration of scientific endeavor and which consequently receive the greatest number of scientific visitors from abroad. The primary objective of this program is to stimulate direct working relationships between U.S. scientists and their colleagues in other parts of the world.

The centers are to be established with the cooperation of state or local academies of science and will provide local facilities for scientific visitors, especially those whose visits to the United States are sponsored by private interests. The main functions of the centers will be: (1) to facilitate contacts between the visiting scientists and scientific personnel in the region; (2) to serve as a coordinating agency for international scientific activities in the region; (3) to offer such assistance to visiting scientists as other institutions may not be equipped to give.

The first of the international science centers was established several months ago in San Francisco with the cooperation of the California Academy of Sciences. It has already begun to receive visitors from abroad and is receiving enthusiastic support from scientific interests in the San Francisco Bay region.

In October, 1953, Council of the New York Academy of Sciences voted to join the Cooperative Research Foundation in organizing and establishing a New York International Science Center. Space for the Center has been made available in the headquarters of the New York Academy. It is hoped that this second center can begin serving visiting scientists and engineers in the New York area early next year. In addition to the San Francisco and New York centers, nine others are contemplated. Each center will seek to evolve an active program which will encourage local scientific and engineering societies, foundations, research laboratories, universities, and industry to cooperate in its activities.

Scientists visiting the San Francisco Bay region are invited to call at the San Francisco International Science Center, which is located in the Morrison Planetarium, California Academy of Sciences, Golden Gate Park. The Center is open on weekdays from 9:00 a.m. to 5:00 p.m. and may be contacted by telephone on BAyview 1-7314 or DAvenport 2-5245.

# Year of Promise in Civil Aviation

This year promises to be an outstanding year for civil airliners built in Britain, not through development of new prototypes of the designs of gas-turbine powered airliners, but because many of the plans based on existing designs will begin to bear fruit.

One important prototype will make its appearance this summer. This is the "Comet 3", the ultimate stage in the development of the basic "Comet" design which first took shape on the drawing board soon after the war. Into the "Comet 3" has gone all the experience of the special problems of jet airliner construction gained from the development of the "Comet" 1 and 2.

However, the main emphasis this year will be on production. The assembly lines will produce "Comet" jet and Vickers "Viscount" propeller-turbine airliners to fill orders from overseas airlines, and to expand the network of air routes on which gas-turbine airliners are now operating. Towards the end of the year production of the long-range Bristol "Britannia" propeller-turbine airliner will begin.

These three types form a pattern in which each is complementary to the other. "Comet" design is based essentially on luxury accommodation and an express speed of travel. The "Comet 1", powered by four de Havilland "Ghost" centrifugal-flow jet engines, carries 36 passengers at a cruising speed of 490 m.p.h. over maximum stage lengths of 1,500 miles. In the "Comet 1A" fuel capacity is increased to give a range of about 1,750 miles, with a seating capacity of 44.

The "Comet 2" is a slightly larger and more powerful version of the design. Four Rolls Royce "Avon" axial-flow jet engines of about 7,000 pounds thrust give it extra power as well as lower fuel consumption which raises its maximum stage length to 2,500 miles with the same seating capacity as the "Comet 1A".

The "Comet 3" takes the basic design and "stretches" it in size, range and power. It will use more powerful "Avon" engines, giving it a cruising speed of 500 m.p.h. and, with extra fuel tanks fitted on the wing leading edge, a range of 2,500 miles. The fuselage will be lengthened by 17 feet, giving capacity for between 58 and 76 passengers. This airliner will almost certainly introduce jet passenger service across the North Atlantic.

The Vickers "Viscount" (series 700) is essentially a [illegible]m-range aircraft, hence it is [illegible]ned for lower speeds, lower [illegible]cude and economical fuel consumption. Its power units are four Rolls Royce "Dart" propeller-turbine engines, which give the "Viscount" a cruising speed of 310 m.p.h. over maximum stage lengths of 1,500 miles. Normal seating capacity is 48, but variations on interior layout take its capacity up to 62.

The "Viscount" series 800, now under development, will have more powerful engines and a longer fuselage to accommodate from 66 to 82 passengers. This is for ranges of about 1,100 miles and will be in production next year.

The propeller-turbine Bristol "Britannia" provides slower but more economical services for tourist-class passengers over the long ranges covered by the Comet. With four Bristol "Proteus" engines, the Britannia "Mark" 100 will carry up to 92 passengers at 350 to 400 m.p.h. over ranges of 3,500 miles. There are two versions, the "Mark" 250, which carries 87 passengers and 10,000 pounds of freight, and the "Mark" 300 to carry 104 passengers.

Provisions for the production of all three were made in anticipation of the orders already placed and in preparation for the demand which the industry expects.

The de Havilland Aircraft company has two production lines of its own for the "Comet" series, and has provided a third line by arranging for another firm, Short Brothers, to produce the "Comet" under subcontract. This will mean that production of the "Comet 3", beginning in 1956, will reach a rate of 70 a year by 1958.

Vickers have turned an entire factory over to producing the "Viscount" at a rate of four a month by next year. The Bristol company is aiming to produce four Britannias a month by 1956.

In addition designs are already well advanced for airliners of the 1960 period onwards. All are based on the critical North Atlantic route on the principle that the airliner designed to economically meet these exacting conditions can fit into any other long range routes.

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# The ASME Boiler Code

### Interpretations

The Boiler Code Committee meets monthly to consider "Cases" where users have found difficulty in interpreting the Code. These pass through the following procedure: (1) Inquiries are submitted by letter to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.; (2) Copies are distributed to Committee members for study; (3) At the next Committee meeting interpretations are formulated to be submitted to the ASME Board on Codes and Standards, authorized by the Council of the Society to pass upon them; (4) They are submitted to the Board for action; (5) Those which are approved are sent to the inquirers and are published in Mechanical Engineering.

The following Case Interpretations were formulated at the Committee meeting April 28, 1954.

#### Case No. 1130

Special Ruling

Interpretations of Parrs. H-29, H-62 and H-115 should be annulled since this Case was written at the time brass was in short supply and allowed the use of cast-iron instead of brass for wash-out plugs in steam heating boilers, there is no shortage of brass now.

#### Case No. 1175

Special Ruling

***Inquiry:*** May low-carbon, high-nickel steel plate, conforming to requirements of Specification SA-353 be used in the construction of unfired pressure vessels under Section VIII? Such vessels would be used for service below −20F.

***Reply:*** It is the opinion of the Committee that low-carbon, high-nickel steel plate conforming to Specification SA-353, may be used in the construction of unfired pressure vessels provided the rules of design, fabrication and inspection of the Unfired Pressure Vessel Code, Section VIII, 1952 are followed, with the following additional provisions:

(1) Specifications — The low-carbon, high-nickel steel plate shall conform to Specification SA-353.

(2) Welding — The welding requirement shall conform to the requirements of Section IX. The classification of the material under Table Q-11.1 shall be P-10.

> "The reduced-section tension specimen shall have a tensile strength that is not less than the minimum of the specified tensile strength of the base material or of the weaker of the two if materials of different specified minimum tensile strength are used, except where Case No. 1182 provides for the use of weld metal at room temperature of lower strength than the base metal, in which case the weld metal shall

satisfy the requirements of Case No. 1182."

(3) Radiography — All longitudinal and circumferential joints shall be double-butt welded and radiographed.

(4) Thermal Stress-Relief — Stress Relieving shall be performed after fabrication by gradually and uniformly heating the vessel to a temperature between 1025F. and 1085F. holding for a minimum of two hours for thickness up to one inch; plus a minimum of one hour for each additional inch of thickness and cooling in still atmosphere to a temperature not exceeding 600F. The heating and cooling rates shall be in accordance with Section VIII.

(5) Allowable Working Stress — The allowable working stress values shall be 22,500 psi except as otherwise provided in Case No. 1182 for weld metal of lower strength than the base metal.

(6) Allowable Temperature — The material may be used at temperatures below −20F.

### Case No. 1185

Special Ruling

***Inquiry:*** Since aluminum alloys GS-11A-T6 and clad GS-11A-T6 are acceptable materials for vessels constructed in accordance with Section VIII and welding qualification are included in the 1953 edition of Section IX, is it permissible to construct vessels of these materials by welding and, if so, what allowable stress values are to be used?

***Reply:*** It is the opinion of the Committee that vessels of aluminum alloys GS-11A-T6 and clad GS-11A-T6 may be constructed by welding provided (1) the applicable rules of Section VIII are followed, (2) the qualification requirements of Section IX are met (3) the stress values in the following table are used where reference is made to stress values in Table UNF-23.

### Case No. 1186

Special Ruling

***Inquiry:*** In view of the urgent need for new rules for openings and reinforcement may the proposed revisions to Par. P-268 which were published in the May, 1954 issue of *Mechanical Engineering* be used for constructions to the Power Boiler Code?

***Reply:*** It is the opinion of the Committee that in view of the need for these new rules for present day designs and since the basic theory is currently being used for constructions to the Unfired Pressure Vessel Code, the proposed revisions to Par. P-268 may be used for constructions to the Power Boiler Code.

### Case No. 1187

Special Ruling

***Inquiry:*** In designing a cylindrical jacketed vessel with staybolts between the jacket and inner shell, would it be permissible to calculate the jacket thickness by using the formula for cylindrical shells under internal pressure? This formula may require less thickness than the one for stayed surfaces when low pressures or small diameters are involved.

***Reply:*** It is the opinion of the Committee that when a jacket extends completely around a cylindrical vessel, the jacket thickness shall be calculated by the formula for cylindrical shells under internal pressure in Par. UG-27(c), and also by the formula for braced and stayed surfaces in Par. UG-47(a), and that the greater of the thicknesses thus obtained shall be used.

#### *Annulment of Cases*

All the Cases that refer to the 1949 Section VIII, Code for Unfired Pressure Vessels are to be annulled effective January 1st, 1955. This refers to the first sixty-nine pages to the Case Interpretation Booklet published February 1st, 1953.

| Alloy and Temper | Specification Number | Maximum allowable stress values for metal temperatures not exceeding deg. F. 100 | 150 | 200 | 250 | 300 | 350 | 400 |
|---|---|---|---|---|---|---|---|---|
| GS-11A-T6 and Clad GS-11A-T6 | SB-178, SB-273 SB-274 | 6000 | 5900 | 5700 | 5400 | 5000 | 4200 | 3200 |

## Proposed Revisions and Addenda to Boiler and Pressure Vessel Code

As need arises, the Boiler Code Committee entertains suggestions for revising its Codes. Revisions approved by the Committee are published here as proposed addenda to the Code to invite criticism.

In the following the paragraph numbers indicate where the proposed revisions would apply in the various sections of the Code.

Comments should be addressed to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.

### Power Boilers, 1953

***Table P-15.*** Revise the "Notes" to read:

(1) Adjusted pressure ratings for steam service at saturation temperature corresponding to the pressure derived from tables 2 to 15 inclusive of ASA Standard B16.5-1953.

(2) Pressures shown include the factor for boiler feed and blow-off line service required by Pars. P-299(d) and P-310(c).

(3) Class A ratings apply to welding ends, ring joints, small tongue and groove facing with any type gasket, large tongue and groove facing with any type gasket, except flat solid metal, and other facings with gaskets which result in no increase in bolt load or flange moment over those previously mentioned. Class B ratings apply to all facings and gaskets not specifically listed under Class A.

### Material Specifications, 1953

The Boiler Code Committee has approved adding to Section II the following new specifications:

***Plates***

SA-7-53T, Steel for bridges and buildings.
SA-129-53T, Open-Hearth iron plates of flange quality.
SA-201-53T, Carbon-Silicon steel plates of intermediate tensile ranges for fusion welded boilers and other pressure vessels.
SA-202-53T, Chromium-Manganese-Silicon alloy steel plates for boilers and other pressure vessels.
SA-203-53T, Nickel-Steel plates for boilers and other pressure vessels.
SA-204-53T, Molybdenum-Steel plates for boilers and other pressure vessels.
SA-212-53T, High tensile strength Carbon-Silicon steel plates for boilers and other pressure vessels.
SA-225-53T, Manganese-Vanadium steel plates for boilers and other pressure vessels.
SA-285-53T, Low and intermediate tensile strength Carbon-Steel plates of flange and firebox qualities (Plates 2 in. and under in thickness).
SA-299-53T, High tensile strength Carbon-Manganese-Silicon steel plates for boilers and other pressure vessels.
SA-300-53T, Steel plates for pressure vessels for service at low temperatures.
SA-301-53T, Chromium-Molybdenum steel plates for boilers and other pressure vessels.
SA-302-53T, Manganese-Molybdenum steel plates for boilers and other pressure vessels.
SA-353-53T, Low-Carbon, High-Nickel steel plates for pressure vessels.

***Tubular Products***

SA-178-53T, Electric-resistance-welded steel and open-hearth iron boiler tubes.
SA-213-53T, Seamless alloy steel boiler, superheater and heat exchanger tubes.
SA-226-53T, Electric-resistance-welded steel boiler and superheater tubes for high-pressure service.
SA-250-53T, Electric-resistance-welded Carbon-Molybdenum alloy-steel boiler and superheater tubes.
SA-335-53T, Seamless Ferritic alloy steel pipe for high temperature service.
SA-369-53T, Ferritic alloy steel forged and bored pipe for high-temperature service.

***Stainless Steel***

SA-193-53aT, Alloy steel bolting materials for high temperature service.
SA-194-53T, Carbon and alloy steel nuts for bolts for high-pressure and high-temperature service.
SA-213-53T, Seamless alloy steel boiler, superheater and heat exchanger tubes.
SA-249-53aT, Welded austenitic stainless steel boiler, superheater, heat exchanger and condenser tubes.
SA-271-53, Seamless austenitic Chromium-Nickel steel still tubes for refinery service.
SA-320-53T, Alloy steel bolting materials for low temperature service.

***Forgings and Miscellaneous Materials***

SA-182-53T, Forged or rolled alloy steel pipe flanges, forged fittings and valves and parts for high temperature service.
SA-193-53aT, Alloy-steel bolting materials for high temperature service.
SA-194-53T, Carbon and alloy steel nuts for bolts for high pressure and high temperature service.
SA-307-53T, Steel machine bolts and nuts and tap bolts.
SA-320-53T, Alloy steel bolting materials for low temperature service.
SA-354-53T, Quenched and tempered alloy steel bolts and studs with suitable nuts.

***Nonferrous Materials***

SB-178-53T, Aluminum and aluminum-alloy sheet and plate for pressure vessel applications.
SB-234-53T, Aluminum-alloy drawn seamless tubes for condensers and heat exchangers.
SB-273-53T, Aluminum and aluminum-alloy bars, rods and shapes for pressure vessel applications.
SB-274-53T, Aluminum and aluminum-alloy pipe and tube for pressure vessel applications.

**Low-Pressure Heating Boilers**

***Preamble.*** Delete entire present Preamble and substitute the following:
These rules are divided into two sections, Part 1 applying to steel plate boilers and Part 2 to cast iron boilers. The code does not contain rules to cover all details of design and construction. Where complete details are not given, it is intended that the manufacturer, subject to the approval of the authorized inspector, shall provide details of design and construction which will be as safe as otherwise provided in these rules.

***Par. H-1(2)*** — Revise to read:
To hot-water heating and hot water supply boilers to be operated at pressures not exceeding 160 psi and temperatures not exceeding 250 deg. F.;

***Par. H-1(4)*** — Add as a new paragraph:
Except as provided in H-1(5) the following classifications are considered not to be within the jurisdiction of this section of the code.

(a) Hot water supply boilers which are directly fired with oil, gas or electricity when none of the following limitations is exceeded.

A heat input of 100,000 btu. per hour.
A water temperature of 200 deg. F.
A nominal water containing capacity of 120 gallons.

***Par. H-1(5)*** — Add as a new paragraph:
All hot water supply boilers including those exempted in H-1(4) shall be equipped with ASME approved safety devices of proper type and size.

**Heating Boilers, 1952**

Delete Pars. H-62 and H-115 because there is no further need for trycocks on heating boilers as it is felt they can operate safely without them.

# *Thirty-five Years Ago*

## Comment on the *JOURNAL* of July 1919

Thirty-five years ago the *Journal* for July, 1919, devoted eight pages of its somewhat limited text content to reprinting in full a schedule of "Compensation for Engineers" that had recently been adopted by the American Association of Engineers. There is, of course, no point in quoting it here in detail; a few excerpts will serve to show its general tenor. The salaries suggested were for "continuous employment . . . with steady advancement in rank and pay . . ." For seasonal employment, such as on construction, "the pay should be such as to amount to about half pay for the necessarily idle season . " and for temporary positions it "should be about 50% above the schedule."

This document first classifies engineers by their specialties—architectural, highway, municipal, public utility, public commission, railway, rural, public improvement, structural or mechanical, telephone and telegraph. Engineers in sales were ignored; perhaps selling was considered non-engineering work, which it certainly is not now. And the engineering teacher was evidently not worthy of a place in the scale. Today other omissions may be noted, but most of them are less real omissions than engineering positions which have developed since this schedule was submitted.

Each branch of engineering was subdivided into positions varying in responsibility from top to bottom. For example, there were 13 classifications of highway engineers, each with its duties carefully specified, but 47 kinds of telegraph engineers, suggesting that the schedule was the work of a zealous, but perhaps somewhat unbalanced committee. It may fairly be said that a schedule written in more general terms and with less attempt to cover the whole field of engineering in minute detail might have been more influential. No matter how representative and expert the committee, it is foolish to think that it could have covered all kinds of engineers, or have dealt with those it did cover with equal skill, either then or now.

A few random examples will suffice to show the general level of salaries recommended: chief highway engineer, $8,000-$10,000: city engineer of a large city, $12,000-$15,000; designing engineer, $5,000-$7,000; general manager (technical) of power utility, $5,000-$8,000; draftsman, $1,800-$3,000; surveyor, $12.50-$20.00 per day. Inflated to 1954 dollars, these rates do not seem out of the way.

The July, 1919, *Journal* is, of course, still promoting the model engineers' licensing act, but there was a lull in activity in this matter at that time. Some Juniors and Students objected to the proposed act because they felt that it might encourage employers to fill minor engineering positions with men without technical training. In a letter to the editor, Mr. C. C. Kirby said, "The students and juniors of the profession should be advised to rely upon their ability to perform their work more efficiently than untrained persons, to obtain employment . . . in the lower stages of the profession, rather than seek protection by legislation, which no other profession enjoys." Another correspondent thought that setting up provincial associations would "impair the usefulness" (polite for "ruin") of the Institute and so proposed that "provincial divisions" of the Institute should become the licensing bodies. Of course, time has proven his fears groundless.

The Niagara Branch wanted Clause i, Section 7, struck out of the act. This clause provided that assistants working under a professional engineer and responsible to him only, should not be considered to be professional engineers.

Letters from six M.P.'s were published, all supporting the campaign for better pay for engineers in the Civil Service. It was also noted that the Acting Minister of Trade and Commerce "has given notice of . . . the bill providing for the reclassification of the Civil Service . . . (which) will . . . straighten out some of the present difficulties."

The Council meetings reported in this number of the *Journal* were concerned almost wholly with routine matters. We do note, however, that "Ross Leonard Dobbin, B.A.Sc., in full charge of water supply and design, Peterboro Utilities Comm., Peterboro, Ont." was advanced to the grade of Member, and that "Thomas Richardson Loudon, B.A.Sc., (Univ. of Toronto) of Victoria, B.C., since May, 1916, Major with C.E.F., 2nd in Command, 1st Batt., Ry. Troops, at present, C.R.C.E., Mil. Dist. No. 11," was also promoted to Member. The first will be recognized as president of the Institute in 1953-54, and the second as Professor T. R. Loudon, who was instrumental in training aeronautical engineers for the R.C.A.F. in 1940-45.

About 70 Montreal members gave Gen. C. H. Mitchell, C.B., C.M.G., D.S.O., a dinner at the Ritz Carlton Hotel to welcome him home from overseas service and to celebrate his appointment as dean of the Faculty of Applied Science and Engineering at the University of Toronto. The banquet menu was most "posh", engraved, with a portrait of Gen. Mitchell and with all his honours set forth at length. On arrival in Toronto, he was given "an informal dinner by the Engineers' Club and the Engineering Institute of Canada . . ."

There were three papers published in July, 1919. The longest and principal one was "The Bloor Street Viaduct, Toronto, Ontario," by

Thomas Taylor. This was a most complete description of the two three-hinged steel arch bridges forming the improvement, a single span across the Rosedale ravine and a multiple span over the Don River and valley. The designer showed commendable foresight in providing for future lower decks in both bridges "as part of a subway system, should the development of the city render (it) desirable." Toronto now has its subway, of course, but so far has not made use of these provisions.

Considerable space in this paper was given to the design and manufacture of the concrete used in footings, piers, abutments, deck, etc. Aggregates and cement were carefully tested, but there was no mention of the quantities of water used in the various trial mixes, a factor which today would be considered of paramount importance. Strengths of standard cylinders made during construction ran from 1,690 to 3,005 p.s.i. for 1:2½: 5 concrete, and from 1,150 to 3,395 p.s.i. for 1: 2¾: 5½ concrete, covering a wider range than would probably be considered satisfactory today.

Quinlan & Robertson, Ltd., of Montreal, were the general contractors for the Don bridge, while the steel work was fabricated and erected by the Hamilton Bridge Co., Ltd. The Dominion Bridge Co., Ltd., furnished and erected the steel for the Rosedale bridge; the rest of the work on this bridge was done by the Raymond Construction Co., Ltd. The author was designing and construction engineer.

In another paper, Mr. Lawrence J. Burpee, its Canadian secretary, asked, "What Is the International Joint Commission?" and answered his own question by outlining the genesis, powers and activities of the Commission. He said it was created because the ways of conventional diplomacy were "too leisurely".

"A question . . . arises at some point on or near the International boundary . . . The local authorities have no power of jurisdiction. The injured parties (let us assume they are Canadian) appeal to Ottawa. The case, cumbered with red tape, travels deliberately through several . . . departments; rests . . . for weeks in the file baskets of (some) officials; is referred back and forth . . .; finally moves on to the Governor-General's Office, and is sent overseas to the Colonial Office in London. Thence it takes its dignified way to the Foreign Office, and back across the Atlantic to the British Ambassador in Washington. The Ambassador takes the matter up with the Secretary of State . . . and the weary process of red tape is repeated . . ."

A short paper, "Overhead and General Costs in Manufacturing," by Thomas R. Deacon, tried, successfully we think, to bring home to engineers the fact that the total cost of any product was made up of far more than merely the cost of material and labour. Mr. Deacon's points were illustrated by a number of homely anecdotes, of which we like this one "A . . . foundryman . . . offered to install cost systems for his local competitors at his own expense, as it cost him far more trying to meet their inaccurate estimates, based on inaccurate cost data, than it would . . . for him to hire cost experts for all of them."

This paper seems to have been the first dealing with the economics of engineering ever published in the *Journal*. It was certainly not the last, as engineers became more and more conscious that money was one of their materials, too.

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# News of Other Societies

The second western regional conference of the **Chemical Institute of Canada** (18 Rideau Street, Ottawa 2) will be held in Vancouver, B.C., September 10-11, 1954.

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Officers of the **Canadian Fan Manufacturers' Association** (P.O. Box 275, Windsor, Ont.) are: president, C. W. Johnson, vice-president of Canadian Sirocco Company; vice-president, K. W. Fraser, M.E.I.C., general manager of B. F. Sturtevant Company of Canada Limited; secretary-treasurer G. W. McCormick, Jr.

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Meetings of the **American Institute of Chemical Engineers** (120 East 41st St., New York 17, N.Y.): September 12-16, 1954, Glenwood Springs, Colorado, Hotel Colorado; the annual meeting, New York City, December 12-15, 1954, Statler Hotel.

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The University of Connecticut has announced the fourth annual management conference sponsored by its School of Business Administration, and the New England chapters of the **Society for the Advancement of Management**, August 20-28, 1954. Information and program are available from Harold E. Smalley, University of Connecticut, Storrs, Connecticut.

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The 27th annual meeting of the **Federation of Sewage and Industrial Wastes Associations** (325 Illinois Bldg., Champaign, Ill.) is arranged for October 11-14, 1954, at Cincinnati, Ohio.

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There will be an international meeting on technique of ships and navigation in Naples, Italy, under the sponsorship of the **National Council of Research** and other naval and marine engineering associations. Information about this meeting, called for the second fortnight of September, 1954, can be obtained from the Secretaria del Congresso di Scienza della Nave e della Navigazione, presso Mostra D'Oltremare, Napoli, Piazza Campi Flegrei.

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## MARITIME PROFESSIONAL MEETING

Digby Pines—Sept. 8, 9, 10, 11, 1954

**Registration and Room Reservation Card**

Last name........................ Full Christian names........................

Address........................

Firm........................ Position........................

Accompanied by........................

(Give full names........................

and addresses)........................

Accommodation required........................ All rooms with twin beds and bath

Time of arrival........................ Date........................ By { car / bus / train / boat

**This tab can be used for registration. Clip it and send it by August 16, 1954, to: W. V. Lodge, M.E.I.C., P.Eng. P.O. Box 460, Halifax, N.S.**

# *Maritime Professional Meeting*

of the Maritime and Newfoundland Branches of the Engineering Institute of Canada and The Associations of Professional Engineers of Newfoundland, New Brunswick and Nova Scotia.

## *September 8, 9, 10, 11, 1954, The Pines, Digby, N.S.*

### Ladies' Program

The ladies will be welcome at all functions on the general program. In addition, special entertainment has been arranged by the Ladies' Committee.

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**Registration:**

Wednesday, 2.30 P.M. to 9.00 P.M.

Thursday, 10.00 A.M. to noon

Advance—You can use the tab on the opposite page to register. Just clip it and send it to W. V. Lodge, M.E.I.C., P.Eng., P.O. Box 460, Halifax, N.S.

**Hotel:**

Convention rate at The Pines is $12.00 per person per day double, and $14.00 single, including meals. All rooms have twin beds and bath. It will be necessary for two guests to occupy each room. Assignment of rooms will be made by the Registration Committee.

**Dress:**

Dress informal.

**Fees:**

Registration fee will be $7.00 for members and $3.00 for ladies. These fees include all costs except golf, swimming and hotel.

**Transportation:**

Delegates planning to take the attractive boat trip across the Bay of Fundy on the S.S. Princess Helene, should obtain full particulars from Canadian Pacific agents. Early reservations are recommended.

## *Program*

### Wednesday, September 8

2.30 P.M. Regional Meeting of E.I.C. Council

9.00 P.M. Operation Night Cap

### Thursday, September 9

8.15 A.M. Early Bird Breakfast

10.00 A.M. Professional Sessions

"Some Industrial Applications of Fluid Drive"
Antony Vickers, Executive Director, Fluidrive Engineering Co. Limited, Isleworth, Middlesex, England.

"Gas Turbines"
Author to be announced.

1.00 P.M. Luncheon

Addresses by Mayor G. E. Morehouse, of Digby, N.S., W. L. Sagar, President of the Dominion Council, and D. M. Stephens, President of E.I.C.

2.45 P.M. Sports and Recreation

6.30 P.M. Reception

7.30 P.M. Dinner

Address by Allan MacEachen, M.P. for Richmond-Inverness, Federal Government.

10.00 P.M. Grand Ball

### Friday, September 10

10.00 A.M. Professional Sessions

"St. Lawrence Waterways"
S. W. Fairweather, Vice-President, Canadian National Railways.

"Atomic Power"
John Convey, Director, Mines Branch, Department of Mines and Technical Surveys, Ottawa.

1.00 P.M. Luncheon

Address by Leslie Roberts, Author

2.30 P.M. Golf Tournament

6.30 P.M. Reception

7.30 P.M. Dinner

Address by The Hon. J. R. Smallwood, Premier, Newfoundland.

10.00 P.M. Old Time Dance

### Saturday, September 11

As you like it.

# NEWS OF THE ASSOCIATIONS & CORPORATION

**Information received through co-operation with the provincial organizations**

## Nova Scotia

### Appreciation

The Association of Professional Engineers of Nova Scotia appreciates the privilege of receiving space in *The Engineering Journal* for a presentation of the activities of the Association.

For some time it has been the wish of Council to provide the membership at large with more information with respect to the work of the Council. It is the hope that the column in *The Engineering Journal* will help supply information which may be of interest.

### Syllabus Studied

A study of the Ontario, Quebec, and British Columbia Syllabus has been undertaken by the examining board of the Association, and in general the Syllabus seems to be satisfactory. However, some problems with respect to the cost of examinations need to be solved. Professor M. L. Baker, Vice-President of the Association, has made inquiries regarding this subject while attending Dominion Council Meeting at Toronto.

### Transfer Fee and Unity

The Transfer Fee for a member in good standing in any other provincial association or the corporation has been abolished when transferring his membership from such an association to the Nova Scotia Association.

A discussion of the J. Herbert Smith "Plan for Unity" was directed by Councillor J. W. MacDonald and Vice-President, Professor M. L. Baker. These two men were particularly qualified to lead the discussion because of their recent contact with members attending the E.I.C. Annual Meeting at Quebec.

The Association's prize to a Nova Scotia Technical College graduate has been increased by double the present amount.

### Officers Appointed

It is a pleasure to announce the following appointments:

Secretary-Treasurer and Registrar: J. D. Kline.

Dominion Councillor: President J. E. Clarke.

Representative on E.I.C. general council: Professor A. E. Flynn.

Representatives on Joint Finance Committee: W. H. Noonan and G. F. Bennett.

Members of Examining Board: W. A. Devereaux, K. E. Whitman, G. D. Stanfield, M .F. Dean, M. R. Foran and G. H. Burchill.

Nominating Committee: D. J. MacNeil, G. J. Currie, J. E. Clarke, Ira P. Macnab and J. D. Kline.

Executive Committee: J. E. Clarke, M. L. Baker, G. J. Currie, J. W. MacDonald and V. M. Coy.

Professional Relations Committee: Dr. Sexton, chairman, and C. N. Murray, F. C. Morrison, W. A. Devereaux, G. T. Clarke, G. D. Anderson, J. P. Vaughan and D. F. Kirk.

## Quebec

The address delivered by the new president at the Annual dinner of the corporation.

Dear Fellow Members:

I am happy to express to every one of you my most sincere thanks for the honour you have conferred upon me by electing me President of the Corporation of Professional Engineers of Quebec. I shall interpret this high consideration as a mark of confidence and with the special collaboration of Council I intend to do my utmost this year to prove worthy of it.

My first ambition would be to succeed in enhancing the prestige of the engineer. This I consider an imperative need over and above the satisfactory solution of the numerous professional problems which confront us.

If the profession is to be true to itself it is necessary that each member be endowed with precise scientific knowledge as well as with unquestionable moral values. Hence we need to limit the practice of the profession to people possessing these qualifications.

It is therefore necessary for the safeness of his profession that the engineer practise according to these principles and that he derive all the merit and the prestige accruing from his work; it is conversely necessary that no one else but he may do so.

As you can see this leads us to action respecting our Act in its present form to prevent further illegal practice and breach of ethics.

Your Council wishes to undertake this task immediately and feels that it can be successful only with the assistance of all the members of the Corporation. I have noted, for instance, that ideas vary considerably as to what constitutes a profession, practice of the profession, engineering work, professional services, and that as a result, our Act is given different interpretations by various individuals or groups, each believing itself to be right.

To clarify this situation, your Council has retained the services of a legal advisor who will attend all its meetings. We are confident that his knowledge will serve the purpose of establishing a better understanding of the profession in order to eventually increase the prestige of the engineer.

In closing I would like to assure you that your Council will seek, by every means, to co-operate with other engineering organizations of the country; and more particularly with those interested in setting up a "Plan for Unity of Engineers". A similar collaboration will be pursued with all other professions who work in fields closely allied to engineering.

GEO. DEMERS,
*President.*

## Ontario

### Dominion Council Annual Meeting

On May 26 to 29 the Ontario Association was privileged to act as host to the Dominion Council of Professional Engineers, gathering in Toronto for its Annual Meeting under the Chairmanship of Dean R. M. Hardy, of the University of Alberta. Each of the eight Provincial registering bodies was represented by either its president, vice-president or a past-president.

Such meetings—and this was the seventeenth Annual Meeting of Dominion Council—are productive of much that is worth while to the profession in Canada. What might take months to settle by correspondence can often be brought to a satisfactory conclusion during a few minutes conversation around a table. Provincial viewpoints are broadened to embrace the whole of Canada. From the interchange of ideas at Dominion Council there is being built a substantial foundation to the engineering profession in Canada.

#### Representatives of Sister Bodies

A very satisfying feature of the 1954 Annual Meeting of Dominion Council was the attendance of representatives of sister bodies and Government. Among Canadian technical bodies were The Engineering Institute of Canada, the Canadian Institute of Mining and Metallurgy, and the Chemical Institute of Canada, and from the Federal Civil Service Commission, its Chief of the Professional Examination Division, G. A. Blackburn. Dominion Council was further honoured by the presence of officers of leading professional engineering bodies in the United States—the National Council of State Boards of Engineering Examiners, the National Society of Professional Engineers and the Engineers Council of Professional Development, the last being represented by its chairman and a member of our own Association, Col. L. F. Grant.

#### Achievements

Very concrete evidence of the achievements of Dominion Council in its work of promoting greater uniformity in professional matters across the Dominion is to be found in the latest edition of the recommended Schedule of Minimum Salaries for Professional Engineers. A glance at the cover will reveal that the Schedule is published with the endorsation of eight of the nine Associations and the only reason the ninth was not included was that at the time of printing the results of a poll of the members on the matter were not complete.

The Syllabus of Examinations, now in use by our Association, bears the seals of two other provincial bodies and when the next edition is printed it is probable that this number will be doubled. Officers and members of past Dominion Councils must take considerable satisfaction in the fruits of their efforts.

#### The Consultant Is Well Qualified

While the professional engineer in Canada is gradually receiving the additional recognition which he desires and deserves, there still remain a number of persons in municipal administration, in industry, and even in the ranks of the profession itself who believe that industrial buildings are not within the scope of professional activity of the engineer.

To many, too, of the general public the term "Consulting Engineer" is associated with sewers, waterworks, roads and bridges. If, however, it is a proposed building that is under consideration will they turn immediately to the consulting engineer? All too frequently the answer is in the negative.

Where does the professional engineer fit into the picture as to design of industrial structures? Let us examine a few of the problems involved:

1. Consideration of process and flow with studies to produce the most efficient layout.
2. Examination of the site with regard to topography, transportation, provision for expansion, drainage and services; the examination of the soil, design of drainage and services, roads, parking lots, curbs, gutters, landscaping, and treatment of industrial waste, if necessary.
3. Structural design, plan, elevations, and details.
4. Design of process steam or heating plant, with distribution.
5. Design of any required ventilating or air conditioning system.
6. Design of electrical services and distribution.
7. Layout of machinery and equipment with connections.
8. Design of conveying or other special machinery or equipment.

Relative to the above, preliminary studies and sketches must be made and estimates prepared. Finally, the production of working drawings and specifications make it possible to obtain competitive bids and award a contract.

Analysis of items 1 to 8 will show clearly that all are engineering problems best solved by civil, mechanical and electrical engineers.

A firm of consulting engineers, by reason of the combined training and experience of its principals and staff, is best able to design an industrial plant in part or whole and to supervise the construction.

What about the aesthetic side, someone will ask. The art exhibit shown at the recent annual meeting of the Association surely indicates that the professional engineer is not lacking in artistic ability.

To those with industrial problems or who contemplate the building of new plants or extensions to existing ones we need have no hesitation in stating that the Canadian consulting engineer is well qualified to handle the job and to save money for his client.

## Saskatchewan

#### Minimum Salaries Approved

At a Council meeting held April 20, the Association approved of a Schedule of Minimum Salaries. This schedule is now endorsed by professional associations in Alberta, British Columbia, New Brunswick, Newfoundland, Nova Scotia, Ontario, Quebec, and Saskatchewan. Copies may be obtained from the Registrar's office.

#### Minimum Consulting Fees Adopted

The Saskatchewan Association has adopted a Schedule of Minimum Fees for professional engineering services, for an interim period of one year. This schedule was drawn up by a committee

**The executive of the Association of Professional Engineers of Newfoundland. Front row, left to right: M. A. Foley, secretary-treasurer, registrar; E. L. Ball, president; C. A. Knight, vice-president. Back row: Councillors W. Watson, C. H. Conroy, J. Breakey, E. Dickinson, immediate past president, E. M. Martin. Missing: Councillors E. Hinton, H. B. Carter, J. M. Hopkins, D. A. Poynter. The membership of the Association now stands at 104.**

headed up by Prof. A. Michalenko of the University of Saskatchewan, Saskatoon.

### Atomic Power Committee

J. W. Tomlinson, a member of the Saskatchewan Association, and general manager of the Saskatchewan Power Corporation, has been named to an advisory committee on atomic power being formed by the federal government. The committee is to consist of senior executive officers of all power commissions and corporations in Canada. The committee would keep those producing power in Canada informed of the progress in developing feasible atomic power production.

Trade Minister C. D. Howe announced formation of the committee in a statement on atomic power in the House of Commons on June 2.

## Alberta

### President's Report

The following report was presented at the 34th Annual Meeting of the Association of Professional Engineers of Alberta, held at Calgary, March 27, 1954:

### Growth of the Association

The reports presented to you by the Chairmen of our various committees and by our representatives on other organizations have given you a broad picture of the work carried on by the Association during the past year. It has been a year of continuing steady growth in membership, which we believe was greatly assisted by the tour which our Executive Secretary made last summer to many outlying points where engineers are stationed. We feel that this work of making contact with engineers who often have no other chance to hear personally about their Association is well worth while, and is appreciated by the members visited.

In spite of increased expenditures, you have heard that our net income added to surplus amounted to $778.40. This indicates the higher income from increased fees and from growing membership, but it also reflects the careful administration of our funds by the Council and efficient management by our Registrar and Executive Secretary.

Many other matters engaged the attention of your Council at its seven regular meetings and three special meetings. Most of these have been mentioned in the various issues of your paper, "The Alberta Professional Engineer," and particularly in the review given in the January, 1954 issue. I need not elaborate on some of these at this time as they will be dealt with at the Forum Sessions this afternoon. However, some others should perhaps be mentioned to bring you up to date.

### Legislation

A proposed revision of The Alberta Boilers' Act was issued for the consideration of all concerned, but after representations from various sources, including our Committee, had been made, the Department decided to hold the Bill over for one year. This will allow more study of the proposals and a better opportunity for everybody interested in the Act to make further representations.

### Co-operation and Uniformity

It has been encouraging to note the progress made in friendly relations and in co-operation between the various Associations of Professional Engineers. Uniformity in examination requirements and qualifications for membership is gradually being reached. One example of improvement in relations has been the recent dropping of the transfer fee between a number of the associations and it is hoped that this will be extended to all the associations in the near future. As a result of this willingness to co-operate it would appear that there is now a possibility that the "Plan for Unity" suggested by J. Herbert Smith, P.Eng., Past President of the Association of Professional Engineers of Ontario, or some similar plan, will have a chance for success. Personally, I sincerely hope that this will be the case. It has always been a matter of regret that the Engineering Profession has not had one strong single organization to speak for the entire profession. This matter will be dealt with in "The Forum" this afternoon.

### Engineers Welfare

The Salary Survey will also be discussed at the Forum. There is a great deal of work involved in such a survey and it takes months to complete. Some of our members were perhaps a little disappointed that the results could not be made available to them sooner than was the case, but every effort was made to complete the survey as rapidly as possible.

In the matter of Salary Negotiations by groups of our Members, I should like to assure all our members that your Council is most desirous of giving every assistance possible. There are usually two stages necessary. First, job descriptions must be written up and all the positions classified by grades. Then the second stage can be started to negotiate salary ranges for each grade. How far the Association should go in assisting members in such negotiations is a question upon which the Council will welcome your opinions and directions. The breadth of our membership is possibly a cause of difficulty in dealing with this problem. We accept the principle that every engineer should enjoy a salary comparable with other salaries paid for similar work in the same area. But we do not only have members who are employees on salary, we also have members who are managers and employers, and members who are consultants. We can easily become involved in delicate and embarrassing situations.

### Public Relations

The status of our Profession is always of concern to all of us. It has seemed to me that our standing in our communities will be commensurate with the parts which we play in those communities. If we accept responsibility for, and give leadership in community activities our prestige among our fellow citizens will rise. The number of engineers taking part in service clubs, giving of their time and effort on committees and boards for community projects, charitable institutions, athletic associations, Chambers of Commerce, churches and so forth is increasing. We should every one accept opportunities to play our part in these activities. Unfortunately we may not always be known as engineers. But that recognition, I believe, will come, and we can assist by making it known that we are engineers.

That is a good beginning, but I feel that we have an obligation to go further. Some of us should offer to serve on city or municipal Councils, on School Boards, or even become politically minded and run for the Provincial Legislature or for Parliament. Many of us cannot afford the time for these things, but consider how many of us reach retirement age in good health, and with a wealth of training and experience. Men like C. D. Howe and others have blazed the trail. Many more of us should be willing to follow. This, I feel, is the surest way to raise the standing of our Profession.

It has been a pleasure during the past year to work in the Association with so many men whose ability, friendliness, and efforts on behalf of the Profession I so greatly admire. The co-operation and support and advice of all Members of Council and of the Registrar and Executive Secretary have been outstanding. I deeply appreciate these things and am grateful for the year's experience, and the honor which you did me when you elected me President.

J. J. Hanna,
*President*

***The Maritime Professional Meeting***

of The Engineering Institute and the Associations of Professional Engineers of Nova Scotia, New Brunswick and Newfoundland.

***The Pines, Digby, N.S.***

September 8, 9, 10, 11, 1954.

***The program is on page 857 of this issue***

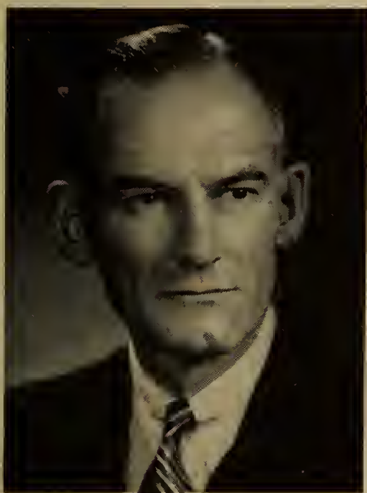
# Personals

**News of the Personal Activities**

**of**

**Members of the Institute**

**K. F. Tupper,** M.E.I.C., until recently dean of the Faculty of Applied Science and Engineering at the University of Toronto, has been appointed president



K. F. Tupper, M.E.I.C.

of Ewbank & Partners (Canada) Limited of Toronto. The new Canadian company is associated with Ewbank & Partners Ltd. of London, England, thermal and electrical engineering consultants, well known in Britain, the Middle East and other parts of the world.

Mr. Tupper has been with the National Research Council and Turbo Research Limited, engaged on the research and design of gas turbines. In 1947 he became director of the engineering division of the atomic industry project at Chalk River. Two years later he was appointed to his post at the University of Toronto.

The new company will operate in close association with Crippen Wright Engineering Limited, engineering consultants in the hydro and civil engineering fields in Vancouver, B.C.

**G. L. Macpherson,** M.E.I.C., has been recently elected a director of Imperial Oil Limited.

General manager of the company's refining operations in Toronto, Mr. Macpherson graduated in mechanical engineering from the University of Toronto in 1920 and entered Imperial Oil Limited as a draughtsman in 1922 in Sarnia where he was employed on the designs for the company's Calgary refinery.

In 1930 the company sent him to the Massachusetts Institute of Technology to study advanced details in refinery design, and on his return he was engaged in the development of refinery equipment.

He was appointed assistant chief engineer in 1937 and six years later, he was named chief engineer, and subsequently manager of the engineering and development division. He became general manager of the company's manufacturing operations in 1949. One of his jobs during World War II was helping to build and set in operation the Polymer Corporation plant at Sarnia.

Mr. Macpherson is a past-president of the Association of Professional Engineers of Ontario. He has also served as chairman of the Sarnia Branch of the Institute and as councillor representing that Branch.

**A. Eric Rankine,** M.E.I.C., was elected a director of Racey, MacCallum and Associates Limited at the annual meeting of the company in May, 1954, and

A. Eric Rankine, M.E.I.C.

has moved to Toronto to direct the operation of the Toronto office.

He is a graduate of Glasgow University in both mechanical and electrical engineering. After serving a post-graduate apprenticeship with Metropolitan Vickers Electric Co. Ltd., he was for some years area engineer for Shell Mex Brazil Ltd.

Upon his arrival in Canada in 1952, Mr. Rankine joined the firm of Charles Warnock and Company Limited which he subsequently left to become one of the original members of his present company when it was formed later that year.

Mr. Rankine is a member of the Association of Professional Engineers of Ontario, and an associate member of the Institution of Electrical Engineers of Great Britain.

**W. Sefton,** M.E.I.C., has been appointed to the position of chief engineer and director of W. V. Zinn & Associates Ltd., consulting engineers in Toronto.

W. Sefton, M.E.I.C.

Previous to this appointment Mr. Sefton was senior engineer supervising design with C. D. Howe Co. Ltd. in Montreal. Some of the projects on which he was employed were the Seven Islands Terminal for the Labrador Quebec Iron Ore scheme, grain elevators, docks and general structural work.

Mr. Sefton graduated from the University of London in 1938 and served with the Royal Engineers with the rank of captain during World War II in the United Kingdom, Africa, Italy and the Middle East. He was wounded at Anzio and was mentioned in despatches.

His earlier engineering experience in the United Kingdom included much structural design on industrial projects. He also served as resident engineer on the construction of a $50 million atomic factory.

Mr. Sefton, who is an authority on concrete shell roofs, delivered a paper on this subject to the Montreal and Ottawa Branches of the Institute, as well as to the Province of Quebec Architects Association. He has devised the only fully precast prestressed type of shell.

Mr. Sefton is an associate member of the Institute of Civil Engineers, the Institution of Structural Engineers, and the American Society of Civil Engineers.

**W. P. Ferguson,** M.E.I.C., has been appointed president and general manager of Peacock Brothers Limited of Montreal. He was previously general sales manager.

W. P. Ferguson, M.E.I.C.

Mr. Ferguson received his engineering degree from McGill University in 1924 and has been with Peacock Brothers since that time. He was in charge of the Toronto and Sydney offices, and was a director and western manager of the company in Vancouver before coming to Montreal in 1947.

**Robert W. Johnstone,** M.E.I.C., has been appointed a vice-president of the Foundation Company of Canada Limited.

Mr. Johnstone came to Canada in 1925 from Scotland where he received his training as a civil engineer. During his long service, Mr. Johnstone has been responsible for the construction of a number of major projects in the commercial, industrial and mining fields in Ontario.

Mr. Johnstone, who is also a vice-president of the Foundation Company of Ontario Limited, is a member of the Association of Professional Engineers of Ontario, a fellow of the Royal Institution of Chartered Surveyors, a member of the Royal Sanitary Institute, and a member of the Toronto Board of Trade.

**Lt.-Col. W. D. Kirk, O.B.E.,** M.E.I.C., chief engineer and a director of E. G. M. Cape and Company, has recently been appointed a vice-president of the company.

Lt.-Col. Kirk received his B.Sc. degree from Queen's University in 1928.

Lt.-Col. W. D. Kirk, M.E.I.C.

He entered E. G. M. Cape and Company in 1935 as resident engineer on a Montreal Harbour project.

During World War II he served with the R.C.E., and was awarded the O.B.E in 1945.

Lt.-Col. Kirk was appointed chief engineer of E. G. M. Cape and Company in 1949.

**James S. Whyte,** M.E.I.C., **chief engineer** of Shawinigan Chemicals Limited at Shawinigan Falls since 1927, has been appointed a vice-president of the company in charge of engineering.

Mr. Whyte will continue to make his headquarters at Shawinigan Falls, but will act also as consultant to the engineering department of Midwest Carbide Corporation which is associated with Shawinigan Chemicals, in connection with its carbide plants at Keokuk, Iowa, and Pryor, Oklahoma.

Born near St. Thomas, Ont., Mr. Whyte was educated there and at Queen's University where he received his degree in electrical engineering in 1914. After two years in the Cobalt

J. S. Whyte, M.E.I.C.

and Porcupine mining areas of Ontario, he came to Montreal to join Canadian Electro Products Company, at that time a newly-organized direct subsidiary of Shawinigan Water & Power, and later in 1916 he was transferred to Shawinigan Falls for the construction of its plant.

A year later he was put in charge of the construction of a war plant for American Electro Products at Shawinigan, and then was transferred to Canada Carbide Company. He was appointed chief engineer of the combined companies when Shawinigan Chemicals was formed 27 years ago.

Mr. Whyte is a member of the Corporation of Professional Engineers of the Province of Quebec.

**G. E. Sarault,** M.E.I.C., has been elected chairman of the Quebec Branch of the Engineering Institute for the term 1953-54.

He was born in Montreal and attended Mont St. Louis College there, and later McGill University where he received his electrical engineering degree in 1934.

During the summer months of his university course he was employed by Beauharnois Power Construction Company, the Laurentian Forest Protection Association, and Canadian Electronics. Upon graduation he joined Northern Electric Company Limited where he remained until 1938 when he entered the Canadian Broadcasting Corporation as engineer in charge of the CBF transmitter. The following year he was named CBC regional engineer for the Province of Quebec.

G. E. Sarault, M.E.I.C.

Mr. Sarault continued in that capacity until 1942 when he joined the staff of Laval University, becoming head of the department of electrical engineering. At the same time he served as a consultant and subsequently formed the firm of Tasse, Sarault and Associates, specializing in the electrical, heating and ventilating fields.

In 1953 he resigned his position as director of the electrical engineering department of Laval University, but has continued to serve on the staff as professor.

Mr. Sarault served as vice-chairman of the Quebec Branch of the Institute in 1953. He is a member of the Corporation of Professional Engineers of the Province of Quebec.

**Professor H. R. Theakston,** M.E.I.C., head of the department of engineering of Dalhousie University, has been awarded the honorary degree of Doctor of Engineering by the Nova Scotia Technical College.

Professor Theakston joined the faculty at Dalhousie University in 1921 as assistant professor of engineering and engineer-in-charge of buildings and grounds. He became professor of engineering in 1929 and head of the department in 1946.

He is a member of the Association of Professional Engineers of Nova Scotia, the American Society for Engineering Education, the Canadian Standards Association, and the senates of Dalhousie University and the Nova Scotia Technical College.

**Dr. Ira P. Macnab,** M.E.I.C., general manager of the Public Service Commission in Halifax, N.S., has been granted the degree of Doctor of Engineering by the Nova Scotia Technical College at its recent convocation.

Dr. Macnab is a past-president of the Association of Professional Engineers of Nova Scotia, the Dominion Council of Professional Engineers and the Engineering Institute.

He is a member of the executive of the Nova Scotia Accident Prevention Association, the board of the Children's Hospital and the board of governors of the Nova Scotia Technical College. He is at present serving his second term as president of the Halifax Board of Trade.

**Donald F. MacIsaac,** M.E.I.C., of Halifax, president of the Atlantic Construction Company and Industrial Machinery Company Limited, was awarded the honorary degree of Doctor of Laws at the post-centenary convocation of St. Francis Xavier University on May 26.

Mr. MacIsaac, a native of Dunmore, Antigonish County, graduated from St. Francis Xavier University in 1909. He subsequently studied at Pennsylvania University where he received his B.Sc. and C.E. degrees.

He is a member of the Association of Professional Engineers of Nova Scotia and of the Canadian Construction Association.

In the Halifax area he has engaged in the work of hospital administration and is a member of the Nova Scotia Housing Commission. He is a member of the board of governors of St. Francis Xavier University and a former president of its Alumni Association.

**Professor F. H. Sexton,** M.E.I.C., president emeritus of the Nova Scotia Technical College was awarded the honorary degree of Doctor of Laws by St. Mary's University at its recent convocation.

Professor Sexton received his early education in New Hampshire and his degree of B.Sc. from the Massachusetts Institute of Technology in 1901. In the years that followed he lectured at the Institute, at Dalhousie University and at the Nova Scotia Technical College.

He was employed for two years as research metallurgist with the General Electric Company in Schenectady, N.Y., and later was appointed assistant professor of mining engineering at Dalhousie University.

In 1907 he was appointed president of the Nova Scotia Technical College and director of technical education for Nova Scotia. He retired in 1947.

Professor Sexton was awarded the Julian C. Smith Medal by the Engineering Institute in 1944. He has served as president of the Mining Society of Nova Scotia, the Canadian Education Association and the Nova Scotia College of Art. He also served as chairman of the Curriculum Revision Committee of the Nova Scotia Department of Education and was a director of the Nova Scotia Research Foundation and a member of the provincial advisory committee on vocational education. He is now a member of the board of governors of the Nova Scotia Museum of Science.

**J. T. Dyment,** M.E.I.C., director of engineering for Trans-Canada Air Lines, was awarded a fellowship in the Royal Aeronautical Society at the annual general meeting recently held in London, England.

The honour is bestowed each year on an aviation expert who has contributed to the technical development of air transportation.

Mr. Dyment is a native of Barrie, Ont., and an engineering graduate of the University of Toronto. Before joining TCA in 1938, he was associated with the Ford Engineering Laboratories at Dearborn, Mich., the aeronautical division of the Department of National Defence, and the Dominion Department of Transport.

Since 1945 he has been a member of the technical committee of the International Air Transport Association and has been chairman of two symposia dealing with turbine power and helicopters.

He served as chairman of the Winnipeg Branch of the Institute in 1943, and in 1945 was awarded the Gzowski Medal of the Institute for his paper "The Engineering Selection of an Airline Aeroplane".

W. K. Gwyer, M.E.I.C.

**W. K. Gwyer, M.B.E.,** M.E.I.C., assistant manager of the engineering division of Consolidated Mining and Smelting Company of Canada Limited in Trail, B.C., has been elected chairman of the Kootenay Branch of the Engineering Institute.

Mr. Gwyer was born in Vancouver B.C., and obtained his elementary education in Penticton, B.C. He then entered the Universitv of British Columbia where he received his B.A.Sc. degree in civil engineering in 1936.

Previous to graduation he was employed as instrumentman on highway location and topographical survey.

In 1936 he served as superintendent of road construction with E. J. Ryan & Associates. Two years later he became superintendent of construction on National Defence projects for Northern Construction Company and E. J. Ryan Ltd.

Mr. Gwyer served with the Royal Canadian Air Force from 1940 until 1945. During that time he was navigator-pilot and O/C of Experimental Flying at E.C.F.S., England. He was later created a Member of the British Empire.

In the five years following the war Mr. Gwyer was associated with the firm of Stevenson and Kellogg Limited and was engaged in plant layout, time, method and organization studies, job evaluation, as well as standard cost and budgetary control installations.

He joined Consolidated Mining and Smelting Company of Canada Limited in Trail, B.C., as assistant to the construction superintendent in 1950. In 1953 he was appointed assistant manager of the company's engineering division.

**Jean P. Carriere,** M.E.I.C., has been appointed chief engineer of the development engineering branch of the Department of Public Works.

This announcement was made by Public Works Minister R. H. Winters, M.E.I.C., who stated that the position of chief engineer of the development engineering branch has been newly created to give more direct supervision over work which has become the responsibility of the Department following the change in Cabinet portfolios last September.

Mr. Carriere has had experience as an engineer in both government and private practice. He was born in Hull, Que., and was educated at College Notre Dame, and Ecole Technique in Hull, and at LaSalle Academy and the University of Ottawa.

He served in various engineering capacities with the Department from 1929 to 1940 in Ottawa, and in the Districts to Rimouski, Montreal, Quebec and London, Ont.

In 1940 he was posted overseas as an officer with the Royal Canadian Engineers. Upon his return to Canada in 1942, he attended the War Staff course and later became a member of its staff. He went overseas again in 1943 and took part in the invasion of Europe as engineer in charge of construction of defence airfields. His final appointment in the field was that of deputy chief engineer for the First Canadian Army, and as such, he carried special responsibility for the construction of bridges across the Rhine and its tributaries. For his war services he was created an Officer of the Order of the Crown by Belgium, and Chevalier de la Legion d'Honneur by France. He was also awarded the Croix de Guerre avec Palme by the French Government.

In 1945 he was discharged with the rank of brigadier, and returned to his position in the engineering branch of the Department of Public Works at Ottawa, remaining there until early 1946 when he resigned from his position

**J. P. Carriere, M.E.I.C.**

to become chief engineer for the City of Hull, Que.

During the following three years he was a member of the National Capital Planning Committee and a member of its various sub-committees.

He was appointed chief engineer of Dufresne Engineering Co. Ltd. of Montreal in 1949, and since 1951, has served as chief engineer of Collet Freres Ltd. in Montreal.

Mr. Carriere is a member of the Corporation of Professional Engineers of the Province of Quebec.

**E. K. Cumming,** M.E.I.C., president of Cumming Galbraith Limited, has been elected chairman of the Edmonton Branch of the Engineering Institute.

Mr. Cumming was born in Cayley, Alta., and received his early education there and at Nanton. He began his engineering course at the University of Alberta and completed his two final years at McGill University, graduating with a B.Eng. degree in mechanical engineering in 1944.

He then served as an engineer lieutenant with the Royal Canadian Naval Volunteer Reserve in the European area, after which he was appointed instructor in mechanical engineering at the University of Alberta, and at the same time supervisor of building construction at the university.

In 1948 he formed Cumming Galbraith Limited to handle the supply of heating, ventilating and air conditioning equipment for the C. A. Dunham Company, the Canadian Sirocco Company, and Powers Regulator Company of Canada Ltd.

Mr. Cumming is a director of several

**E. K. Cumming, M.E.I.C.**

other Alberta companies. He is a member of the Association of Professional Engineers of Alberta, and is at present chairman of the Association's Public Relations Committee.

**Dugald Cameron,** M.E.I.C., president of Dugald Cameron Associates Limited in Malton, Ont., and director of Thomas C. Wild Machinery (Canada) Limited, has been appointed vice-president and managing director of Dexion (Canada) Limited.

Mr. Cameron has been connected with the steel industry for over 30 years. He received his engineering training in Scotland before coming to Canada in 1923. He is a member of the Association of Professional Engineers of Ontario.

**R. B. Spence,** M.E.I.C., has been appointed general sales manager of Canadian Vickers Limited in Montreal. Before his recent appointment he was assistant sales manager of the company.

Mr. Spence is a graduate in chemical engineering of the University of Toronto, class of 1948.

**John B. Stirling,** M.E.I.C., has been elected president of the Montreal Better Business Bureau for the year 1954-55. He succeeds Romuald Bourque, M.P.

**J. G. G. Kerry,** HON. M.E.I.C., has completed 60 years of corporate membership in the Engineering Institute this year. A partner in the consulting engineering firm of Kerry & Chace Limited, Mr. Kerry retired from active engineering work in 1939. Before his retirement he was president of the Northumberland Paper & Electric Company, president of Seymour Electric Power Company and associated companies, and president of Quinte & Trent Valley Power Company. He was also secretary of Boundary Investments Limited.

Mr. Kerry joined the Canadian Society of Civil Engineers as a Student in 1888, transferred to Associate Member in 1894, and became a full Member in 1904. He was granted Honorary Membership in the Institute in 1952.

Mr. Kerry was awarded the Gzowski Medal of the Institute for his paper "The Winter Temperature Cycle of the St. Lawrence Water" which appeared in the January, 1946 issue of the *Journal.*

**Gaston Masse,** M.E.I.C., superintendent of the gas and electricity department of the City of Sherbrooke, Que., has been elected chairman of the Eastern Townships Branch of the Engineering Institute.

Gaston Massé, M.E.I.C.

A native of Sherbrooke, he received his elementary education at local schools and St. Cesaire College, after which he obtained his B.A. degree from St. Charles Borromée Seminary in 1926. In 1931 he graduated with a B.Sc. degree in electrical engineering from McGill University.

During his first two years after graduation Mr. Massé was on the staff of Crepeau and Cote, consulting engineers, and on the staff of the Provincial Road Department.

In 1933 he entered the gas and electricity department of the City of Sherbrooke. He was appointed general superintendent of the department in 1939.

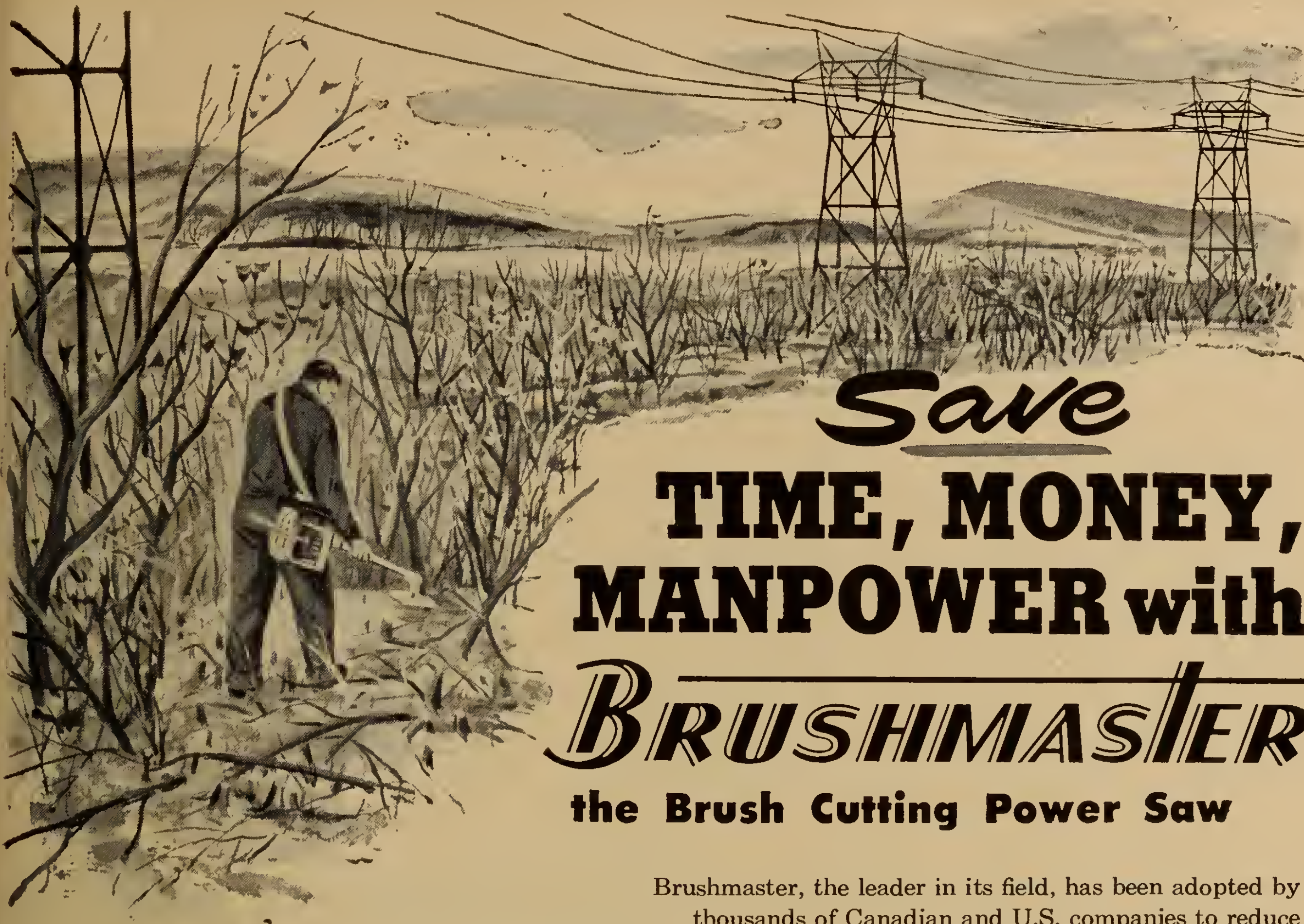
Mr. Massé is a member of the Corporation of Professional Engineers of Quebec, and of Les Fusilliers de Sherbrooke.

**A. H. W. Busby,** M.E.I.C., has resigned his position as superintendent of engineering research and development with Consolidated Mining and Smelting Company of Canada Limited in Trail, B.C., to join the Anglo American Corporation of South Africa, Ltd., as assistant consulting mechanical and electrical engineer.

Mr. Busby completed his apprenticeship with General Electric Company in Birmingham in 1918, and served with the Royal Air Force during 1918 and 1919 before entering the University of Birmingham where he received his degree in mining engineering in 1923.

He was electrical research engineer with the British Mines Department before coming to Canada in 1924 and joining the electrical department of the Consolidated Mining and Smelting Company in Trail, B.C.

Since 1927 he has occupied successively the positions of assistant superintendent of the electrolytic department of the zinc plant, senior research assistant in the research department, senior research engineer and supervisor of the instrument and physical testing division, superintendent of physical research, and superintendent of engineering research and development.



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FREDERICTON: Kilburn Equipment Co.
TRURO: Goodspeed-Millard Equipment Ltd.
ST. JOHN'S, NFLD.: A. E. Hickman Co. Ltd.

Mr. Busby is a member of the Association of Professional Engineers of British Columbia, the National Association of Corrosion Engineers, the Instrument Society of America, and the Society of Experimental Stress Analysis.

He is a past-chairman of the Kootenay Branch of the Engineering Institute. In 1949 he was awarded the Gzowski Medal of the Institute for his paper "Localized Overheating in the Wall of a High Pressure Vessel and its Effect on Rupture Strength".

**J. T. Turnbull,** M.E.I.C., who recently retired as district highway engineer of the New Brunswick Department of Public Works in Fredericton, has been appointed engineer for the Parish of Simonds, N.B.

Mr. Turnbull's engineering career dates back to 1903 when he joined the staff of Canadian Pacific Railways in the Lake Superior region.

He was transferred to Saint John, N.B., in 1910 and was engaged on a right-of-way survey for the company. Three years later he went into private practice with D. R. Smith, M.E.I.C., now city engineer of Woodstock, Ont., and from 1917 to 1920 he worked with the Saint John Dry Dock Company.

His 28 years with the Department of Public Works began in 1926.

Mr. Turnbull is a past-president of the Association of Professional Engineers of New Brunswick.

**A. D. Harris,** M.E.I.C., formerly chief maintenance engineer in the manufacturing division of Ford Motor Company of Canada Limited in Windsor, Ont., retired from the company at the end of 1953.

Mr. Harris joined the company in 1922 and during that time filled a number of key engineering positions.

In 1935 he was moved to New Zealand where he spent two years supervising the construction of a new plant for the Ford Motor Company of New Zealand.

He became acting head of the engineering department at Ford of Canada in 1941 and chief plant engineer the following year.

**J. M. King,** M.E.I.C., has been appointed general manager of the J. J. Turner Company of Peterborough, Ont.

A graduate in metallurgical engineering of the University of Toronto, Mr. King has been engaged in a series of manufacturing and engineering projects with Canadian General Electric Company Limited since 1940.

He is a member of the council of the Association of Professional Engineers of Ontario, and a past-chairman of the Peterborough Branch of the Engineering Institute.

**S. H. Lassman,** M.E.I.C., is now an associate in the Montreal consulting engineering firm of Mendel, Brasloff, Lassman and Sidler.

Previous to joining the company, initially known as Mendel & Brasloff, in 1951, Mr. Lassman was employed by A. D. Ross & Co.

He is a graduate in electrical engineering of the University of New Brunswick, class of 1945.

**Andrew Ferguson,** M.E.I.C., is now associated with Alumina Jamaica Limited in Jamaica, B.W.I.

Before his transfer to Jamaica he was on the staff of the general engineering department of Aluminum Company of Canada, Ltd. in Montreal.

Mr. Ferguson received his B.Sc. degree in mechanical engineering from the University of Glasgow in 1924.

**V. R. Currie,** M.E.I.C., formerly commissioner of works in Kingston, Ont., is now with the engineering department of the City of Ottawa.

Mr. Currie has been commissioner of works in Kingston since 1949.

He is a graduate of Queen's University, class of 1923, and had been formerly associated with the Department of Transport.

**A. E. Hanson,** M.E.I.C., is now director of works for the City of Saint John, N.B.

He was previously parish engineer for the Parish of Simonds, N.B.

Mr. Hanson is a 1929 graduate in civil engineering of the University of New Brunswick.

**John McLellan,** M.E.I.C., has been appointed chief of engineering sales by Standard Iron and Steel Works Limited in Toronto.

He was previously structural checker with Dominion Bridge Co. Ltd. in Toronto, Ont.

**J. A. Campbell,** M.E.I.C., has been promoted to the position of manager of distribution planning for Northern Electric Co. Ltd. in Montreal. He was previously distribution engineering superintendent.

Mr. Campbell graduated in electrical engineering from the University of Toronto in 1935.

**E. J. Bartley,** M.E.I.C., is now supervising electrical engineer with Foundation of Canada Engineering Corporation Limited in Toronto, Ont.

He was previously employed in the plant engineering sub-division of Ford Motor Co. of Canada Limited in Windsor, Ont.

Mr. Bartley is an electrical engineering graduate of the University of Toronto, class of 1941.

**David Beattie,** M.E.I.C., has been appointed sales engineer in the Toronto office of Powerlite Devices, Limited, according to a recent announcement by Dudley S. Young, M.E.I.C., vice-president of the company.

Mr. Beattie is an honour graduate of the University of Toronto in engineering physics, class of 1949, and has been affiliated with the James R. Kearney Corporation as a sales engineer in both Ontario and British Columbia for the past four years.

**David Beattie, M.E.I.C.**

During the war he served with the Canadian Army and gained considerable experience with military radar equipment.

He is an associate member of the American Institute of Electrical Engineers, and a member of the Association of Professional Engineers of Ontario.

**H. S. Marmorek,** M.E.I.C., has been appointed assistant works manager with Radio Engineering Products Ltd. in Granby, Que.

He was formerly supervisor of production control with the Canadian General Electric Company in Montreal.

Mr. Marmorek received his B.A. and M.A. degrees in mechanical science from Cambridge University in 1940 and 1944, respectively.

**John R. Cooper,** M.E.I.C., is design engineer with the Standard Steel Construction Company, a branch of the United Steel Corporation in Welland, Ont.

Before joining this company he was associated as design engineer with the Dominion Bridge Company in Lachine, Que.

Mr. Cooper is an associate member of the Institute of Structural Engineers.

**V. M. Wallingford,** M.E.I.C., previously with Anglo-Canadian Pulp and Paper Mills Ltd. in Quebec City, has joined the staff of Mannix Limited in Montreal, Que.

Mr. Wallingford is a graduate in civil engineering of the University of Toronto, class of 1944.

**E. B. Wilkins,** M.E.I.C., has been appointed district airway engineer in Lethbridge, Alta., by the Department of Transport.

He was previously resident engineer on the Department's runway evaluation program in Lethbridge.

Mr. Wilkins graduated in civil engineering from the University of Alberta in 1943.

**E. Klug-Andersen,** M.E.I.C., has been transferred by the Foundation Company of Canada as resident engineer to Hamilton from Sault Ste. Marie where he had been employed as design and structural engineer.

Mr. Klug-Andersen received his M.Sc. degree in civil and structural engineering from the Technical University of Denmark in 1947.

**Camille Le Clair,** M.E.I.C., of Toronto, has recently combined his consulting practice and his engineering research organization under the firm name of Le Claire Engineering Company. Mr. Le Clair will continue as sole proprietor.

He is a member of the Institution of Mechanical Engineers.

**Robin R. Jackson,** M.E.I.C., has joined the radio and electrical engineering division of the National Research Council in Ottawa, having completed his studies at the Graduate School of Engineering of the Carnegie Institute of Technology.

Mr. Jackson is a graduate in electrical engineering of the University of Alberta, class of 1944.

**Ralph T. Morgan,** M.E.I.C., has accepted a year's contract with the United States Air Force at Goose Bay, Labrador, Que.

He was formerly plant engineer with Zwicker and Company Limited in Lunenburg, N.S.

Mr. Morgan is a mechanical engineering graduate of Queen's University, class of 1944.

**L. J. Laflamme,** JR.E.I.C., is now associated with Montreal consulting engineer Paul Pelletier.

He was previously on the staff of the Quebec Streams Commission.

Mr. Laflamme is a graduate in civil engineering of McGill University, class of 1947.

**Wm. John Hodge,** JR.E.I.C., is sales representative with Kawneer Canada Limited in Winnipeg, Man.

Prior to accepting this position, he was associated with Canadian Brown Steel Tank Company Limited in Brandon, Man.

Mr. Hodge graduated from the University of Manitoba in 1948 in civil engineering.

**A. M. Thomson,** JR.E.I.C., is now employed as a sales engineer by Canada Cement Company Limited in Ottawa, Ont.

He was previously associated with Canadian Brazilian Services in Toronto, Ont.

Mr. Thomson is a graduate in civil engineering of the University of Saskatchewan, class of 1948.

**E. G. Hachborn,** JR.E.I.C., is design engineer on the staff of the department of public works for the City of Kitchener, Ont.

He was previously research assistant in the sanitary engineering department of Cornell University.

Mr. Hachborn in an honours civil engineering graduate of Queen's University, class of 1948.

**Clive Bennett,** JR.E.I.C., has been transferred by C. D. Howe Co. Ltd. from Port Arthur, Ontario to Quebec City.

Mr. Bennett received his B.Sc. degree from London University in 1949.

**F. C. Hamata,** Jr.E.I.C., is now in the construction division of Ensign Stores Limited in Calgary, Alta.

He was formerly project engineer with Missouri Valley Dredging in installing a submerged pipeline under the Fraser River near New Westminster, B.C.

Previous to this he was associated as construction supervisor with Braid, LeBrun and McKinnon, in Bowidji, Minn.

Mr. Hamata is a graduate in civil engineering of the University of Manitoba, class of 1949.

**Thos. E. Wilson,** Jr.E.I.C., is now sales engineer with Cumming Galbraith Ltd. in Calgary, Alta.

Mr. Wilson graduated in mining engineering in 1949 from the University of Alberta.

**J. C. S. Bloomer,** Jr.E.I.C., formerly on the staff of Montreal Locomotive Works Ltd. in Montreal, is now associated with Canadian General Electric Co. Ltd. in Montreal.

Mr. Bloomer is a 1949 graduate in electrical engineering of the Nova Scotia Technical College.

**Wm. A. H. McCorquodale,** Jr.E.I.C., has accepted the position of electrical engineer in the maintenance engineering department of the Ford Motor Company of Canada in Windsor, Ont.

He was formerly employed by Northern Electric Co. Ltd. in Montreal, Que.

Mr. McCorquodale graduated in electrical engineering from the University of British Columbia in 1949.

**Jean Paul Lavigne,** Jr.E.I.C., is now on the staff of the building inspection department of the City of Montreal.

Mr. Lavigne graduated in civil engineering from Ecole Polytechnique in 1949.

**A. S. Malmgren,** Jr.E.I.C., is now production engineer with Malmgren Implement Co. (Manitoba) Ltd.

He was formerly methods improvement engineer with Canadian Industries Ltd. in Brownsburg, Que.

Mr. Malmgren is a graduate in mechanical engineering of the University of Manitoba, class of 1949.

**R. Cohen,** Jr.E.I.C., is now supervisor of process and material engineering with Canadian General Electric Co. Ltd. in Montreal.

He was formerly with the Department of Mines and Resources in Ottawa Ont.

Mr. Cohen is a chemical engineering graduate of McGill University, class of 1950.

**C. R. Hannah,** Jr.E.I.C., is an assistant engineer with James F. MacLaren Associates in Saint John N.B.

He was formerly road engineer for the City of Saint John, N.B.

Mr. Hannah is a 1950 graduate of the University of British Columbia in civil engineering.

**Lieut. L. G. Holtby, R.C.N.,** Jr.E.I.C., is now attached to the trials section of electrical engineering of the Chief Directorate in Ottawa.

He was previously electrical officer at the Naval Armament Depot in Halifax, N.S.

Lieut. Holtby graduated with a B.A.Sc. degree in electrical engineering from the University of British Columbia in 1950.

**Walter Kruchowski,** Jr.E.I.C., has joined Stock, Ramsay & Associates of Regina, Sask.

Walter Kruchowski, Jr.E.I.C.

He was previously design engineer with Foundation Engineering Ltd. in Toronto, Ont.

Mr. Kruchowski graduated from McGill University in electrical engineerin 1950.

**Wm. Edward Turner,** Jr.E.I.C., is employed as Alberta Land Surveyor by the Simpson Elevation Company.

He was formerly on the engineering staff of the City of Calgary, Alta.

Mr. Turner graduated in civil engineering from the University of Alberta in 1950.

**Capt. S. Thomson, R.C.E.,** Jr.E.I.C., has been transferred from the Directorate of Engineering Development at Ottawa to the headquarters of the Northwest Highway System at Whitehorse, Yukon.

Capt. Thomson graduated from the University of Toronto in civil engineering in 1950.

**E. J. M. Crawley,** Jr.E.I.C., is now sales engineer with Rogers Majestic Electronics Limited in Calgary, Alta.

He was previously associated with Canadian Electronics Ltd. as communication engineer in Edmonton, Alta.

Mr. Crawley graduated in electrical engineering from the University of Alberta in 1950.

**Frederick P. Gordon,** Jr.E.I.C., is now with the Aluminum Company of Canada at Kemano, B.C.

He was previously associated as field engineer with Vancouver Iron Works in Vancouver, B.C.

Mr. Gordon graduated in mechanical engineering from the University of British Columbia in 1950.

**David R. Hughson,** Jr.E.I.C., has joined Turnbull Elevator Co. Ltd. in Toronto, Ont., having completed his post-graduate study at the Harvard Business School.

Mr. Hughson is a graduate of the University of Toronto in electrical engineering, class of 1951.

**R. B. McCormack,** Jr.E.I.C., is now on the staff of the flight test engineering department of Trans-Canada Air Lines at Dorval, Que.

He was formerly on the engineering staff of Canadian Pratt & Whitney Aircraft Ltd. in Longueuil, Que.

Mr. McCormack is a civil engineering graduate of McGill University, class of 1951.

**Fred Booth,** Jr.E.I.C., has been appointed sewer engineer with the Department of Works of the City of Toronto.

Mr. Booth graduated in civil engineering from the University of Toronto in 1951.

**M. Storrier,** Jr.E.I.C., is at present associated with the Iron Ore Company of Canada at Knob Lake, Que.

He was formerly assistant to the equipment engineer of Hudson Bay Mining & Smelting Co. Ltd. at Flin Flon, Man.

Mr. Storrier graduated in mining engineering from McGill University in 1951.

**Gerard Hackett,** Jr.E.I.C., is a mechanical engineer on the staff of the Quebec Power Company in Quebec City.

He was formerly with J. T. Wing Co. Ltd. in Windsor, Ont.

Mr. Hackett graduated in mechanical engineering from McGill University in 1951.

**Michael O. Jones,** Jr.E.I.C., has been transferred by the Ford Motor Company of Canada from Windsor, Ont., to the Geelong subsidiary in Australia for an indefinite period.

In his new position he will be assistant to the general superintendent of the manufacturing division and will be handling special assignments. While in Windsor he was facilities engineer of the overseas operations division.

Mr. Jones graduated with a B.A.Sc. degree in mechanical engineering from the University of British Columbia in 1951, after which he entered the A. V. Roe Canada Limited in Malton, Ont., as development engineer in the gas turbine division.

**M. G. Colvin,** Jr.E.I.C., has been named chief field engineer with Canadian Kellogg Co. Ltd. in Winnipeg, Man.

He was previously job engineer with W. M. Barnes Co. of Canada Ltd. in Oakville, Ont.

Mr. Colvin is a graduate in civil engineering of the University of Toronto, class of 1951.

**J. A. Brenchley,** Jr.E.I.C., has joined the plastics department of Canadian Industries Limited as sales representative.

Before joining the company, he undertook post-graduate study at the Graduate School of Business of the University of Western Ontario.

He is a mechanical engineering graduate of McGill University, class of 1951.

**Yvan Montcalm,** Jr.E.I.C., has been appointed sales engineer of Powerlite Devices Limited in the Montreal office.

A native of Montreal, he spent most of his early years in Three Rivers, Que. He graduated in electrical engineering from McGill University in 1951.

Mr. Montcalm was previously associated with the Quebec Power Company as distribution engineer for Quebec City, and prior to that, he was with the Shawinigan Water & Power Company where he completed the company's graduate engineer training course.

Mr. Montcalm is a member of the Corporation of Professional Engineers of Quebec and of the Illuminating Engineering Society.

**Antonio Chabot,** S.E.I.C., is now associated as sanitary engineer with the Department of National Health and Welfare in Moncton, N.B.

He was formerly on the staff of Canadian National Railways.

Mr. Chabot is a graduate in civil engineering of Laval University, class of 1953.

**Wm. J. Watson,** S.E.I.C., recently joined the engineering staff of the construction and building supplies firm of M. F. Schurman Co. Ltd. in Summerside, P.E.I.

He was previously with the Ontario Hydro-Electric Power Commission in Niagara Falls and Toronto.

Mr. Watson graduated in civil engineering from McGill University in 1953.

**M. Luciuk,** S.E.I.C., is now a geophysical operator trainee with Imperial Oil Limited in Edmonton, Alta.

Mr. Luciuk graduated in engineering physics from the University of Saskatchewan in 1953.

**J. L. Y. Marguis,** S.E.I.C., has joined the staff of the Quebec Hydro Commission in Montreal, Que.

Mr. Marguis received his B.Eng. degree in electrical engineering from McGill University this year.

# Obituaries

*The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.*

## John Morrice Roger Fairbairn, President, 1921

**John Morrice Roger Fairbairn,** M.E.I.C., retired chief engineer of the Canadian Pacific Railway, and a past-president of the Engineering Institute, died at his home in Westmount, Que., on May 27, 1954, after a long illness.

J. M. R. Fairbairn, M.E.I.C.

Mr. Fairbairn was born in Peterborough, Ont., on June 30, 1873. He received his early education in Peterborough and in London, Ont., and graduated in civil engineering from the School of Practical Science (University of Toronto) in 1893. He was awarded the degree of Doctor of Science by the same university in 1921.

During the summer months of his university course in 1891 and 1892 he was employed on railway location surveys and plans for the Irondale, Bancroft and Ottawa Railway, and as leveller and topographer on the Peterborough, Parry Sound and Sault Ste. Marie Railway.

Upon graduation in 1893, he was associated for four years with the Departments of the Interior, Railways and Canals, and Militia and Defence. He went west in 1897 to become principal assistant to the late Charles A. Stoess on land grants and mining claim surveys in the Slocan district of British Columbia. A year later he engaged in surface and underground surveys of various mining properties, and at the same time acted as city engineer of Kaslo, B.C. Having served his apprenticeship with Mr. Stoess, he passed the necessary examinations and became a licensed land surveyor for British Columbia. Mr. Fairbairn then entered private practice as a civil and mining engineer and provincial land surveyor at Kaslo and Greenwood, B.C.

In April, 1900, he joined the construction department of the Canadian Pacific Railway as leveller on grade reduction surveys between Winnipeg and Fort William, and in August of that year, when the work was shut down, he returned to the Department of Railways and Canals as engineer in charge of section 3 of the Simcoe-Balsam Lake division of the Trent Canal. In August, 1901, he returned to the Canadian Pacific Railway and remained with the company until his retirement on January 1, 1939. During that time he occupied the positions of principal assistant to the district engineer in Montreal, division engineer in Ottawa, assistant engineer in the chief engineer's office in Montreal and acting district engineer. Then in 1906 and 1907 he served as district engineer of the Ontario district and district engineer of the Quebec district. A year later he was appointed principal assistant engineer in the chief engineer's office in Montreal, and in 1910, engineer maintenance of way. The following year Mr. Fairbairn became assistant chief engineer of eastern lines, and three years later, assistant chief engineer of the entire system. He was appointed chief engineer in 1918, a position he occupied continuously for over 20 years.

When Mr. Fairbairn joined the company it had only about 8,500 miles of railway line. He played a major part in building the mileage to more than 17,000. During his time as chief engineer, the company spent approximately two hundred million dollars on construction for which Mr. Fairbairn was responsible.

His work during this period not only gained him a wide reputation as an engineer, but it included much public-spirited activity in professional and international matters. In 1929 he represented his company at the World Engineering Congress in Tokyo, Japan, where he also headed the Canadian delegation to the World Power Conference. He served as vice-president and a member of Council of the Engineering Institute of Canada, and was elected its president in 1921. He was president of the American Railway Engineering Association in 1925. He was a member of Council of the Institution of Civil Engineers and served as chairman of its Canadian Advisory Board. He was awarded honorary membership by the American Society of Civil Engineers, and served as chairman of that society's Canadian Membership Committee. He was also an honorary life member of the Canadian Engineering Standards Association.

When World War II broke, Mr. Fairbairn came out of retirement to become director of works and buildings for the Army under Col. J. L. Ralston. In 1941 he was appointed to the position of director of works and buildings for the Naval Service of the Department of National Defence in Ottawa.

In 1945 Mr. Fairbairn was awarded the Sir John Kennedy Medal of the Engineering Institute for his outstanding contribution to the field of engineering.

He joined the Engineering Institute as an Associate Member in 1899, and transferred to Member in 1908. On January 1, 1947, he attained Life Membership in the Institute.

**Norman Marr,** M.E.I.C., director of the engineering and water resources branch of the Department of Resources and Development, died suddenly at his home in Ottawa on April 20, 1954.

Mr. Marr was born at Walkerton, Ont., on June 29, 1890. Upon completion of his public and high school education, he undertook civil engineering study at the School of Practical Science, (University of Toronto), graduating in 1910. In 1912 he obtained his B.A.Sc. degree from the University of Toronto. He received his C.E. degree from the same university in 1922.

Mr. Marr gained experience as a student during the summer months of his university training as a chainman on a land survey in Manitoba, as a rodman on a waterworks extension survey in London, Ont., as a leveller on a Quebec Eastern Railroad preliminary survey, and as an instrumentman with the Transcontinental Railway at Cochrane, Ont.

Upon graduation he became assistant engineer with C. H. and P. H. Mitchell, consulting engineers on the construction of La Colle Falls hydro-electric development in Prince Albert, Sask.

In 1913 he joined the Department of Railways and Canals as engineer in charge of construction on sections 4 and 5 of the Trent Canal at Campbellford. Five years later he was appointed senior hydraulic engineer in the water power and reclamation service of the Department of the Interior, and in 1926 he was named chief hydraulic engineer. He was appointed director of the engineering and water resources branch of the Department of Resources and Development in 1952, and at the time of his death had completed 36 years of government service.

Mr. Marr was a key figure in the lengthy negotiations with the United States in connection with the development of the St. Lawrence Seaway project. He served on numerous committees and boards dealing with international waterways problems and was widely known both in Canada and the United States. He was a member of the

Norman Marr, M.E.I.C.

Inter-Departmental Committee which negotiated the St. Lawrence power development agreement signed in Washington on June 30, 1952. For many years he was a member and honorary secretary of the Canadian committee of the World Power Conference, a body dealing with the development of various power sources. He also represented Canada at the International Lake Superior Board of Control, the International Niagara Board of Control, the International Massena Board of Control, and he served as a consultant to the Canadian Temporary Great Lakes—St. Lawrence Basin Committee. He was a member of the Professional Institute of the Public Service of Canada.

Mr. Marr served as chairman of the Ottawa Branch of the Engineering Institute in 1945 and as councillor representing the Ottawa Branch in 1946. He joined the Institute as a Student in 1909, transferring to Junior in 1911, to Associate Member in 1916, and to Member in 1928. In January, 1951 he attained Life Membership in the Institute.

**George Hemmerick,** M.E.I.C., general sales manager, assistant treasurer and assistant secretary of Dow Chemical of Canada Limited, died suddenly at his office in Toronto on April 14, 1954.

Born at Conestoga, near Kitchener, Ont., on April 29, 1891, Mr. Hemmerick received his early education there before entering Queen's University where he graduated in civil engineering in 1916. During his summer holidays previous to graduation he was employed by Hollinger Gold Mines Ltd. at Timmins, Ont.

After graduation, Mr. Hemmerick began his engineering career as a municipal engineer in western Canada. While in the west he spent some time teaching mathematics. He returned to the east and in 1922 took a post-graduate course in economics at Queen's University.

Mr. Hemmerick subsequently became construction engineer for E. G. M. Cape Company Limited in Quebec and afterwards moved to Ontario as field engineer with the Department of Highways.

He joined Dow Chemical of Canada Limited as a sales engineer in 1926. From that time he represented the company in Canada on all of its products, and early in World War II, when the company built the styrene unit for Polymer Corporation, he was placed in charge of construction and the ensuing operations. When Dow Chemical of Canada Limited formed its sales organization, he became the first sales manager.

He was a member of the Canadian Good Roads Association, the Canadian Manufacturers Association, the Society of the Plastics Industry, and an active supporter of the Queen's Alumni.

Mr. Hemmerick joined the Engineering Institute as a Student in 1916, transferring to Associate Member in 1918, and to Member in 1940.

**George Herbert Gillett,** M.E.I.C., manager of the apparatus division of the Canadian General Electric Company's Pacific district in Vancouver, was killed instantly on April 8, 1954, in a crash between a westbound Trans-Canada Air Lines plane and a Harvard trainer over Moose Jaw, Sask. He was returning home to Vancouver from an apparatus division sales conference which had taken place in Toronto earlier that week.

G. H. Gillett, M.E.I.C.

Mr. Gillett was born in Westmount, Que., on January 17, 1902. After completing his general education at Wykeham House and Westmount High School, he entered McGill University in 1920 and obtained his B.Sc. degree in electrical engineering four years later.

In 1924 he undertook the Canadian General Electric Company's test course in Peterborough, Ont., and in September, 1925, entered the industrial control engineering department there. The following year he was transferred to Toronto as an engineer in the transformer engineering department, and he later became engaged in the preparation of transformer estimates and propositions.

Mr. Gillett was transferred to Montreal as sales engineer in 1928. In 1949 he was promoted to the position of sales manager of the apparatus division of the Montreal district and was responsible for the company's heavy electrical equipment for utilities and industry throughout the Province of Quebec. In 1953 he was appointed to the position he held at the time of his death.

He was a past-president of the Electrical Club of Montreal and a Member of the American Institute of Electrical Engineers, the Montreal Board of Trade, and the Corporation of Professional Engineers of the Province of Quebec.

Mr. Gillett joined the Engineering Institute as a Student in 1924, transferring to Associate Member in 1936, and to Member in 1940.

**Frank Harvey Barnes,** M.E.I.C., supervisor of metallic ammunition and empty shot shell operations for Canadian Industries Limited in Brownsburg, Que., died on March 9, 1954.

Mr. Barnes was born in Port Hope, Ont., on November 27, 1890. After completing his public and high school education, he entered McGill University where he received his B.Sc. degree in mechanical engineering in 1912.

During his summer vacations while attending university and for two years after graduation, Mr. Barnes served as an apprentice in the shops and roundhouses of the Canadian Pacific Railway.

He then became shop foreman at the Dominion Arsenal in Quebec. Within three years he was promoted to the position of mechanical superintendent and production manager with full responsibility for plant operation, maintenance and tool design. He remained in that position until 1920 when he joined the Laurentide Company in Grand'mere, Que., as assistant to the head of the planning department. In 1921 he was appointed shop superintendent for the Canadian Brill Company in Preston, Ont., where he was in full charge of all steel construction on street railway cars.

Mr. Barnes went into business for himself in 1923 during which time he operated an auto electric service station in Oshawa, Ont. A year later he became plant manager for Thomas Watson Limited of Woodstock, Ont., where he was in charge of the plant and the design of new machines. Within the same year he accepted the position of designer on paper machinery with Charles Walmsely and Company Limited in Longueuil, Que. In 1926 Mr. Barnes joined the Northern Foundry and Machine Company as designing engineer, and a year later, was appointed to the position of designing engineer and assistant manager. He remained with this company nine years, during which time he became chief engineer and general superintendent.

In 1935 Mr. Barnes joined the engineering department of Mathews Conveyor Co. Ltd. in Port Hope, Ont., and was associated with this firm until 1939 when he was appointed to the British Supply Board as inspector on three shell contracts. In 1940 he became superintendent of production for Defence Industries Limited in Brownsburg and Verdun, Que., and in 1945, was appointed to the position which he held at the time of his death.

Mr. Barnes joined the Engineering Institute of Canada as an Associate Member in 1928 and transferred to Member in 1940.

**Alexander Stirling Ross,** M.E.I.C., former B.C. Telephone Company staff engineer who retired less than five months ago after completing 50 years of service in the telephone industry, died suddenly in hospital in Waltham, Mass., on April 26, 1954.

**Stirling Ross, M.E.I.C.**

Mr. Ross was born in Renfrew, Ont., in 1887. He began his engineering career with the Northern Electric Company in 1904, and five years later went to Vancouver, B.C., where he joined the B.C. Telephone Company as switchboard installation foreman on the first addition to the old Seymour exchange.

Mr. Ross was appointed superintendent of switchboard construction in 1922, and two years later, was named equipment engineer. In 1944 he assumed the dual position of equipment and building engineer, and in 1953, was appointed staff engineer in charge of special projects. As equipment and building engineer, he was largely responsible for the design and erection of all company buildings.

Mr. Ross was a member of the Point Grey School Board, and was its last chairman before its amalgamation with the City of Vancouver in 1929. He was also a member of the Point Grey Town Planning Commission, and played an important part in the construction of various schools in that area. He was a member of the Association of Professional Engineers of British Columbia. He also organized the B.C. Chapter 53 of the Telephone Pioneers of America and served as its first president.

Mr. Ross joined the Engineering Institute of Canada as a Member in 1946.

**Frederick Crease,** M.E.I.C., provincial plant superintendent of the Manitoba Telephone System in Winnipeg, Man., died suddenly on January 28, 1954.

Mr. Crease was born in Taunton, Somerset, England, on March 4, 1889. Previous to coming to Canada in 1910, he was employed by the National Telephone Company in England.

Since joining the staff of the Manitoba Telephone System, Mr. Crease had held various appointments and was due for retirement within a few months.

During the first World War he served overseas with the 203rd Battalion of the Royal Winnipeg Rifles.

Mr. Crease was one of Winnipeg's earliest amateur radio operators. When

**Frederick Crease, M.E.I.C.**

radio broadcasting was in its infancy, he constructed a number of receiving sets which were among the best of their kind built in Winnipeg. At that time it was the practice to pick up programs from distant stations and feed them via telephone lines to a local station which rebroadcast them for the benefit of listeners whose sets were good only for short-range reception. Much of this service was furnished by Mr. Crease.

His interests ranged from radio to photography and included wood-working and the reading of technical literature. In his chosen field of telephony his knowledge and sound training were widely recognized.

Mr. Crease was a member of the Association of Professional Engineers of Manitoba, the Telephone Pioneers of America and the Manitoba Electrical Association.

He joined the Engineering Institute of Canada as a member in 1952.

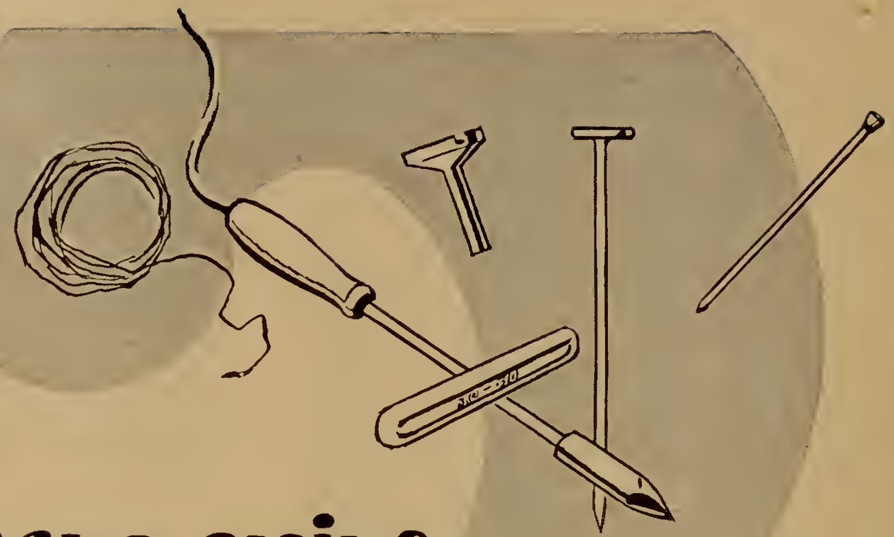
**Rupert Don Baugh, M.M.,** Jr.E.I.C., general production comptroller of Dominion Structural Steel Limited in Montreal, was killed instantly in the Trans-Canada Air Lines aircraft and Harvard trainer collision over Moose Jaw, Sask., on April 8, 1954. Mr. Baugh was on his way from his home in Beaconsfield, Que., to visit a sister in Vancouver, B.C.

Mr. Baugh was born at Moosomin, Sask., on December 4, 1915. He attended the Moosomin Collegiate Institute and then served with the Canadian Army before and during World War II. From 1939 until 1945 he was stationed in Canada, England and on the Continent, and was awarded the Military Medal for gallantry.

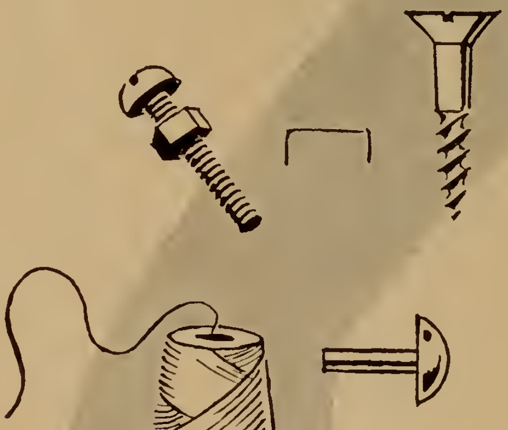
In 1946 he entered McGill University and graduated with a B.Eng. degree in civil engineering in 1949. During the summer of 1947 he was employed as instrumentman with the Quebec Hydro-Electric Commission, and the following summer he served as assistant construction engineer with Central Mortgage & Housing Corporation.

He joined the staff of Dominion Structural Steel Limited in Montreal on May 10, 1949, and was employed in various engineering capacities until he recently assumed the position of general production comptroller.

Mr. Baugh joined the Engineering Institute of Canada as a Student in 1948 and transferred to Junior Member in 1951.







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**INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.**

## SITUATIONS VACANT

### CHEMICAL

A CHEMIST WITH a B.Sc. degree in chemistry or better with good background in organic chemistry, preferably with one or two years' experience in the pulp and paper industry, but not an absolute requisite. Duties include special analytical work, experimentation on cooking and bleaching of kraft base pulp, also on development of by products. File No. 4835-V.

GRADUATE CHEMIST REQUIRED TO BE trained as assistant to chief chemist. Plant located at Cardinal in Ontario in one of Canada's oldest food industries. Forward all details of experience, education, with pictures, and anticipated salary to File No. 4837-V.

CHEMICAL ENGINEERS required for research and development department of large world wide organization with plant located in Montreal. Duties to do development work on various products made from fibres or adhesives. This work will consist of improving our present operations and finding new methods of processing. A certain amount of research work on developing new products will be undertaken. File No. 4844-V.

LECTURER OR ASSISTANT professor of chemical engineering required to give unit operations course with laboratory and design calculations course to junior and senior year classes. Time available for graduate study and research. Industrial experience desirable but not requisite. Salary dependent upon qualifications. Apply Nova Scotia Technical College, P.O. Box 1000, Halifax, Nova Scotia. File No. 4851-V.

RESEARCH ENGINEER required by Saskatchewan Department of Mineral Resources $326-$397 per month. Recent graduate in ceramic, chemical or geological engineering; to carry out lab. and pilot scale experimental work, field exploration, and economic surveys dealing with the non-metallic or industrial minerals of the province. Good pension plan and conditions of employment. For further information and application forms contact the Public Service Commission, Legislative Building, Regina. File No. 4852-V.

CHEMICAL ENGINEER required, 1954 graduate with pulp and paper experience. Investigation of paper quality or production problems on both laboratory and mill scale, analysis of test date, development of test methods, etc. Working under the divisional chemist. File No. 4864-V.

CHEMICAL ENGINEER required in Montreal with a fairly extensive knowledge of the theory of thermo dynamics as well as chemical training. Some experience in the compressed gas or allied industry would be interesting but not essential. The duties will involve some chemical analysis and in addition, general engineering duties connected with plant construction and development as well as plant operation and method improvements. File No. 4881-V.

GRADUATE CHEMICAL ENGINEER from Canadian University required by manufacturer of organic chemical products. Attractive opening in new project located in Ontario. Several years of practical experience in production and process development is required. File No. 4900-V.

CHEMICAL ENGINEER required to fill position of managing engineer in a newly incorporated Canadian company. Organization is engaged in the process of plating non-ferrous products. Age 28-35 and should have experience in cost and production control, to be able to work with sales and also be interested in development work on new products. File No. 4902-V.

### CIVIL

CIVIL ENGINEER required for bridge design in a large transportation company with headquarters in Montreal. File No. 4850-V.

ASSISTANT CHIEF ENGINEER wanted for large construction company. Applicant must have thorough knowledge and experience in reinforced concrete design capable of estimating buildings, road construction and all branches of general construction work. Excellent salary to the right man. Good prospects for the future. Do not apply unless you are thoroughly experienced. File No. 4853-V.

CIVIL ENGINEER REQUIRED by the technical co-operation service department of Trade and Commerce, Ottawa, Canada, to serve in Burma. The union of Burma has plans for an expansive scheme in Hydro Electric development. The engineer should be Canadian and will act as special advisor to the chairman of the Burmese electricity supply board to review the designs and specifications and supervise general construction. Salary would be in the range of $14,000 to $17,000 per annum. Free furnished accommodations, cost of internal travel, free hospital and medical treatment. File No. 4857-W.

CIVIL ENGINEER required preferably recent graduate of McGill university with at least one year's experience in the field. Will be sent to U.S.A. for two months to study the methods of operation, after which time he would be attached to Montreal office. Applicant must be Canadian. File No. 4860-V.

ENGINEER CIVIL PREFERABLY, wanted for young progressive construction company. Preferably one with experience in sewage and water supply as well as cement work as we are specializing more in this line of work. When replying, please state age, graduation and experience. File No. 4865-V.

QUALIFIED ENGINEER required as principal Ahsanullah Engineering College, Dacca, Pakistan. Candidate should possess a good honours degree in civil engineering from a recognized University. He must have enough practical experience of actual execution of large projects, and their organization, and teaching and administrative experience in a recognized engineering institution. Candidate should preferably be 45 years of age or thereabouts. Further information apply File No. 4878-V.

THE CITY OF MONCTON, N.B., invites applications from engineers preferably with municipal experience, for service in the city engineers office. In reply please give details of experience, including any service with H.M. Forces and indicate salary required. File No. 4887-V.

GRADUATE CIVIL ENGINEER for company in Brazil as technical assistant for chief planning. Age around 40, with 5 years experience in: 1) preparing and completing preliminary and basic studies and layouts of hydro electric developments for consideration as to technical and economic feasibility, 2) analysing and evaluating hydrological topographical and geological data with relation to power development studies, 3) determining survey work required. Position requires engineer of maturity and judgment with teaching experience and leadership ability. File No. 4888-V.

CONSTRUCTION DEPARTMENT of prominent oil company with headquarters in Maritimes requires experienced man to supervise construction of bulk plant facilities and pipelines. Position has an excellent potential. Please write details, and if possible enclose photo. File No. 4889-V.

ASSISTANT CITY ENGINEER required in Guelph, Ontario. The work includes responsibility for all technical and contract work and the direction of two instrument men under the general supervision of the City Engineer. The engineering department supervises all public works and waterworks construction and maintenance. The job offers a good variety of experience in a rapidly growing city. Applicants must be graduate civil engineer with at least one year of municipal or equivalent experience. File No. 4903-V.

PLANNING DIRECTOR wanted to organize and take charge of the Metropolitan Planning Office of Greater Victoria, British Columbia. Salary $6,000. City Planning experience essential and formal training desirable. Energy, tact and pleasing personality absolutely essential. Apply with full particulars and references to the Secretary, Capital Region Planning Board of B.C., City Hall, Victoria, B.C., by July 19. File No. 4907V.

### ELECTRICAL

ELECTRICAL ENGINEER with several years experience required mainly with experience on production engineering of electronic equipment. Salary would commensurate with the applicant's experience and qualifications. File No. 4862-V.

TORONTO MANUFACTURER requires a designer for aircraft electrical systems: A.C. and D.C. generators and motors, regulators and protective devices. A degree in electrical engineering or equivalent in design experience is essential as work includes basic design calculations. Familiarity with A.N. specifications a real asset. Reply with full particulars and salary required to File No. 4870-V.

ELECTRONIC ENGINEERS required for attractive positions. Degree in electrical engineering or equivalent, 5 to 10 years general experience with 1 to 5 years specific radar experience. Supervisory ability, able to maintain liaison and work efficiently under pressure. Canadian citizenship or British nationality a requisite. Attractive employee benefits. File No. 4874-V.

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## ENGINEERS WANTED

**Prominent Oil Company with headquarters in Maritimes has openings for two engineers.**

**(1) Construction Dept. — Experienced man to supervise construction of bulk plant facilities and pipelines.**

**(2) Lubrication Dept. — Mechanical engineer to be trained in doing lubrication surveys and selling same.**

**Each of these positions has an excellent potential. Please write details, and if possible enclose photo. File No. 4889-V.**

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GRADUATE ELECTRICAL ENGINEER required with at least five years experience preferably on electric motors and control, switchgear, and similar apparatus. He should be familiar with modern manufacturing methods as applied to this type of equipment, also capable of directing a small number of junior engineers and draughtsmen. He should have a personality which would enable him to readily contact customers' engineers for the purpose of discussing engineering problems in connection with the above products. This position will provide an excellent opportunity to establish in new division of one of the largest companies in Canada and the U.S.A. File No. 4885-V.

ELECTRICAL ENGINEER (Electronics) required by major world-wide electronics organization. Present opening for a fully experienced electrical engineer to do project development work on monochrome T.V. The successful candidate must have a minimum of 3 years in T.V. receiver design and 10 years in electronics in general. Salary will be commensurate with ability. Reply in writing, stating details of age, experience, education and salary desired. All applications will be held in strictest confidence. File No. 4892-V.

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## Assistant Professor

**Applications are invited for the positions of Assistant Professor of Civil Engineering and Assistant Professor of Applied Mechanics, duties to commence on September 1, 1954. Salary $4000.00 plus a cost-of-living bonus of about $300.00; the annual increment is $250.00. Duties will include teaching and research. Confirmation in the appointment will be subject to the satisfactory completion of a probationary period of two years. Applications should be addressed to the Dean, Faculty of Engineering, University of Alberta, Edmonton, Alberta, Canada, and should give personal data, details of training and experience, the names of three referees, and be accompanied by a recent photograph. Closing date August 1, 1954.**

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JUNIOR ELECTRICAL ENGINEER — single, 25 to 30 years of age with 1-5 years experience in metering department of a large public utility or manufacturer. Location Rio de Janeiro, Brazil. File No. 4898-V.

### MECHANICAL

DESIGN ENGINEER WITH minimum eight years' experience in gear design and automotive transmissions. Age 45 or under. Must be creative and willing to do actual design work on board. File No. 4842-V.

DESIGN ENGINEER WITH minimum eight years experience in the design of farm tractors or other farm equipment. Must be creative and willing to do actual designing on the board. Age 45 or under. File No. 4842-V.

DESIGN ENGINEER WITH minimum eight years' experience in the design of internal combustion engines, preferably as applied to tractors. Age 45 or under. Must be creative and willing to do actual design work on board. File No. 4842-V.

DESIGN ENGINEER with minimum eight years' experience in hydraulics preferably as applied to tractors. Age 45 or under. Must be creative and willing to do actual design work on board. File No. 4842-V.

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## Junior Electrical Engineers

**Electric Utility has opening for two junior electrical engineers or engineering graduates in Halifax, N.S. The work will provide opportunities for advancement along both technical and administrative lines. Applicants should hold a University degree and have not over three years' post-graduate experience.**

**Apply direct to—**

**Mr. Norman T. Smith,**
**Manager,**
**Nova Scotia Light and Power Company, Limited.**

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PLANT FACILITIES ENGINEER required for a major appliance manufacturer. Graduate mechanical engineer with a minimum of 3 years machine design and a sound knowledge of electrical welding and substations. A challenging position is offered to a person capable of initiating and carrying through cost reduction, machine and process improvement including working with maintenance supervisors on installation and maintenance. Age to 45. Salary commensurate with ability. File No. 4845-V.

POWER PLANT EQUIPMENT sales engineer, mechanical graduate of Canadian university, wanted to form own company to sell and later to assemble in Eastern Canada, power plant controls and instruments. Prominent American manufacturers launching extensive expansion program of sales and service in Canada. Several years experience in sales to power plants or in operating steam plants essential. Any personal capital advantageous. File No. 4849-V.

CHIEF MECHANICAL ENGINEER, salary up to $7,200. required by Department of National Defence, Ottawa. Details and application forms at your nearest Civil Service Commission office, National Employment Office and University Placement Office. Quote Competition No. 54-1204. File No. 4855-V.

MECHANICAL ENGINEER required in mechanical department to teach machine design AND physical metallurgy among other subjects. Applicant should have his M.S. in M.E. The faculty rank of the position will depend upon the qualifications of the person engaged. A properly qualified individual can expect to be the head of the department in 4 or 5 years. One with less experience will be given a contract as an instructor or assistant professor. File No. 4863-V.

MECHANICAL OR MINING ENGINEER required by small expanding sales engineering company backed by large financial organization, handling conveyors, belts, transmission equipment and related items to mines, quarries, and larger industrial organizations. Applicant should be 25-35, be prepared to travel in Ontario and Quebec, operate from Montreal primarily and later to open Toronto office. Salary and commissions with travelling paid, set on incentive bases, with no top limit. Average man should earn minimum $6,000.00. State qualifications and availability. File No. 4869-V.

gauges. Canadian background required Location in Montreal. Write giving full details of training experience and state salary desired. File No. 4884-V.

MECHANICAL ENGINEER required in the lubrication department of prominent oil company with headquarters in Maritimes to be trained in doing lubrication surveys and selling same. Position has an excellent potential. Please write details and if possible enclose photo File No. 4889-V.

MECHANICAL ENGINEER required in Edmonton, Alberta, who has graduated from a recognized Canadian university and who has about five (5) years experience in a chemical plant or refinery. He will deal mostly in equipment used in the manufacture of petrochemicals and synthetic fibres. Duties will consist of general engineering, which will include design, layout, estimating and some administration. Must be able to handle project work and general plant engineering problems File No. 4891-V.

MECHANICAL ENGINEER required who has had practical experience in structural design. He will be required for commercial vehicle designing particularly. This is a good opportunity with a sound future. Location Ontario. File No. 4893-V.

### MISCELLANEOUS

THREE SALES ENGINEERS required by manufacturer of multiwall Kraft bags and related paper products. 1954 graduates to 3 years of experience. Training period in Montreal. Subsequent work in variety of locations. File No. 4777-V.

THREE DESIGN engineers required by Department of Transport, Ottawa. Structural, electrical, mechanical to design and develop program for new airport terminal buildings, across Canada, and also modifications to existing terminal buildings. File No. 4832-V.

MECHANICAL OR CIVIL engineer with a minimum of seven years up to ten years' experience to undertake work supervising installations, etc., which would be engineered in our engineering department. File No. 4835-V.

THREE TECHNICAL SALES TRAINEES required to understudy various positions throughout the sales organization which include inside representative, field salesman, technical serviceman, sales administrator. Graduate from Canadian University '52, '53 or '54. Location Toronto initially, could be located in any one of six major Canadian cities. File No. 4840-V.

SALES DEVELOPMENT engineer, mechanical, civil or metallurgical required for sales force of long established fabricating plant. Experience in pulp and paper mill or mining field an asset. Location Montreal with considerable travelling. File No. 4843-V.

CHEMICAL OR MECHANICAL ENGINEER, recent graduate required by oil company in Montreal. Age limit 25-32. Preferably bilingual and car owner. Salary depending upon qualifications. File No. 4846-V.



ENGINEERING LIBRARIAN required to operate technical library with staff of seven, serving aircraft engineering department of 750 personnel. Applicants should have an aeronautical engineering degree or the equivalent aeronautical engineering experience, library training and direct experience in the operation of a technical library. Replies should indicate training and experience in detail, and salary requirements. File No. 4848-V.

CIVIL AND/OR MECHANICAL engineer required by a firm of consulting engineers in Western Ontario. Preference given those with experience in municipal engineering and sewage treatment plant design, or commercial and industrial building design. This position can lead to an interest in the firm if qualifications are sufficient. All replies treated with strict confidence. Please provide complete outline of experience and background with first letter. File No. 4854-V.

RESEARCH PHYSICIST or engineer required by the Pulp and Paper Research Institute of Canada to take charge of a long-range project now being initiated on the fundamentals of mechanical pulping, i.e. the factors governing the mechanical separation of paper making fibres from wood. Necessary qualifications will include a post-graduate physics or engineering degree with emphasis on mechanics and mathematics; experience in planning, executing, and reporting research projects, and the ability to confer with mill staffs on the practical data pertinent to the problem. Salary will be commensurate with training and experience. File No. 4856-V.

ENGINEER REQUIRED BY paper board converter organization manufacturing a wide variety of cardboard containers and special packaging. Duties include a considerable amount of machine design and in addition to investigate a preventative maintenance program to cover all production equipment. Applicant should be prepared to continue on as assistant engineer in the engineering department. Salary would be based on qualifications The location will be London, Ontario. File No. 4858-V.

PRODUCTION MANAGER required for manufacturers of aluminum doors and windows. Someone experienced in this phase of work would be appreciated, but not absolutely necessary. Applicant should be 30 years of age or over and bilingual. Salary is open, depending upon qualifications. File No. 4861-V.

CHIEF PLANT ENGINEER required for a senior position. Applicant must be a graduate engineer with extensive experience on design and construction of office and plant buildings and plant mechanization and be capable of planning and guiding the work of a large department. File No. 4866-V.

FOUNDRY METALLURGIST required by large manufacturing concern in Montreal, operating steel cast iron and bronze foundries. Experience desirable but not essential. File No. 4876-V.

SENIOR ELECTRONIC ENGINEER with degree in physics or electronics from a recognized university with at least five years experience in electronic circuit design. British subject preferred. Salary commensurate with ability. Send resume to File No. 4877-V.

LECTURER REQUIRED in an expanding department. Subjects economic geology, geomorphology, stratigraphy, M.A. desirable. University year September 15 to

May 15. Salary range $2500 to $3000. File No. 4880-V.

ENGINEER REQUIRED by consulting firm located in Calgary, Alberta, minimum 5 years experience in sales and foundations with some post graduate training. Applicant should state age, summary of experience and salary expected. File No. 4883-V.

GRADUATE CHEMICAL OR mechanical engineer required with two to five years experience on industrial maintenance work. As project engineer duties include the maintenance of the buildings and equipment of the plant, including some design work in the nature of alterations and improvements. Location Province of Quebec. File No. 4885-V.

YOUNG ENGINEER either mechanical or electrical to assist in the design and manufacture of blue printing and white printing. Location Ontario. File No. 4894-V.

TWO INSTRUCTORS required to divide the following subjects: tool design, manufacturing analysis, metrology, engineering drawing and strength of materials: applicants should have a genuine interest in teaching at the junior college level and have had some industrial experience. They should be professional engineers with either a degree or the Higher National Certificate. These positions lead to a permanent appointment in the Ontario Civil Service providing a three week annual vacation, adequate superannuation and sick leave benefits. File No. 4895-V.

CANADIAN SALES REPRESENTATIVE, preferably a professional engineer required with successful sales record to industrial organizations. Must have knowledge of materials handling, dust collection and fume disposal equipment. Work can be undertaken in conjunction with other activities if desired. Exclusive territory. File No. 4896-V.

STRESS ENGINEER, graduate in mechanical or civil engineering, with two or three years experience in stress analysis of steel structures and machinery. Required by manufacturer in the Montreal area, opportunity for varied experience in the stress analysis of heavy machinery and structures. Salary commensurate with experience. File No. 4897-V.

A CIVIL OR MECHANICAL engineer preferably with knowledge of soil mechanics and some practical experience to work on the engineering aspects of snow and ice research, especially on field studies of ice and snow. A Physicist or Engineering Physicist with M.Sc. or Ph.D. degree to assist with the research program. Positions are in connection with the completion of special laboratory facilities for snow and ice research in the new building, Research Centre, Ottawa. Salaries will depend on training and experience. The opening provides challenging opportunities in a new field of work. File No. 4899-V.



YOUNG ENGINEERS for industrial engineering training in the textile industry in Ontario. Besides technical ability work will require ability to sell ideas and to deal successfully with mill personnel. Replies should outline experience, age and salary expected. File No. 4901-V.

CHEMICAL ENGINEER required to fill position of managing engineer in a newly incorporated Canadian company. Organization is engaged in the process of plating non-ferrous products. Age 28-35 and should have experience in cost and production control, to be able to work with sales and also be interested in development work on new products. File No 4902-V.

NATIONAL RESEARCH COUNCIL CANADA rquires at Ottawa a health and safety engineer under direction, to develop a program of safety consciousness throughout the laboratories of the Council. The duties will include the investigation of potential accident and health hazards, accidents and fires, and the recommendation of safety measures. Graduation in Engineering, chemistry or physics, from a university of recognized standing is required; must be physically fit, and have several years' experience in technical work, safety engineering experience desirable but not essential. Initial salary will depend on qualifications. Apply to the Employment Officer, National Research Council, Sussex Street, Ottawa 2, Ontario, giving full details of qualifications and experience. File No. 4908-V.

MECHANICAL ENGINEER M.E.I.C., P.Eng. (Que.), 8 years experience including 3½ years with a telecommunications manufacturing concern, checking mechanical design, supervision of prototype work and liaison with factory. Interested in obtaining position with responsibility and scope for advancement, preferably in electronic or allied industry. Apply in writing to File No. 2829-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., interested in design or development work in I.C. engine, automotive or similar field or in instrumentation and control. Available on one month notice to present employer. File No. 3460-W.

MECHANICAL ENGINEER Jr.E.I.C., single, age 26, N.S.T.C., 1951. Seeking position with insurance underwriters or in some branch of sales. Experience in building construction, design of manufactured gas installation and presently employed as fire survey engineer. File No. 3903-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., B.E. 1950, single, age 27, bilingual, presently employed as assistant chief engineering draughtsman with wide responsibilities, 30 months diverse experience prior to graduation in pulp and paper and automotive industries. Seeking position with increased responsibility, would consider overseas assignment. File No. 3931-W.

EMPLOYERS are you looking for a potential future executive in production or management? Ambitious professional engineer (electrical) with the following qualifications desires change of employment with future possibilities of primary importance. McGill 1951, age 26, married, C.G.E. test course, wire and cable engineering, presently employed as assistant project engineer with large chemical manufacturer. File No. 4014-W.

CHEMICAL ENGINEER, McGill 1950, Jr. E.I.C., P.Eng., 3½ years experience in control, development and operation. Desires permanent position with promising future. Development work preferred, but would consider other offers. File No. 4042-W.

MECHANICAL ENGINEER, M.E.I.C., graduated, married, sound Canadian practice, twenty years experience includes: design, estimating in piping, heating, ventilation, air conditioning, refrigeration plumbing, steam and powerplant installations. Experience in manufacturing industry, foundry, boilers pressure vessels, pumps, compressors, valves, shopwork, paper and pulp industry construction. Capable for administrations, organizing, supervision, sales. Desire a position of responsibility suitable to past experience with possibilities for advancement. Location in Montreal. Available on one month's notice. File No. 4211-W.

MANAGEMENT ENGINEER, M.E.I.C., age 39, family, Queen's 1936, B.Sc. (Hon) mechanical, P.Eng. (Ont.). Seventeen year's industrial experience: eight years in aircraft, three years in bus and five years in miscellaneous sheet-metal manufacture; last year spent in light construction industry operating own business. Experience includes all phases of factory operation as well as top level general management assignments. Good record in organization work, labor relations and product development through all phases of design, tooling, material and production control, sale s cost accounting and management control. Seeking management career opportunity, any location domestic or foreign with Southern Ontario preferred. Available on short notice. File No. 4219-W.

1943 GRADUATE IN CIVIL ENGINEERING, University Berlin, age 34, married, 2 children. Specialization in hydraulics, 7 years experience in design of navigable waterway, dams, locks and hydro power stations, hydraulic research and hydraulic laboratory work, and also river regulations and water supply. File No. 4244-W.

CHEMICAL ENGINEER, 32, B.A.Sc. (Hon), P.Eng., Jr.E.I.C., veteran, 1½ years process and quality control supervision, 2½ years process development in cellulose products, lacquers and solvent recovery, 3 years business experience, desires responsible position preferably in Southern Ontario, supervisory and/or technical. File. No. 4391-W.

# SITUATIONS WANTED

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc. (E.E.) McGill 1950, age 26, single, bilingual, C.G.E. test course graduate. 6 months transformer designs. 2½ years assistant electrical superintendent on construction of industrial plant. Desire work of permanent nature with responsibilities commensurate with experience. File No. 385-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Eng. (McGill '50), age 26, married, since graduation employed by firm manufacturing pulp and paper mill machinery with experience including design, production and engineering sales. Desires responsible position with electrical firm offering an opportunity to specialize in the electrical power field. Location Montreal preferred but will consider locating anywhere in Canada. File No. 730-W.

STRUCTURAL STEEL DETAILER REQUIRES immediate employment anywhere in Canada; now in Toronto. Long term preferred, short term accepted. Have capacity for checking, supervision, estimating, and sales. Contract tenders submitted. M.E.I.C., P.Eng. (Que.) File No. 1935-W.

GRADUATE ENGINEER, B.A.Sc., M.E.I.C., P.Eng. (Ont.) seeks technical development work as assistant to works manager or chief engineer of medium sized company. Experience includes office work and training course with Canadian electrical manufacturer, four years in Canadian patent office, and ten years varied work on technical phases of design, development and manufacture of domestic refrigeration and other products. Recent aptitude testing confirms suitability for this type of work. Present earnings $7,500. File No. 1958-W.

PUBLIC UTILITY ENGINEER, nine years experience, water, hydro, gas, sewerage. Present contract expires June, 1954. Supervising $3 million project including preparation rate structure, construction, design, purchasing. Canadian, aged 40, married. B.A.Sc., M.E. I.C., C.E., P.Eng. Desires position as public utility engineer or staff consultant anywhere in Canada. File No. 2466-W.

MECHANICAL ENGINEER M.E.I.C.,, with apprenticeship and university background available for responsible position, on reasonable notice. Interested in representing manufacturers wishing to develop and service markets in Canada or abroad. Experience includes design, construction and maintenance in the pulp and paper industry, several years handling sales of power plant equipment. Working knowledge of French and German. Free to travel. File No. 2642-W.

GRADUATE MECHANICAL ENGINEER, McGill 1950, with master of business administration degree, University of Michigan 1954, looking for a career with a progressive company. Three and a half years experience in industrial engineering and also summer work in several industries. Would want to start in production or industrial engineering work. File No. 4444-W.

CONSTRUCTION ENGINEER. M.E.I.C., age 45; no dependents, 30 years general construction and mechanical experience, 21 since graduating. 10 years sales. Extensive public speaking, lecturing and public relations experience. Now completing an operation. Free to travel or relocate anywhere. Canada or foreign. Prefer north country, frontier or foreign — general construction, townsite, supervisory, public relations. File No. 4451-W.

GRADUATE MECHANICAL ENGINEER, 1952, Jr.E.I.C., married, age 30, with varied maintenance experience on high pressure equipment in the chemical industry, electrical repair for a mining company and some industrial engineering experience. Desires employment on plant maintenance or field supervision of industrial equipment installation and alteration. Location preferably in Ontario. File No. 4453-W.

ELECTRICAL ENGINEER, graduate 1949, power and machinery, Edinburgh, Scotland. M.E.I.C., grad. I.E.E., Whitworth Prizeman, age 29, married, two children. 5 years electrical engineering apprenticeship, 3 years electrical draughting, 3 years electrical engineering. Experience on rural and urban distribution; construction, maintenance and operation; H.V. and M.V. lines, cables, substations and associated gear; estimating, profile surveying, pressure testing, fault location, etc. Also inspection, testing and maintenance of all types industrial electrical machinery and cabling in paper mills, quarries and other industry; i.e. generators, motors, switchgear, transformers, elevators, etc. Desires employment on either distribution work, plant maintenance or with consulting engineer, commencing beginning of September. File No. 4475-W.

SENIOR MECHANICAL ENGINEER, B.Sc., P.Eng., M.E.I.C., age 41 years Member A.S.M.E., A.S.H.V.E., A.S.R.E., over twenty years experience in air conditioning, heating and ventilating, piping, plumbing, refrigeration design and installation, waterworks and sewerage plant, workshops and plant layout, buildings, roads, and utilities and fully experienced in all mechanical and steam power plant boilers, pumps hot water systems, design, specifications installation, maintenance and planned maintenance desires an engineering appointment anywhere in Canada, U.S.A. or on overseas projects. Previous experience as resident engineer on very large projects overseas, on construction of varied type jobs on contract basis for government departments. Further particulars will gladly be forwarded to interested employers. File No. 4481-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng. (Alberta), age 35, single, 5 years general engineering training with one of the largest electrical manufacturers in U.K., 3 years mechanical design in light engineering works, 4 years in oilfields and refinery abroad on installation, erection, and maintenance of electrical and mechanical plant which included pumps, air compressors, A.C. and D.C. motors, steam and diesel power plants, power distribution and lighting. Desires position in construction or in which experience can be utilized. Location anywhere. File No. 4489-W.

INDUSTRIAL ENGINEER, mechanical engineering degree, age 38, with fifteen years experience in light industry on: manufacturing methods, time and motion study, process engineering, production control, factory engineering, administrative engineering and production supervision, available immediately. File No. 4493-W.

HARVARD BUSINESS SCHOOL and Toronto engineering and business graduate seeks marketing position with a manufacturer of consumer goods. Presently employed outside Canada with a similar firm. Prefer Southern Ontario basing. Age 25, married. File No. 4494-W.

ADMINISTRATOR, PROFESSIONAL ENGINEER, experienced in chemicals production, management and training with definite sales potentials, plus some sales training and experience. Seeks challenging opportunity, in technical sales or service, leading to sales management in chemical or pharmaceutical firm. Presently in Toronto, will locate anywhere. File No. 4496-W.

MECHANICAL ENGINEER, graduate 1951, Jr.E.I.C., single, age 24, experience in materials handling, and pulp and paper desires position with opportunity for advancement. File No. 4498-W.

MECHANICAL ENGINEER, graduate, A.M.I.M.E., A.M.I.E.T., government certificate, 15 years experience design and development field work, oil refinery, material handling plants, installations, machinery grainery, conveyors, elevators, construction, structural steel, reinforced concrete, docks, timber structure. Knowledge of Spanish, Italian, Arabic, little French, desires employment South America, Peru. Age 36, Canadian citizen. Past experience also includes report writing, drafting, estimates, civil engineering. Presently employed Engineering and Research Department. Salary secondary to opportunity for advancement. Free to travel anywhere at short notice. File No 4499-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., P.Eng., age 38, married, veteran. Eight years industrial experience, mainly in chemical plant design including pressure vessels, high measure piping, material handling, steel-and reinforced concrete construction, steel fabrication, etc. and cost estimating. Also some construction and some maintenance experience. Desire employment with responsibility and with future possibilities. Preferable location Alberta File No. 4503-W.

GRADUATE ENGINEER, B.E. Mechanical and Electrical, Sydney University, Australia, 1948. Age 32, single, 4 years experience plant engineering, construction, steel industry, sugar, hydro-electrical industry. Interested in position; design, development production engineering or plant engineering; inventive. File No. 4504-W.

CHEMICAL ENGINEER, Jr.E.I.C., 27, graduated from University of Toronto 1950. Four years experience in the protective coatings industry dealing with plastics, paints, varnishes, and waxes. Engaged in sales, supervisory and research capacities. Presently employed but seeking a more challenging position. Would consider other fields than protective coatings if sufficiently interesting. File No. 4505-W.

ELECTRICAL ENGINEER, Australian citizen, age 39, single, Associate Member of Institution of Engineers, Australia, and Member of Association of Professional Engineers, Australia. Desires position with a supply authority whilst establishing professional status in Canada. Twenty years experience in Electrical industry, 14½ with supply authorities in Australia and 1¼ with consultants and construction engineers, Great Britain. Experienced in design, construction, maintenance and operation of distribution works, substations and thermal station electrical installations. Experience up to 66KV. Field experience on 275 KV general line construction British electricity authority. File No. 4506-W.

CIVIL ENGINEER, S.E.I.C., P.Engineer, located in Montreal desires evening work in draughting, design etc. File No 4507-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc. Manitoba 1950, married, 2 children. Age 30. Seeks position in electrical utility or plant maintenance in industrial concern. 4 years in transformer design, production and test. Some sales. Western Canada preferred. File No. 4508-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P. Eng. (Ont.), B.A.Sc. 1948, M.A.Sc. 1951, U.B.C., age 28, married, one year on design of substation layout and control with a large public utility prior to receiving M.A.Sc. Completed industrial training and sales course with a large electrical manufacturing company. Experience in application and manufacture of low voltage air circuit breakers, power fuses and grounding resistors. Design of metalclad switchgear control circuits and layout of wiring diagrams. Also teaching experience. Desires position requiring initiative, organizing and supervisory ability with opportunity for advancement. File No. 4509-W.

ELECTRICAL ENGINEER, B.Sc. Queen's 1951; power option; Jr. E.I.C., P.Eng., aged 26, married, one son, and am a veteran. Employed since graduation by large chemical company. Have had varied experience in mechanical design, plant start-up, trouble shooting and in electrical maintenance. Some experience with pneumatic instrumentation. Good knowledge of electronics through signal corps and amateur radio. Have done electrical estimating on minor plant projects. Would like to further electrical training through position with construction company installing generation equipment, or with consulting engineer on design and layout of plant power distribution systems. Location no object. Will send transcript of education, details of work background and references on request. 4510-W.

CIVIL ENGINEER, honours graduate, of Glasgow University, with two years of construction experience, desires position in design office or on construction. Single, willing to work anywhere in Canada. File No. 4514-W.

CHEMICAL ENGINEER, S.E.I.C., Laval 1953, presently working for the Defence Research Board with chemical engineering group. Age 25, married, one year experience. I would be glad to meet possible employers at any time. File No. 4515-W.

CIVIL ENGINEER, Manitoba 1952, Jr. E.I.C., age thirty, married, one child. Presently employed by oil company on work becoming more the province of petroleum engineer, desires employment with consultant or contractor on heavy construction or municipal projects. Five summers experience in highway and drainage construction, bituminous and concrete paving as instrument man and resident engineer. Location immaterial. File No. 4518-W.

MECHANICAL ENGINEER seeks senior executive position in chemical or allied industry, or firm of consulting engineers. 12 years experience in the financial and engineering side of large scale plant expansions in the chemical industry. Excellent knowledge of the following processes: ammonia, methanol, urea, formaldehyde, chlorine, wood saccharification, alcohol distillations. 5 years experience in dyestuffs including complete design and erection of services and maintenance workshop. Superintendent planning engineer in charge of drawing office of 40 men, reorganization of engineering department of large concern. Excellent references, bilingual, graduate 1942, M.E.I.C. File No. 4519-W.

ELECTRICAL ENGINEER, M.E.I.C., P. Eng., with 3 years urban distribution experience and CGE test course in switch gear, motor generator, installation and transformers seeks post with utility, involving generation, transmission and distribution. Present salary in power transformer engineering sales $350 per month. File No. 4525-W.

EUROPEAN CIVIL ENGINEER would accept part time work in structural designing. File No. 4526-W.

AGRICULTURAL ENGINEER, M.E.I.C., U. of S. 1945 available December 1, 1954. 4 years teaching experience, 3 years research engineer for Sask. Research Council. Thoroughly acquainted with automotive and internal combustion equipment. Age 38, married. File No. 4527-W.

ELECTRO - MECHANICAL ENGINEER P.Eng. (Ont.), membership several English Professional Institutions. 2 years post graduate course in servo-mechanisms and control equipment. Practical experience of electro-hydraulic mechanisms. Desires position in administrative capacity. Minimum salary $7,000 per year. File No. 4528-W.

STRUCTURAL ENGINEER A.M.I., Struct. E., P.Eng., desires responsible position in the Hamilton area. Experienced in the competitive design of light and heavy industrial and commercial structures and road and rail bridges. Eight years and three years English and Canadian experience respectively. At present employed in Hamilton. File No. 4529-W.

CIVIL ENGINEER graduate of U. of Latvia in Riga, 1926. 18 years experience in railroad, road, reinforced concrete and structural steel constructions. Seeking position in any part of Canada. File No. 4530-W.

ELECTRICAL ENGINEER, graduated Norwegian University 1950, age 30, married. Experience: 2 years design and development of hydro-power station and lighting engineering, 1 year as a sales engineer. Available immediately, location anywhere. File No. 4531-W.

CIVIL ENGINEER (European) graduate Polish University College, London, Jr. E.I.C., age 41. Married. Seven years experience (including two years in Canada) in design, draughting and supervision of all sorts of engineering structures, buildings, industrial plants, bridges and earthworks. Will accept position in line with his experience. Location preferred Montreal or Southern Ontario. Available on reasonable notice. File No. 4532-W.

CIVIL ENGINEER, member E.I.C., A.C.I., graduate University of Pennsylvania, U.S.A., bilingual, married, 2 children, 18 years varied experience abroad and in Canada. Last 9 years specialized in design and supervision of reinforced concrete and steel structures of all types. Seeking permanent position where technical skill and experience would be of value. Available on reasonable notice. File No. 4533-W.

CIVIL ENGINEER, graduate of technical university of Norway, 1949, age 30, married, no children. 3 years experience in structural engineering and two in construction. Desires position in construction engineering. Free to travel, but would prefer to be in eastern provinces. File No. 4534-W.

CIVIL ENGINEER, B.Sc., Jr.E.I.C., 1950 grad., R.C.A.F. veteran, age 34, married with 2 children. Have had extensive experience in plant maintenance, administration and design. Now wishes to broaden experience and would be interested in a responsible position in the field surveying or general field engineering. Will be available July 15th File No. 4538-W.

CIVIL ENGINEER, B.Sc., U.B.C., 1951, Jr. B.C.P.E., Jr.E.I.C., age 25, 3 years heavy construction experience having responsible work in layout and construction supervision during the excavation and construction of an underground power house and power tunnels. Seeks position in design office or responsible field position where experience will be of value. Preferably in Montreal or vicinity. File No. 4539-W.

MECHANICAL & INDUSTRIAL ENGINEER, graduate, 1937; M.E.I.C., P.Eng., A.S.M.E., age 45, married, now employed as plant manager, wishes to locate outside Quebec. Reason plant closing. Seasoned senior engineer with vast mechanical experience in paper making, construction and the steel industries. Well qualified for the positions of plant manager, chief engineer, plant engineer, mechanical superintendent, etc. Seeks a position in a reliable company where application and effort will be rewarded with advancement, peace of mind, and permanency in order to establish a home. File No. 4540-W.

ELECTRICAL ENGINEER, B.E., M.E.I.C., 12 years of experience in responsible positions including operation and testing of AC and DC machinery, design and supervision of construction of transmission lines, overhead and underground distribution systems, and substations, also system planning, report writing, economic studies, budgeting, staff supervision, etc. Desires position with increasing responsibility. Excellent references. Available on suitable notice to present employer. File No. 4541-W.

CHEMICAL ENGINEER 33, veteran, graduate with five years wide experience in mechanical, chemical and electrical engineering, presently employed by plant manufacturers in Scotland, available for employment in Canada in August, 1954. Desires responsible position in planning, plant or production engineering, or industrial research and development work. Resume and references on request, languages, locality no barrier. File No. 4542-W.

CIVIL ENGINEER, P.Eng., M.E.I.C., with extensive experience in design and detailing of R.C. structures. Seeks part time employment in Toronto area. File No. 4544-W.

MECHANICAL ENGINEER, Jr.E.I.C., Polytechnique, 1953 P.Eng., equivalent of 4 years in plumbing and heating business as an apprentice, service man, design, estimate, sales and surveillance of complete plumbing and heating system for a contractor in Eastern Townships. Seeks employment in similar work preferably in Eastern Townships or Montreal but would locate anywhere. Married, one child, 26 years old, bilingual. File No. 4548-W.

CHEMICAL ENGINEER, M.A. (Hons. Engineering), Cambridge University, England; A. F. Inst. of Petroleum, 28, married, recently arrived from England. Four years service with Royal Engineers as survey officer in the Middle East. Three and a half years supervisory experience in control, development, and maintenance of various types of petroleum refinery plants. Desire responsible position anywhere in Canada. File No. 4551-W.

CHEMICAL ENGINEER, M.E.I.C., P.Eng., Toronto 1942, married. 12 years industrial experience in chemical plant project supervision, process equipment and piping design and fabrication. Seeks position with chemical company on new projects supervision or with process plant design engineering and construction company. File No. 4552-W.

ELECTRICAL ENGINEER, McGill 1953, S.E.I.C., presently employed, seeks position which calls for judgment, initiative and willingness to accept responsibility. Over two years varied experience (including summer work) in switchgear, rotating equipment, household appliances, sales, and drafting. Location Montreal. File No. 4553-W.

PROFESSIONAL ENGINEER, Jr.E.I.C., B.A., B.A.Sc., Athlone Fellow '52, age 27, bilingual. Post graduate studies in engineering production and management principles, Birmingham University, England. One year experience in construction, Canada; and one year experience with manufacturing concern. Seeks employment in the Montreal area preferably. Available for work at the beginning of September. File No. 4554-W.

ELECTRICAL AND MECHANICAL ENGINEER, B.A. (Eng.), A.M.I.E.E., British, aged 44, family; seeks administrative, sales or consulting engineering post, any location not involving prolonged separation from family. Twenty-two years technical sales of heavy electrical plant, generation with all types of prime mover, distribution, application. Newly arrived from five years in Brazil as technical chief, selling and supervising diesel and diesel alternator installations. File No. 4555-W.

GEOLOGIST, SOILS ENGINEER and Surveyor, M.E.I.C., P.Eng., age 41, 18 years experience in geological and geophysical exploration (oil, coal, chromium, tin, iron), glacier research, soil mechanics (foundations, airports, hydrology, laboratory), diamond drilling, terrestrial and aerial photogrammetry, photogeological interpretation. 8 years consultant in Europe. Very experienced alpinist. Seeking responsible position with occasional field work in Western Canada, preferably Calgary. Permanently employed. File No. 4556-W.

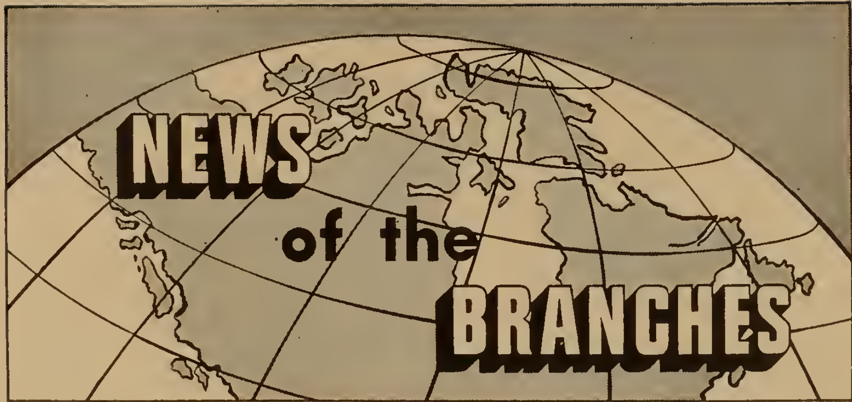
MECHANICAL ENGINEER, Jr.E.I.C., 1949 N.S.T.C., age 28, married with children desires a responsible position with an energetic company. Experience in general mechanical design, standardization, cost reduction, shop supervision, personnel administration and manufacturing methods. Interested in manufacturing, sales or design. File No. 4557-W.

ELECTRICAL ENGINEER, Jr.E.I.C., N.S. T.C., 1952, age 23, single. Interested in all fields of electrical engineering activity and willing to take responsibility and apply himself. Presently in second year of graduate student training course with large and reliable Canadian manufacturer of electrical equipment. Experience includes one year in transmission and distribution departments of hydro-electric utility. Some accounting experience. Desires position in Canada and would give special consideration to Newfoundland as as a location. File No. 4558-W.

MECHANICAL ENGINEER, Jr.E.I.C., graduate N.S.T. College 1951. Experience includes 1 year research work and 2 years mechanical design. Interested in position in plant engineering maintenance or design. Preferably located in Montreal area. File No. 4559-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc. (Maths. and Chem.), Acadia University 1949, B.E. Nova Scotia Technical College, 1952. Age 27, married. Experience: One year as engineer in distribution department of small electrical utility; presently taking Westinghouse Graduate Training Course. Desires position offering scope for learning and advancement with smaller company or utility. File No. 4560-W.

CONSTRUCTION ENGINEER, B.Sc. (1943) M.E.I.C., A.M.I.C.E., A.M.I. Struct. E., 11 years experience. Seeks responsible position. Has held the following positions: General superintendent, assistant project engineer estimator. Experienced on light and heavy construction excavation water mains, sewers, concrete etc. Married, 33 year old, bilingual. File No. 4561-W.




**Activities of the Forty-seven Branches of the Institute**
**and**
**abstracts of papers presented at their meetings**

## Belleville Branch

E. L. Littlejohn, Jr.E.I.C.,
*Branch News Editor*

C. H. Lusk, Jr.E.I.C.,
*Secretary-Treasurer*

### Annual Meeting

The Belleville Branch of the Engineering Institute of Canada held its Annual Meeting on April 12 at the Masonic Temple with approximately 50 members and guests present.

A. O. Drysdale was elected chairman of the Branch. Other officers elected were A. D. Janitsch, vice-chairman, H. T. Floyd, E. L. Littlejohn, and C. H. Lusk. Continuing in office were J. C. R. Punchard, A. E. Argue, and T. E. Flinn. S. Sillitoe will act as Councillor for the Branch on the main executive Council of the Institute.

T. E. Flinn as chairman of the committee arranging for a Professional Development Course, presented a short report on the progress of his committee.

The film, "Man With a Thousand Hands", was shown, which depicted the construction of the Aluminum Company of Canada's development at Kitimat.

### Management and Administration

Mr. Drysdale then introduced the speaker, Professor J. A. Coote of McGill University.

Prof. Coote addressed the Branch regarding further training for engineers in management and administration. He pointed out that wherever there were two people working together, there was a problem of administration. He also pointed out that as time passes, engineers become less and less concerned with technical things and more and more concerned with administrative matters. This was a satisfactory situation since administrative jobs demand greater remuneration. When an engineer becomes an administrator, he becomes concerned with human relations; problems far more complex than technical problems. Therefore, the good engineer-administrator must broaden his outlook if he is to become a good executive.

The professor spoke with the hope of interesting the Branch in sponsoring a course from McGill on management and administration. A committee, headed by T. E. Flinn, is investigating the possibilities of running such a course in Belleville.

## Brockville Branch

J. G. Kerfoot, M.E.I.C.,
*Secretary-Treasurer*

John F. Preston, Jr.E.I.C.,
*Branch News Editor*

### Dinner Meeting

The people of eastern Ontario can look forward to a bright industrial future H. D. Rothwell, Ontario Hydro liaison engineer for the St. Lawrence power project told the meeting of the Brockville Branch of the Engineering Institute of Canada in the Hotel Manitonna on March 24. But, Mr. Rothwell qualified, the bright future will require the advantages of the St. Lawrence power project and the determination of the people.

Mr. Rothwell told the engineers that the St. Lawrence was the last major source of hydro-electric power in Ontario that lies within economical transmission distance of the centre of population.

"If Ontario is to continue to develop and expand, the province needs supplies of energy in ever-increasing amounts," Mr. Rothwell pointed out, suggesting that the St. Lawrence project was the answer.

"It is one of our cheapest sources of energy yet untapped," he explained.

Saying that this area was blessed with excellent water, highway and railway facilities, plus an oil pipeline and possible natural gas pipeline, Mr Rothwell felt eastern Ontario had a bright future.

"People in this area can look forward to changes in this part of the province in the next 25 years that will astound even the most pessimistic," Mr. Rothwell stated.

The speaker outlined the history of hydro in Ontario and spoke of the future possible uses of natural gas and atomic energy as sources of power.

The speaker was introduced to the meeting by John F. Preston and thanked by J. E. Pickering, both employees at C.I.L., Maitland.

Over 85 engineers attended the dinner-meeting which was presided over by Fred Walsh, vice-chairman of the Institute.

During the dinner reports were heard from the Branch's councillor, Harold Brewer, on recent council meetings held in Montreal, and from Bob Powell, program chairman, who announced the tentative date for the next meeting.

### Engineering Committee

Chairman Walsh announced the formation of an Engineering Committee by the Brockville Chamber of Commerce, which he will head, and asked the members of the Institute to assist in engineering problems when called upon. The committee is to act in an advisory capacity only.

### May Dinner Meeting

Colonels Sagar and Medland of the Association of Professional Engineers of Ontario were guests at the dinner meeting of the Brockville Branch held on May 18 at the Manitonna Lodge. After being introduced by Rex Davey the president of the Association, Col. Sagar, presented a strong case for the national unification of Canadian engineers.

The plan, introduced by last year's Association President H. Smith, calls for the formation of a permanent body sitting at Ottawa empowered to speak for Canadian engineers and to bring the industrial engineer more into the public eye. This plan is expected to be of great interest to the Ontario Provincial Association because of the large concentration of industry in this area. Colonel Sagar emphasized the unofficial nature of his talk and the fact that he spoke only on the personal level as yet but urged those present to think of the plan amongst themselves.

He hoped that the day would come in the not too distant future when the provincial bodies from across Canada could present a concrete proposal for discussion by the members. "Many obstacles remain to be hurdled," he said. "but already the spirit of compromise between the several Associations and the Engineering Institute is paving the way for more detailed proposals."

A spirited discussion period followed during which the Association Executive Director, Colonel Medland added to the president's remarks.

The visitors were thanked on behalf of the Engineering Institute by Bob Tivy of Automotive Electric. After refreshments and further discussion of this important subject, the meeting adjourned.

## Edmonton

P. M. Butler, M.E.I.C.,
*Secretary-Treasurer*

K. Provost, M.E.I.C.,
*Branch News Editor*

### Plant Tour

On the afternoon of April 5, members of the Edmonton Branch were conducted on a tour of the Canadian Chemical Co. plant. That evening Mr. Dave Keck, plant engineer of the Canadian Chemical Company, addressed the regular dinner meeting of the Branch. His topic was "The Place of the Chemical Engineer in Industry". Mr. Keck traced the development of the chemical engi-

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Switchboards
Switchgear, indoor and outdoor
Turbo Blowers
Turbo Generators
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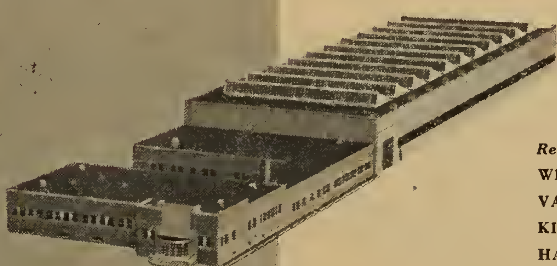

*Plant:* St. Johns, Que.

*Representatives:*
WINNIPEG: Power & Mine Supply Co. Ltd.
VANCOUVER: Gordon Russell Ltd.
KIRKLAND LAKE, ONT.: Mine Equipment Ltd.
HALIFAX: General Equipment Ltd.

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neering profession from its beginning and described the part played by the chemical engineer in the planning, construction and operation of the Edmonton plant

## Huronia

L. Morgante, Jr.E.I.C.,
*Secretary-Treasurer*

G. A. Antenbring, M.E.I.C.,
*Branch News Editor*

**Plant Tour**

A meeting of the Huronia Branch was held in Owen Sound on May 7, for the purpose of touring the plant of the William Kennedy and Sons Limited, and to hear talks on Kennedy products by two of the company's personnel.

Arrangements were made to conduct visitors through the company's West Machine Shop, where the machining operations are carried out. Here it was possible to observe work in process on many of the firm's diversified products.

Visitors were also shown the facilities in the steel, bronze and iron foundries, where all the castings are manufactured for machining and assembly on the firm's premises. A substantial volume of work is done in the manufacture and sale of rough castings.

After the tour, C. R. Stones, chief engineer, gave a paper entitled "Kennedy Products for the Pulp and Paper Industry". He outlined the firm's development since it was founded in 1857 and its gradual expansion into the field of pulp and paper treating machinery. Brief descriptions were given of the company's grinders, sulphate washers, pulpmasters, stockmakers, agitators, and paper machine drives.

S. A. Scott, manager of the company's Falk division described the company's association with the Falk Corporation of the U.S.

## Hamilton

N. A. Parry, Jr.E.I.C.,
*Secretary-Treasurer*

F. S. Gue, Jr.E.I.C.,
*Branch News Editor*

**Students' and Juniors' Night**

The Hamilton Branch Annual Students' and Juniors' Night was held Thursday, March 18. It featured the presentation of four technical papers in a competition which has come to be keenly anticipated by the Hamilton membership, offering as it does an interesting variety of technical topics.

Winner of the Past-Chairmen's Prize of $50 was Frank Gue, Jr.E.I.C., with a paper titled "Some Aspects of Canadian Westinghouse Company Practice in Generator Coil Manufacture." The electrical, mechanical, and maintenance problems encountered in the manufacture of windings for high-voltage synchronous machines were outlined, and a brief description of three prominent present day insulations (micafolium, asphalt bonded, and "thermalastic") was given.

Second prize of $35 was taken by B. A. Warren, Jr.E.I.C., with his paper "Murdochville—Building Canada's New Mining Town." The problems of establishing a modern, comfortable townsite in the middle of the virgin bush in the heart of the Gaspe were dealt with capably and often whimsically in this interesting paper.

D. B. Williamson, Jr.E.I.C., outlined the economic and technical factors which have, in the past few years, greatly increased the number of broadcast transmitters operating by remote control. He gained third prize with his paper "The Unattended Operation of Broadcast Transmitters."

K. J. Reekie, Jr.E.I.C., delivered a well-prepared discussion of "Waterworks Construction and Maintenance."

On behalf of the Judges' Committee, W. A. Dawson, past-chairman, congratulated the contestants. W. A. Wheten chairman, commented upon the importance to both the local and national bodies of this type of activity among the younger engineers.

**Joint Meeting**

In a joint meeting with the A.I.E.E., on April 23, the Hamilton Branch was privileged to hear an address by J. B. MacNeill, consultant on switchgears for the Westinghouse Electric Corporation, who spoke on "Switchgear Development."

Mr. MacNeill, who was born in Prince Edward Island, had much to interest his Canadian audience. He began by outlining the protective devices which were largely either primitive or non-existent 60 years ago. The early plants at the Falls were the first polyphase system designed for power transmission, and were almost defenceless against short circuits; the only course open was to shut the station down until the fault cleared.

Progress was traced from the crudities of fuses which were more of a menace than a safety device, through unsatisfactory trials with air circuit breakers, to the present highly refined and dependable oil breakers. The rising curves of kva. and kv. rating steepening steadily through the years, at present have reached 25 million kva. at 330 kv.; a power flow which can be interrupted in the time it takes a penny to drop one half inch, with reclosure in a quarter second. In the design stage are breakers designed for 30 million kva. at 440 kv., or about 10 times the power of the entire Sir Adam Beck No. 1 Generating Station in the Niagara Gorge.

The speaker was introduced by J. W. Kerr, general manager, power products division, Canadian Westinghouse.

On May 8, the Branch enjoyed the hospitality of the Ford Motor Company at Oakville during an extensive tour of the new manufacturing facilities. Almost 500 members attended, a record turnout for a gathering of this kind.

The Ford tour concluded the regular meeting schedule of the Hamilton Branch for the 1953-54 season.

## Kingston

D. R. Graham, M.E.I.C.,
*Secretary-Treasurer*

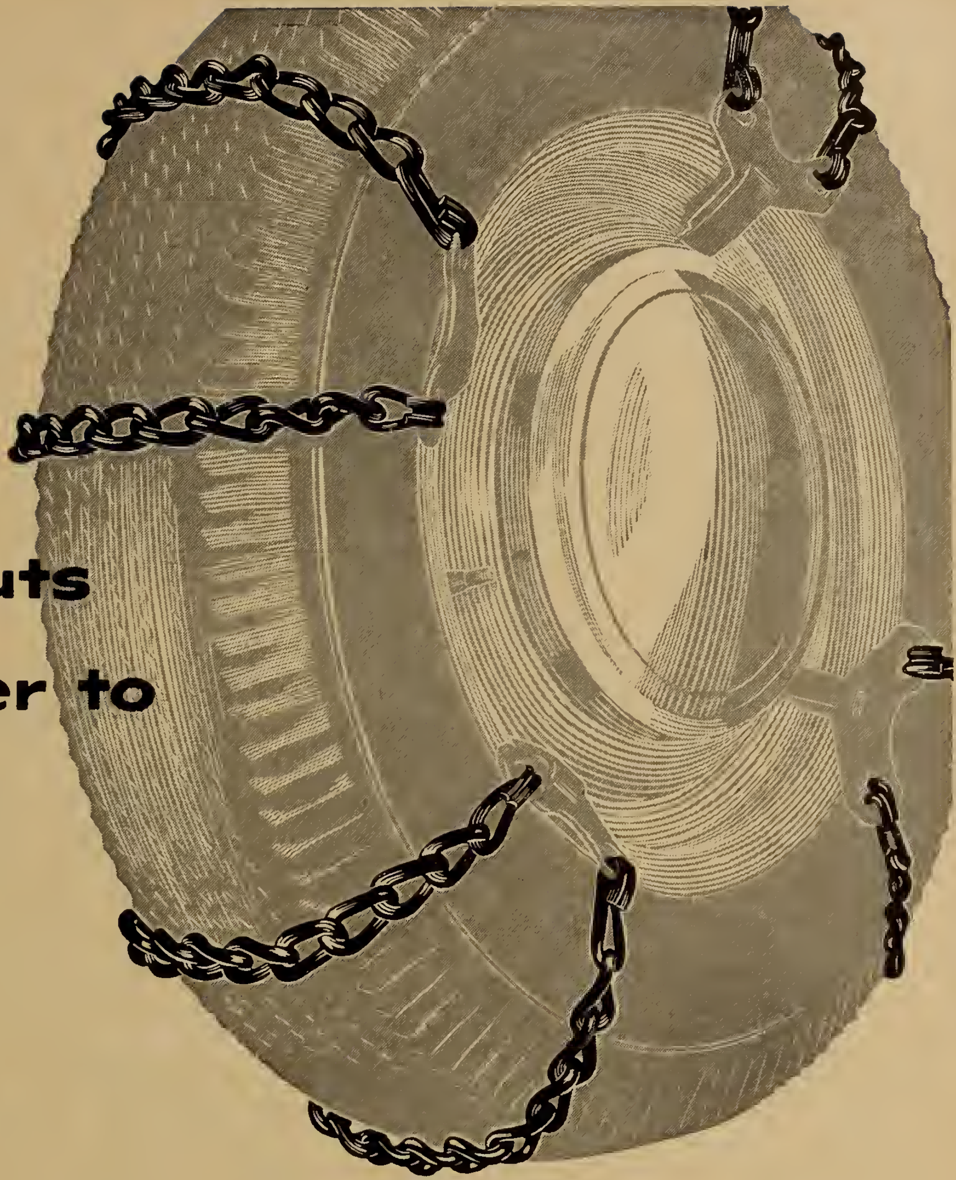
G. D. Burwash, Jr.E.I.C.,
*Branch News Editor*

**April Meeting**

The April meeting of the Kingston Branch was held in conjunction with the Kingston Metallurgical Society in the R.C.E.M.E. officers' mess at Barriefield on April 20.

The guest speaker was Dr. D. F. Gibbons of the Royal Military College. His topic was "Plastic Deformation of Metals". Dr. Gibbons is presently a Defence Research Board Fellow in physics at the Royal Military College. He was introduced by Dr. J. Reekie, R.M.C., chairman of the Metallurgical Society and thanked by A. E. Hyde of Aluminium Laboratories, Kingston.

**Members of the Toronto and Hamilton Branches visit the Ford Motor Company at Oakville, Ontario.**



## Lakehead

G. E. Cook, M.E.I.C.,
*Secretary-Treasurer*

H. Penner, Jr.E.I.C.,
*Branch News Editor*

***Lynn Lake Railroad***

"On Wednesday, April 7, the Lakehead Branch met at the Port Arthur Armouries to hear J. L. Charles, M.E.I.C., chief engineer of the Western Region of the C.N.R., speak on the Lynn Lake Railroad. The talk covered all phases of the location and construction of the 144 mile railroad from Sherridon, Manitoba, to the Sherritt-Gordon Mines Limited new nickel-copper mine at Lynn Lake, 120 miles away by air. This talk is to be the subject of a paper in the Engineering Journal in the near future.

A movie taken by the CNR as the job progressed illustrated the various aspects of the work. One of the most interesting of these was the crossing of the Churchill River. This was done with three separate steel spans.

After the movie, the group took time out for refreshments. Following this Mr. Charles answered a number of questions by various members. R. B. Chandler thanked the speaker.

***Wive's Association***

Members discussed the formation of an Engineers' Wives Association at the Lakehead. Most members were of the opinion that it was an excellent idea and Mr. Charles stated that the Engineers' Wives Association formed in Winnipeg was very successful and very active.

***A. F. Telfer Speaker***

"On Wednesday, April 28, the Lakehead Branch met to hear A. F. Telfer, public relations officer for the Canadian Standards Association, speak on industrial standardization and the functions of the C.S.A. G. S. Halter, branch chairman, introduced Mr. Telfer, who is a native of Collingwood, Ontario, and a graduate of Toronto, Osgoode Hall. Since 1948 he has been executive assistant to the advisory committee of the C.S.A.

Mr. Telfer cited many examples of the use and importance of standards even outside the scientific field. A good deal of the credit for the rapid transition of Canada from a primarily agricultural country to one of the world's important industrial nations should go to standardization of products and practices in industry.

Standardization and mass production have made possible great reductions in the price of consumer goods.

***C.S.A.***

Mr. Telfer explained that the C.S.A. is a voluntary non-profit organization, supported by manufacturer's and retailer's groups. Although it receives an annual grant from the National Research Council and works in fairly close conjunction with this body, the C.S.A. is not a government organization. Many of its recommendations and specifications governing safety have been incorporated in by-laws and have thus become law.

W. D. Beckett extended the thanks of the group to Mr. Telfer for his very interesting talk.

## Lethbridge

R. D. Hall, Jr.E.I.C.,
*Secretary-Treasurer*

***Supper Meeting***

Saturday, March 20, 1954, the Lethbridge Branch of the Engineering Institute of Canada held their monthly supper meeting. Entertainment was provided as a piano-violin duet by Mr. and Mrs. George Brown. The soloist for the evening was George Gowlland, Jr.

The speaker for the evening was Ray Miles and was introduced to the group by city engineer, J. C. Neufeld.

***Science and Imagination***

Mr. Miles, representing the Armco Drainage and Metal Products, discussed the rapid progression of scientific discoveries in the last twenty-five years. The tremendous advance in technical inventions has made our generation practically immuned to surprises. When scientists claim today that they will fly to the moon before the end of the twentieth century, people do not consider the proposed feat an impossibility or even an improbability.

Mr. Miles prompted the engineers to continue to use their imagination and

initiative to develop new devices which will help to increase our standard of living. Proof of the continued advancement in Canada is the St. Mary Dam Development in the Lethbridge area, the Frobisher project in the Yukon, the St. Lawrence Seaway and the Kitimat project in British Columbia. With this recent advancement Canada has grown rapidly resulting in an increase in population and in the standard of living. The engineering profession is destined to play an important role in this present revolution.

Mr. Miles was thanked by William Mills.

## Lower St. Lawrence

Jean R. Menard, M.E.I.C.,
*Secretary-Treasurer*

### Annual Meeting

On April 24, the engineers of the Lower St. Lawrence were hosts at a social evening held at the Hotel St. Louis, Rimouski. A cocktail was served at 6.30 p.m., followed by a banquet and a dance attended by some 50 persons.

Brigadier Maurice Archer, M.E.I.C., vice-president of the National Harbour Board was guest speaker at the banquet. He described the economical look of the St. Lawrence River, its maritime traffic from the Great Lakes to the Atlantic Ocean and its future development, the St. Lawrence seaway. He also spoke about the hydro-electrical development in the international zone of the river.

### Film Presentation

On May 2, some 15 engineers attended a presentation of five films at the Curling Club. The local plant of Canada Wire and Cable presented two films related to the construction of cables. Also three films on construction of roads, bridges and sea-walls were shown. These latter films were loaned to our Branch by Georges Demers, M.E.I.C., who had them mailed to him by "La Société des Ingénieurs Civils de France"

## Moncton

V. C. Blackett, M.E.I.C.,
*Secretary-Treasurer*

### Halifax Harbour Bridge

The construction of the Halifax harbour bridge, which when completed, will be the largest bridge structure in the Maritime Provinces, was the subject of an address given by the designer, Dr. P. L. Pratley, at the final branch meeting of the year, held in the dining hall of the Moncton Curlers Association.

R. T. Sansom, chairman of the branch, presided. The attendance was a record for branch technical meetings.

The speaker prefaced his remarks by telling of two early attempts to build low-level bridges across the narrows connecting Halifax harbour and Bedford basin. One was destroyed by fire, the other by storms.

The structure, now under construction, will be a suspension bridge with a total span of 1,447 feet. It will accommodate highway traffic between Halifax and the town of Dartmouth now either carried by ferries or routed around Bedford basin. The estimated cost of the structure is ten million dollars. It is expected the bridge will be in use in 1955 once arrangements on the Halifax side have been completed to take care of the traffic problem which even now looms on the horizon.

A detailed study of the project was given in two films narrated by Hugh Pratley, son of the speaker, and resident engineer on the bridge construction.

Following the address, a buffet luncheon was served and an informal discussion held.

## Montreal

R. J. Harvey, M.E.I.C.,
*Secretary-Treasurer*

J. A. Paget, M.E.I.C.,
*Publicity Chairman*

### Plastic Laminates

Plastic Laminates was the topic of a paper presented on Tuesday March 9 to the E.I.C. Montreal Branch by H. M. Brazener, technical superintendent of Arborite Company Limited. The speaker described the different grades of paper and types of resins used to obtain the physical properties and colours of modern laminates. Mr. Brazener then went on to describe the cutting, stacking, press curing, sanding and trimming of the laminate during manufacture.

A summary of the electrical, physical and fabricating properties of laminates was given and many interesting samples of commercial products made of laminates were displayed.

Industrial products including gears, bearings, etc., form a small part of the market. Decorative laminates getting their colour from the top layer of paper, their strength from the lower layers, and their durability from a high quality surface of transparent resin, form the bulk of production. The meeting chairman was E. S. Yuil and Stewart Lockhead thanked the speaker.

### Materials Handling

On March 10 a forum on this subject was held at a joint meeting of the Montreal Branch and the Montreal Chapter of the American Materials Handling Society. The chairman of the discussion was Emile Dupré, and the panel consisted of W. A. Meddick, Elwell Parker Electric Co., E. A. Byrne, American Monorail Co., Ollie Haynes, Island Equipment Corporation, and George Hanhauser, Fab-Weld Corporation. C. B. Elledge, president of the American Institute of Material Handling was also present, and acted as the first speaker. He stated that the Institute consisted of 70 member companies in the U.S.A. who co-ordinated many of their activities for the purpose of advancing the science of material handling. Much of its work is concerned with education and the sponsoring of symposiums between buyers and sellers of equipment so that economical purchasing on the part of the buyer will result and handling costs will be reduced.

### Trucks

W. A. Meddick, the second speaker, discussed industrial trucks, high-lift trucks, and fork trucks, and the economic factors involved when selecting power-driven trucks or trucks pushed by manual labour. He also discussed the relative merits of gasoline driven and electrically driven trucks for several different applications.

### Overhead Equipment

E. A. Byrne's topics included monorails, hoists and overhead cranes. He pointed out that overhead equipment was flexible and versatile. Its main advantages are that it saves floor space and is readily available to all of the floor area underneath it. Methods of controlling and powering overhead equipment and the approximate maximum load capacity of each type of equipment were also discussed.

### Conveyors

The fourth speaker was Mr. Haynes, who spoke on conveyors. He stated that there were three main types of conveyor: gravity, belt or chain, and fixed bed, and that the conveyor played a fundamental part in mass production factories and chemical plants where a continuous steady flow of material is required.

He also discussed roller bearing life in conveyors and its improvement in recent years, and the use of light metals such as aluminum and magnesium in conveyor construction.

### Floor Equipment

Mr. Hanhauser, the last speaker, discussed trailers, skids, fork trucks, floor industrial trucks, and racks, and provided the audience with some up-to-date figures on the cost of some of these articles in the United States. A large audience attended this meeting which was sponsored by the transportation section. Meeting arrangements were made by J. D. Sylvester.

### Atomic Energy

On March 11, Doctor Huet Massue, M.E.I.C., a director of the crown company Atomic Energy of Canada Ltd., gave an illustrated address on the subject "Atomic Energy". Doctor Massue introduced the subject by discussing the present-day uses of radio isotopes in medical work, welding, X-ray inspection, and control, etc., and by briefly discussing the various forms of atomic power such as the atom bomb and Nautilus submarine.

Doctor Massue then went on to discuss the supply, cost, and the method of production of power in various parts of the world today, and pointed out that if the increasing demand for power in certain areas continues, hydro electric power resources will soon be used up and it will have become necessary to resort to steam plants using coal, oil, or nuclear power. He stated that the cost per kilowatt-hour of power derived from coal had been reduced by a factor of about 6 since coal was first used for power generation, and that the same kind of reduction in the price of power derived from atomic energy could certainly be expected. Atomic energy, therefore, will probably become a major source of power in the future, especially if supplies of coal and oil fall off, and the demand for power increases rapidly. P. E. Gagnon of Quebec City acted as chairman, and meeting arrangements were made by J. E. Hurtubise.

### Power Plant Instrumentation

On March 15 an illustrated talk on power plant instrumentation for load frequency and line bias control was given to a joint E.I.C., A.I.E.E. meeting by W. H. Sissons, power utilities and industrial manager, Brown Instrument Division, Minneapolis-Honeywell Co. The slides illustrated the basic electronic principles used by the company to measure temperature, pressure, electrical potential, amperage, power etc. Slides showed the two phase selsyn system and its application in several types of instruments. The methods of load frequency and the line bias control were described. The meeting chairman was P. P. Vinet and meeting arrangements were by J. R. Holmes. About eighty engineers attended the meeting.

*Stainless Steel Trains*

On Thursday, March 18, Benjamin Labaree, chief engineer of the railway division of the Budd Company of Philadelphia, gave an illustrated lecture on the stainless steel transcontinental coaches now under construction for the Canadian Pacific Railway. The order for 173 cars of several types, including dome cars and sleepers was placed late last spring. Delivery will commence twelve months after placement of the order.

The speaker acknowledged the contribution by Canadian industry of couplers, draft gear, and furnishings amounting to a considerable part of the cost. Mr. Labaree showed graphs depicting the increased use of stainless steel cars because of their superior strength, light weight and low maintenance. He stated that a locomotive limited to six old cars could pull seven Budd cars due to their lighter weight. A Budd car is 38 percent lighter than a modernized steel car although the comparison is not quite as favourable when high strength steel cars of recent design are used as a basis.

Sixty-five people attended the meeting which was arranged by H. N. Young. The meeting chairman was J. D. Sylvester and C. Mitchell thanked the speaker.

*The Engineer and Nuclear Developments*

On Tuesday, March 23, a panel consisting of J. L. Gray, A. J. Mooradian, Dr. D. C. Brunton and Dr. Leo Yaffe with Dr. L. Theismeyer as moderator discussed the impact of nuclear developments on the engineering profession in Canada.

Mr. Mooradian, senior supervisor of Process Engineering of A.E.C.L. at Chalk River dealt with the type of engineer most useful in nuclear work. Twenty-six percent of Chalk River engineers were operational staff in the reactor and extraction branches. Reactor staff included graduates of engineering physics, metallurgy and chemical engineering courses, while the extraction branch employed chiefly chemical graduates. Another 26 percent of Chalk River engineers were employed in the development department chiefly on processing problems. Most of these were chemical engineers. The remaining 48 per cent of the engineers were of various types engaged in service and design.

Mr. Mooradian said that, since in any forseeable program there would always be more problems to investigate than engineers to work on them, technical intuition will be required to find the most profitable course of action.

Dr. D. C. Brunton, president Isotope Products Ltd., one of the three or four firms in North America and the only firm in Canada concerned with atomic applications, followed Mr. Mooradian. Dr. Brunton divided current and potential isotope applications into two categories: Bulk radiation uses: and Irradiated isotope uses. In the first category were:

1—The cobalt bomb for beam therapy.
2—Sterilization and pasteurization which would require excessively large sources by today's standards.
3—Control of insects in grain requiring sources only 1 percent of the above but still large.
4—Catylitic action by large sources. Polymerization by radiation produces a different effect than heat polymerization.

In the second category come:

1—Tracer and thermapeutic uses of radio active iodine and other elements.
2—For measuring density, homogenity and thickness of materials like paper webs, moving steel sheet, uncured rubber, loose powders and other hitherto unmeasurable materials thereby making their production more readily subject to automatic control.
3—Radiographing of welded vessels by the "one shot method" now pays for itself in steel savings.

Dr. Brunton was followed by Mr. Gray, vice-president in charge of administration and operations at Atomic Energy of Canada Ltd. Mr. Gray said that Canada's participation in atomic work is directed toward power production. He visualized a program aimed at producing 100,000 k.w. of experimental capacity for Southern Ontario by 1960 followed by 7,000,000 k.w. of atomic power capacity by 1980.

He estimated that 25 percent of the cost of the first power reactor would be engineering with this figure dropping to 15 for the next and 10 percent for succeeding reactors. At $9000.00 per year per man this would mean that present manpower of 150 men engaged in reactor design would rise to 200 by 1958, remain steady until 1970 then jump to 700 by 1972 and reach 1400 by 1980.

These men would be employed by one or two closely knit organizations. Engineering requirements were four engineers to one draftsman in the early stages of a project and this changed to a ratio of one engineer to one draftsman. Thus for 200 total staff 100 would be engineers split as follows: 47 percent mechanical, 32 percent civil, 13 percent chemical and 8 percent electrical.

Mr. Gray said that in atomic work heavy industry would be asked for close tolerances on large parts, freedom from leaks, and, for heavy water reactors, economy of contents in heat exchangers and other apparatus. He said that the development facilities of Canadian industry were practically non existent but that large firms developing such facilities could anticipate atomic work.

In reply to a later question Mr. Gray said that 16 engineers of the 150 men he said were engaged in reactor design were at Chalk River and most of the others were with the C. D. Howe Co. Ltd. in Montreal.

Dr. Leo Yaffe, special lecturer in Radio Chemistry at McGill followed Mr. Gray and described what he felt were the educational requirements for atomic work. He deplored the apparent shortage of graduate students and said that it might have unfortunate results. Dr. Yaffe described in some detail the courses in atomic work offered by various universities.

Dr. L. Theismeyer thanked the speakers and concluded the evening. Meeting arrangements were by H. G. Burbridge.

#### The Coal Industry

Lionel A. Forsyth, president of Dominion Steel and Coal Corporation, addressed the Montreal Branch on March 25. His discussion was concerned primarily with the coal industry in Nova Scotia.

He stated that coal is still the most important single source of energy in our economy, being, the source of about half our total power requirements. Mr. Forsyth stated that Canada is now burning about one-third more coal than in the immediate prewar years, but there is about 1½ tons of imported coal for each ton of Canadian coal burned. The industry is now in the position where it cannot compete with foreign oil and coal in a large part of the Canadian industrial and domestic market, and the only way to maintain the industry and employment for its workers is to continue the existing Dominion Government subsidy.

Increasing government subsidies is not the solution to the industry's problems at present, and much can be accomplished by improving methods of mining, processing, and transportation.

Mr. Forsyth also discussed the possibility of burning the Nova Scotia coal in locomotives powered by coal-burning gas turbines, which could probably operate more economically than diesel equipment. However he stated that the chances of introducing coal-burning equipment at the present time are not great since both railways are in the process of replacing steam engines with new diesel equipment.

The meeting was sponsored by the management section. Arrangements were made by M. J. Oldershaw, G. H. Hoganson acted as meeting chairman, and A. M. Thurston thanked the speaker.

#### Atomic Reactors

Arthur G. Ward, a senior physicist with Atomic Energy of Canada Ltd. at Chalk River, spoke on "Control of Atomic Energy Reactors" at a joint meeting with the A.I.E.E. on March 29.

Mr. Ward described four classifications of neutrons and their significance He defined the effective multiplication factor, K, the main operating parameter. He outlined the method of control and stressed how delayed fission neutrons and photo neutrons from the heavy water facilitate the control problem and stabilize the reactor. He told also of the reactor's inherent thermal stability as an increase in temperature brings about a decrease in reactivity.

Another problem is the xenon poison effect, a condition which prevents the restart of a reactor for several hours after shutdown due to one of the fission products being an isotope of xenon with a very high neutron capture cross-section and a half life of several hours. Once this isotope has formed some time after a shutdown, it is impossible to restart the reactor until the xenon has decayed.

Meeting arrangements were by A. G. Moore who also acted as chairman and thanked the speaker.

#### Ore Handling at Seven Islands

On March 30 Mr. D. H. Sharp, a project engineer with the C. D. Howe Co. Ltd. described the ore handling facilities at Seven Islands to a meeting of the Montreal Branch E.I.C. Since mining operations at Knob Lake are limited to 5½ months of the year and shipping is spread over an 8 month period, storage facilities for ore must be provided at the port of Seven Islands in addition to the ore loading facilities.

Crushed ore arrives at Seven Islands in 115 car trains carrying about 10,000 long tons each. Each train is pulled by four 1,600 h.p. diesel locomotives. The ore cars are sorted by grade of contents in a classification yard at Seven Islands.

The ore handling equipment which is capable of loading or stock piling at a maximum rate of 8,000 long tons per hour consists of two duplicate conveyor systems, one of which may be run without the other.

An extensive system of electrical interlocks protects the equipment against operator errors or accidents due to the stoppage of one unit in a chain of equipment. The plant at Seven Islands, for which the C. D. Howe Co. Ltd. are consulting engineers, will cost between $20,000,000 and $30,000,000. The machinery alone will amount to four or five million dollars.

Mr. Sharp's lecture was illustrated with slides. A motion picture of the construction of the Q.N.S. & L. Railroad to Seven Islands was also shown. Meeting arrangements were by W. Sefton and R. H. Quintal acted as chairman.

#### Gas Turbines

On April 1 Mr. Kerez, an application engineer with Brown Boveri of Baden, Switzerland, gave an illustrated lecture on gas turbine operating experience with particular reference to the Beznau Power Station. Brown Boveri favours open cycle gas turbines because their performance is most readily predicted. They can guarantee 3,000 to 4,000 hours of operation before shutdown for maintenance using oil firing but their experience with coal burning units has been poor. Gas turbines require no cooling water and are competitive with water power and steam power for peak load plants of moderate size. The space requirement is about 70 percent of that for a steam plant of the same rating. The company installed their first commercial gas turbine in 1935. The speaker mentioned two such installations in Switzerland and one in a South American cement plant. The gas turbines at Beznau are of 27,000 and 13,000 k.w. capacity. Meeting arrangements were by P. J. Kunstler and R. S. Griffiths was chairman. The attendance was about one hundred.

## Niagara Peninsula

G. W. T. Richardson, jr.e.i.c.,
*Secretary-Treasurer*

J. H. Saldat, jr.e.i.c.,
*Branch News Editor*

#### Atomic Energy

J. L. Gray of the Atomic Energy of Canada Ltd., spoke to the members of the Niagara Peninsula Branch about atomic energy developments in Canada on April 22, 1954 at the Red Casque Inn in Niagara Falls.

Mr. Gray graduated in mechanical engineering from the University of Saskatchewan in 1935 and has been associated with the atomic energy program since 1948.

He pointed out that the most important phase of Canada's atomic program is in the study, design, and building of reactors and that two research reactors have been built in Canada. The first power reactor design is expected to be complete within a year.

Mr. Gray believed that power reactors will compete with steam but it may be some time before hydro plants are replaced. The present cost of a power reactor is about 100 times the price of an equivalent steam plant. The lecture was illustrated with slides.

A. J. Bennett was chairman, W. A. Scott introduced the speaker and J. H. Ings thanked Mr. Gray for the interesting talk.

## Nipissing and Upper Ottawa

D. K. Campbell, jr.e.i.c.,
*Secretary-Treasurer*

#### April Meeting

The regular April meeting of the local Branch of the Engineering Institute of Canada was held Wednesday evening at White Oakes Inn, Temiskaming. There were twenty-seven members and guests present for the dinner which was followed by a short business meeting. The feature of the meeting was the presentation of short talks on engineering practice by four of the members.

#### Propeller Performance

J. F. Kennedy of the engineering department, Canadian International Paper Company, talked about propeller performance on bush type aircraft. In particular, the difficulties in finding substitutes for the discontinued Hamilton Standard propellers used on Canadian Pacific Airlines Fairchild 71C aircraft were presented.

#### Relaying Schemes

A. T. McKerrall, meter and relay engineer of the Ontario Hydro explained the different relaying schemes in use for protection of the eight $600,000.00 generators at the Otto Holden Generating Station, near Mattawa. This concise explanation of modern protective relaying was of particular interest to the electrical engineers present.

#### Factory Maintenance

J. R. Lewis, engineering department of C.I.P., presented a thought provoking talk on factory maintenance problems. He outlined the probable method of attack by an "old time" engineer which was characterized by very little inspection work and delegated responsibility for maintenance and repair to small labour units located throughout the plant. Its advantages were the intimate knowledge of the machines by the group responsible and good personnel relations and job interest. The centralized and highly organized "modern" maintenance program was characterized by separate inspection groups, volumous records and a centralized repair crew who had been divorced from a personal interest in the machines they repair. In summing up, Mr. Lewis tried to show that the combination of the best points of both systems with the elimination of the faults of each would give the best results.

**Railway Freight Yards**

T. C. Macnabb, ass't. district engineer, C.P.R., addressed the meeting on the subject "Railway Freight Yards". He first reviewed the types of yards to be found here and in Europe and gave their distinguishing characteristics. With the use of diagrams, the latest method of breaking up the yard into distinct areas of receiving, classifying and departure was explained. The design of the new Montreal freight yard, in which Mr. Macnabb participated, was explained. The mechanical retardation devices, signals and switching for this type of yard were described.

The meeting was adjourned at 11.30 p.m.

## Northern New Brunswick

L. L. Marshall, m.e.i.c.,
*Secretary-Treasurer*

R. W. Rankine, jr.e.i.c.,
*Branch News Editor*

**Industrial Instrument Display**

A general meeting of the Branch was held at Dalhousie, N.B., on February 23, 1954. Some 45 members and guests were present.

The meeting was arranged in conjunction with the Minneapolis-Honeywell Regulator Company Ltd. who presented an industrial instrument display from 10 a.m. until 10 p.m. at the Chaleur Inn. Members of the Branch were also invited to visit the New Brunswick International Paper Company mill in Dalhousie.

During the evening dinner was served at 7.30 and a short business meeting followed. The speaker for the evening was Otto Cepella of Minneapolis-Honeywell who gave a talk entitled "Automatic Controls". Mr. Cepella illustrated his talk by slides and dwelt mostly on the principal types of process instruments. The clear and concise explanations given were received with particular interest by those present.

Assisting Mr. Cepella was Henry Marks of the same company who discussed briefly the reasons for choosing either pneumatic or electric operation of process controlling instruments.

## Ottawa

G. A. Sutherland, m.e.i.c.,
*Secretary-Treasurer*

C. E. Howard, m.e.i.c.,
*Branch News Editor*

**Urban Transit**

"The Place of the Trolley Coach in Urban Transit", was the subject discussed by L. W. Birch, transportation engineer of the Ohio Brass Company, at the luncheon meeting in the Chateau Laurier on March 24, 1954.

Mr. Birch, a railway and transit consultant, predicted that streetcar and track maintenance costs in Ottawa will bring a demand within the next 10 years for conversion either to motor bus or trolley coach operation. The speaker chose a 10 year period for his streetcar estimate because of calculations he has made on the cost of operating trolley buses.

In his statistical comparisons, Mr. Birch did not give figures for streetcar operation but it was intimated they were economically sound on routes of greater passenger density than the majority of those in Ottawa.

The trolley bus—motor bus comparison was based on six items of cost of operation, as follows:

(a) Transportation (includes wages, tickets, etc.)
(b) Maintenance
(c) Fuel

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(d) Administration
(e) Depreciation (including interest)
(f) Taxes

Assuming that the comparison is between a trolley bus and a motor bus of the same seating capacity and type, the transportation item was identical in each case and could be cancelled out. It was stated that oddly enough the sum of the two items, administration and taxes is almost identical for both types of vehicles according to studies made by the Dominion Bureau of Statistics and the A.T.A. These two items were eliminated for comparison.

#### Variable Costs

The variable costs, maintenance, fuel and depreciation were discussed fully. D.B.S. figures were quoted to the effect that trolley bus costs in these categories in 1951 in Canada totalled 17 cents a mile, motor bus costs 24 cents. This meant that the average cost of operating a trolley bus in one of the 15 Canadian cities which uses them was about 7 cents cheaper per mile than operating a motor bus.

A comparison of maintenance cost figures in the years 1938 to 1952, of 14 companies which operated both types of vehicles showed a continuous advantage in favour of the trolley bus, including cost of overhead wires. This figure increased from 2 cents a mile to about 4 cents, as the motor bus fleets wore out. The trolley bus was the more durable and the main reasons for lower maintenance cost was the smaller amount of labour necessary to keep it in repair.

With regard to fuel, electricity cost per trolley bus mile in Ottawa was now 4.5 cents; per motor bus mile it was 4.9 cents. This ratio was generally true across Canada and was likely to increase in favour of the trolley bus if electricity costs fell because of new hydro developments.

For bookkeeping purposes, on depreciation and interest some companies considered the life of the trolley bus to be 15 years; of the motor bus 10 years. Mr. Birch thought 15 years a conservative estimate for a trolley bus. He said a fleet of trolley buses has been operating in Columbus, Ohio for 19 years and Chicago is still running a few 1930 buses. Mr. Birch used 16 years in his calculations.

The figures given for depreciation cost per mile were 6 cents for the motor bus and 4 cents for the trolley bus. Depreciation of the overhead wires added 7/10 of a cent to the latter figures.

The speaker was introduced by Roland Hayes, chairman, and thanked by H. Welch of Ottawa.

## Saint John

John A. B. Brenan, M.E.I.C.,
*Secretary-Treasurer*

H. M. McCleave, Jr.E.I.C.,
*Branch News Editor*

#### The Engineering Act

A. N. Carter, Saint John barrister, was guest speaker at the regular meeting of the Saint John Branch, held March 26, at the N.B. Telephone Company Building.

Mr. Carter spoke on the engineering act of the Province, pointing out that its main aim was to establish standards for engineering work and to protect the people of the province.

The Act, passed in 1920, has been amended twice, each time requiring the approval of the legislature. Because some members of the legislature are suspicious of granting special privileges, it is difficult to modify the act properly.

Mr. Carter pointed out that there could be two types of acts. One would be of a general definition and the other particular. Difficulties are present in both acts. The particular type may not include new fields which develop due to the advance of technology, while the general act may be too broad. However, the speaker felt that it would be preferable to retain the particular definition and add new types rather than turn to a general definition.

In general, Mr. Carter felt that if the act was working in practice revision would not be necessary.

H. Townsend on behalf of the gathering, thanked Mr. Carter for his most interesting talk.

The film, "Exploring with X-rays," was shown by F. L. Doty. Refreshments brought the meeting to a close.

## Saguenay

C. C. Louttit, Jr.E.I.C.,
*Secretary-Treasurer*

#### Joint Meeting

A joint meeting of the Saguenay Branch of the Engineering Institute of Canada and the Saguenay Region of the Corporation of Professional Engineers of Quebec was held at 8.15 p.m. Tuesday, March 30, 1954, in the auditorium of Aluminium Laboratories Limited in Arvida. Thirty-four members of both societies attended.

J. E. Dyck, introduced Mr. G. Demers, councillor and vice-president of the C.P.E.Q. through whose efforts the three films shown at the meeting were obtained from Europe. The three films shown were:

1) "Reconstruction du Pont de Villeneuve (in French, black and white, sound) showing the construction of a prestressed concrete highway bridge across the Seine River.

2) "Percee en Foret Equatoriale de la Route Douala Edea" (in French, colour, sound) showing the construction of a 125 mile highway through jungle in French West Africa.

3) "Nouvelles Techniques de Construction des Jetees Maritimes" (in French, black and white, sound) describing hydraulic laboratory experiments dealing with the effects of wave action on piers and jetties.

All three films were very interesting and highly informative. Mr. Schopflocher, thanked Mr. Demers for making the films available for the meeting and expressed the group's appreciation of his efforts. The meeting adjourned at 10.30 p.m.

#### Aluminous Cements

A joint meeting of the Engineering Institute of Canada, Corporation of Professional Engineers of Quebec and the Chemical Institute of Canada was held at the Saguenay Inn on Wednesday, April 14, 1954. The guest speaker was Dr. T. D. Robson, technical manager of the Lafarge Aluminous Cement Co., London, England, whose topic was "Special Properties of Aluminous Cements." Sixty members of the societies were present. G. K. Clement presided and introduced the speaker.

Dr. Robson stated that the original reason for the development of aluminous cement was to obtain a cement with a higher magnesium sulphate resistance than portland cement. Upon development the aluminous cement was found to have the desirable property of being rapid hardening. This property has been used to good advantage ever since, commencing with gun emplacements in France during the first World War.

Dr. Robson had a series of slides describing the manufacture and uses of aluminous cements and used them as the basis of his talk.

#### Advantages

Dr. Robson described some of the advantages of using aluminous cement for its fast hardening properties and pointed out that aluminous cement concrete does not contain free lime and is therefore free of the troubles associated with it, such as the corrosion of aluminum, lead, etc., buried directly in the concrete.

The cement can also withstand very high heat and is suitable for the manufacture of refractories for temperatures to 1200° F. Aluminous cements also possess a very high resistance to thermal shock and are therefore used where spillage of hot metals might occur, in locations of high radiant heat and in molten metal casting runways.

The speaker was thanked for his very excellent talk by E. A. Woods, chairman of the Saguenay Section of the Chemical Institute of Canada.

## Sudbury

George Fleming, M.E.I.C.,
*Secretary-Treasurer*

T. C. Robertson, M.E.I.C.,
*Branch News Editor*

J. W. Kirk was guest speaker at the dinner meeting of the Sudbury Branch of The Engineering Institute of Canada held at the Granite Club on April 8, 1954. Introduced by Frank Destefano, Mr. Kirk, a graduate of Queen's University in 1944, travelled widely in the Dominion of Canada and South America before becoming district manager of The International Water Supply Company at London, Ontario.

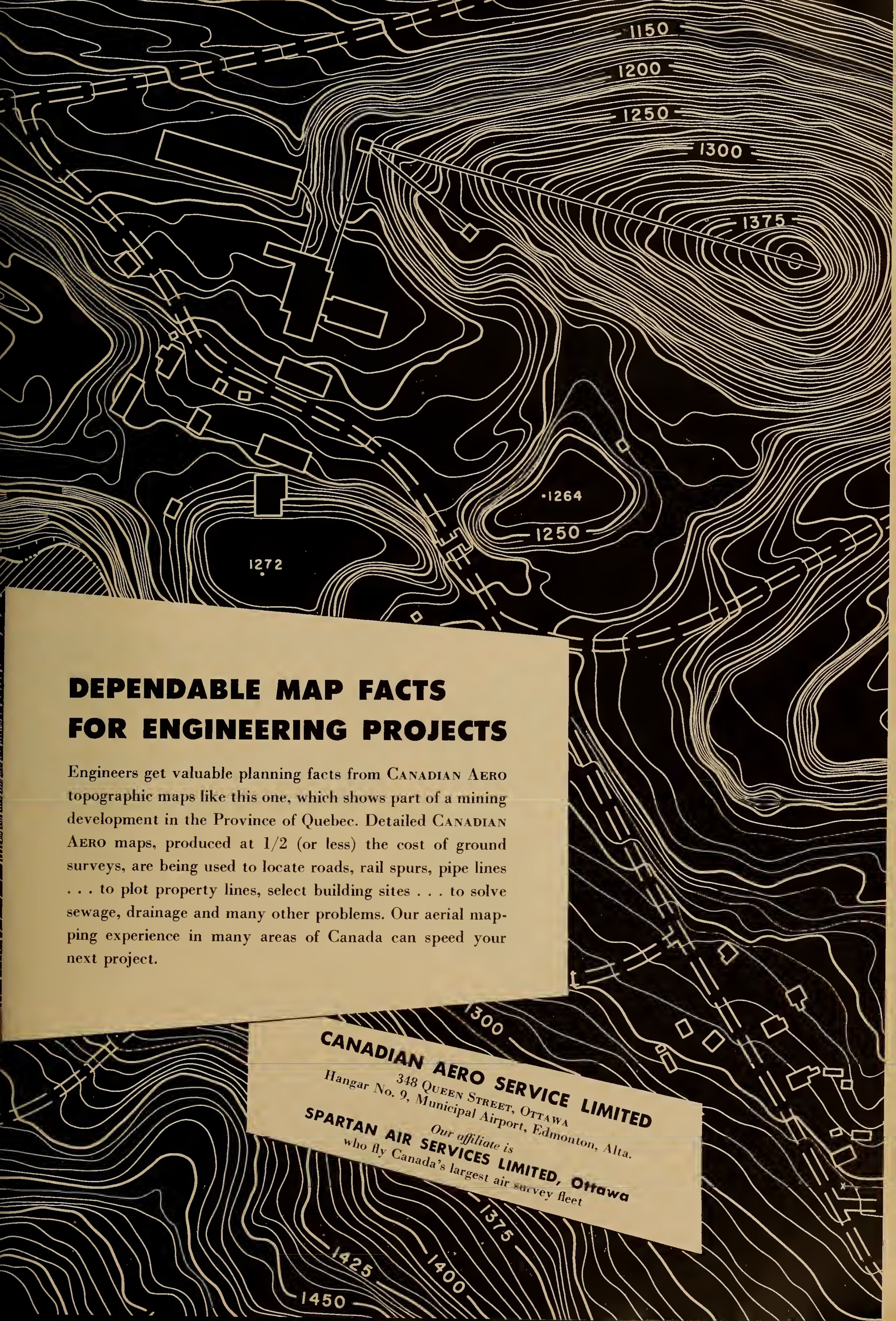
#### Deep Water

In his introductory remarks to the coloured film "Deep Water" Mr. Kirk explained that ground water supplies for industries and private use was one of the renewable resources of the country and yet little was known about it. However, its importance was increasing yearly. Aside from the fact that it provided a constant supply, ground water also possessed important advantages such as constant quality and temperature the year around.

With reference to the Sudbury district Mr. Kirk stated that the 3.3 million gallons per day at present being used was backed by a known supply of 6 million gallons and he expected that an additional 6 million gallons would be proven in the near future.

#### The Earth's Surface

The film "Deep Water" pictured the surface of the earth as 2/3 ocean bed and that even the so-called dry land was not really dry but only a covering on a vast system of underground lakes and rivers. The source of this underground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system was rainfall gathered in pockets by the porous layers of the earth's crust. Since the various strata are usually tilted there are outcrops which yield very large water supplies.

To obtain a supply for home use is a comparably easy task but when a continuous flow of millions of gallons is required the problem develops into one requiring much engineering skill and scientific ability. Each job is an individual problem and the why, when, where and how as to location, type of well, and equipment to be used has to be answered.

As to the location, a study of the geophysical formation of the earth coupled with preliminary tests such as resistivity measurements precede the drilling of a test well.

After the well is completed a final test is made by pumping at a given rate for a definite period and noting the drop in the water level. This determines what is known as the "cone of influence" and accurate prediction of the output is calculated.

A lengthy question period followed after which Peter Semler thanked the speaker and the meeting adjourned.

***Annual Meeting***

The Annual Dinner-Dance and General Meeting of the Sudbury Branch of The Engineering Institute of Canada was held May 7, 1954, in the Italian Hall, Copper Cliff. At the close of the dinner W. J. Ripley, the retiring chairman, told of the year's work. He was pleased with the number that had attended the meetings throughout the year stating that the attendance per membership ranked very high in comparison with other branches. He attributed the success of the year to the hard work of his supporting staff and complimented them highly for their work.

Geo. Fleming, secretary-treasurer, then read the financial report which showed a favourable year's operation. J. Smith of the paper's committee, W. Miller of the entertainment committee, H. M. Whittles of the membership committee and L. Lane of the educational committee then spoke briefly of the year's work in their respective divisions.

The election of officers for the '54-55 season resulted as follows: F. A. Orange, chairman; W. S. Black, vice-chairman; H. M. Whittles, resident committeeman; W. B. McCallum, non-resident committeeman. F. A. Orange outlined his aims for the ensuing year and asked for the continued co-operation of the membership.

The retiring officers were thanked by R. Eaton for a job well done. The formal meeting then adjourned and dancing was enjoyed by all.

## Toronto

L. F. Bresolin, Jr.E.I.C.,
*Secretary-Treasurer*

H. Fealdman, Jr.E.I.C.,
*Branch News Editor*

***Vertical Transportation***

A. W. Paulson, of the Otis Elevator Co., New York, discussed the subject of vertical transportation before a joint meeting of the Toronto Branch, and the Toronto branch of the American Institute of Electrical Engineers on Thursday, April 1.

Mr. Paulson, who has been with the Otis Elevator Co. for 29 years and is now chief engineer, has made many notable contributions in the field of elevator controls and has had a great deal to do with the development of the elevator which thinks for itself! This development and the description of the complicated electronics which make up the brain of the elevators provided the subject matter for a most interesting and fascinating lecture.

***Management Panel Discussion***

Problems facing the engineer in management were discussed by a panel of experts which assembled before a very large audience on Thursday, April 22 last. The organizer and moderator of the panel was C. E. Potter, M.E.I.C., assistant to the vice-president, Angus Robertson Ltd. Considerable interest was shown in this program, judging from the number of questions fired at the panel.

***Visit to Ford, Oakville, Ont.***

About 220 members of the Toronto Branch joined with a similar number from the Hamilton Branch on Thursday, May 6, last, to spend a very enjoyable evening at the new assembly plant of the Ford Motor Company at Oakville, Ontario which is said to be the largest industrial building under one roof in Canada. Members were able to see the complete assembly of Ford and Meteor cars from start to finish with evident fascination.

After the tour, refreshments were very kindly provided by the Ford Motor Co.

## Winnipeg

C. S. Landon, M.E.I.C., *Secretary-Treasurer*

W. Victor Morris, M.E.I.C., *Branch News Editor*

**April Meeting**

N. S. Bubbis, general manager, greater Winnipeg Water and Sanitary Districts, spoke to the Winnipeg Branch of the Engineering Institute of Canada on Thursday, April 22, on the topic "The Greater Winnipeg Sanitary District and River Pollution Abatement".

**Sewage Disposal History**

Mr. Bubbis gave a brief history of sewage disposal in the Greater Winnipeg Area, first describing the development of the combined system of sewer drainage. When this created certain nuisance conditions during the drought years in the early '30s, the Greater Winnipeg Sanitary District was organized to undertake the treating of sewage in this area.

The speaker then went on to outline the various methods of sewage treatment, describing the primary system of treatment which is now used by the district and which uses the diluting capacity of the water in the Red and Assiniboine Rivers in the process. He also explained that further treatment known as "secondary" or "tertiary" treatment can be given the sewage where necessary but that this was much more expensive and he illustrated the difference in costs between the various degrees of treatment.

He then outlined the basis of design used by the district's first consultant, the late W. S. Lea, and described both the original installation and the additional structures that were presently being constructed under the district's plan of extensions.

**Industrial Wastes**

In relation to the matter of industrial wastes, Mr. Bubbis pointed out that up to the present, there was one point to which sufficient thought in zoning had not been given, namely: the location of wet industries. That is, industries which use a considerable quantity of water in their processing and which in turn produce an appreciable amount of waste that has to be disposed of.

Mr. Bubbis concluded his remarks by stating that a realistic approach should be adopted towards the solution of this problem. "The facts of the matter are that we are living in an area that is growing and just beginning to develop industrially. Our rivers are natural resources that should serve the best use of the greatest number. While we don't want them to be turned into open sewers on the one hand, we certainly don't want to set up such extreme standards that would add a tremendous financial burden to the community and prevent further industrial development." He pointed out that for every one hundred thousand dollars spent on capital account for screening and pumping stations, it would cost eighteen thousand dollars per year for debt charges, maintenance and operating costs.

The address was illustrated with slides. G. B. Williams introduced the speaker and the vote of thanks was delivered by Prof. A. J. Carlson.

### Civil Section

I. B. Henderson, M.E.I.C., *Section News Editor*

The Civil Section of the Winnipeg Branch of the Engineering Institute of Canada held a meeting on Thursday, March 25, 1954, in the auditorium of the Canadian Westinghouse Ltd. J. B. Striowski was chairman in the absence of W. White. The minutes were adopted as read on motion of N. S. Bubbis, seconded by F. Thompson.

**Kemano-Kitimat**

A one hour colour film, owned and produced by International Harvester Co. was shown, picturing the construction of the aluminum development at the delta of the Kitimat River and the Kemano Power project in British Columbia, 400 miles north of Vancouver. Each phase of this project would be remarkable in itself, combined they form probably the largest development of its kind ever undertaken.

**Lift Slab Construction**

Following the presentation of this picture classic, C. V. Antenbring, president and manager of Cowin and Co. Ltd. showed some twenty slides which he had made of the use of the Youtz Slick lift slab method of construction. This method was developed between the years 1946 and 1948 by Philip Youtz and Tom Slick and has been used in the construction of such structures as a two-storey Trinity University building and a Naval Barracks building.

F. R. Lount and Son have the exclusive rights to this patented process in Canada. It is, however, available to contractors at a rental cost in the neighbourhood of 25 cents per square foot of slab area.

The Youtz Slick method was first used in Winnipeg in the construction of an apartment building in 1950, and then on several projects in 1952 and the years following. The nurses' residence, started in 1953, was the highest building to be constructed by this method. The slabs were first lifted to the head of normal steel columns, then the columns were extended and the process repeated. The steel columns for this job were designed by Prof. J. Hoogstraten of the University of Manitoba. Slab design is standard except that a thicker section is desirable, and the re-steel must be carefully positioned. Spans run at about twenty feet in either direction. A variation from the normal will be the construction of a grandstand at Portage la Prairie this summer. In this instance, one side only of the slab will be raised to provide the inclined floor for the seats.

A question period followed the presentation of the slides. H. B. Brehaut led off with a query as to relative costs, using the lift slab method vs. the normal poured in place method. It appeared that the savings in forming were offset by the increased slab thickness and stronger columns required, so that costs were about equal. However, it was thought that some saving resulted in the trades being able to move in sooner than would ordinarily be possible.

N. S. Bubbis asked if any design problems were inherent in the method. The reply was to the effect that the architect must design specifically for this type of construction in that he must have the symetric column layout and a minimum of large openings (such as stair wells, etc.). Otherwise the design was normal. Prof. Herriot made a remark that was answered by stating that the jacks and their controls were patented. Their application was limited only by the 12 jacks and control console being the only unit currently available in Winnipeg. The jacks and console are available to contractors at a rental, as mentioned earlier.

The speaker was thanked on behalf of the section by W. Taylor of Supercrete Ltd., and the meeting adjourned for coffee in the Westinghouse canteen.

### Electrical Section

G. Flavell, Jr.E.I.C., *Section News Editor*

**April Meeting**

The Civil Section of the Winnipeg Branch of the Engineering Institute of Canada met in Canadian Westinghouse auditorium on Thursday evening, April 8, 1954, under the chairmanship of Mr. B. Striowski.

The speaker of the evening, Leon T. Eliel, was introduced by F. S. Duckley, sales manager of Aero Surveys Limited, Vancouver.

**Aerial Surveys**

Mr. Eliel, vice-president, Fairchild Aero Surveys, Inc., Los Angeles, Cal. and managing director, Aero Surveys Limited, Vancouver, B.C., has personally developed many new devices to improve the art of surveying from the air. He has served as technical advisor to various governments, and written many articles on his hobby and business of aerial surveying. The paragraph on this subject in the Encyclopedia Britannica is attributed to him.

Mr. Eliel spoke briefly of early exploration, the marvelous achievements of men penetrating the unknown without maps or guidance of any kind, the surprising accuracy of the crude maps they drew of their travels.

Today one of the latest bits of exploration wizardry was developed here in Winnipeg by Prof. G. M. Brownell, chairman of the Geology Dept. and Prof. R. W. Pringle of the Physics Dept. of the University of Manitoba. This device, the scintillometer, is used all over the world in the search for uranium. Weighing about four pounds, the instrument is sensitive to gamma radiation and is used both on the ground and in the air to measure the change in intensity of radiation as it is moved across the face of the earth's surface.

**Types of Aircraft Used**

The prospector on foot, in one day, covers a very narrow strip of ground that may be traversed by air in one hour. Many types of aircraft are available for this purpose. The helicopter is the ideal unit to deliver men and supplies to otherwise inaccessible spots and for detailed surveys of small areas in rugged terrain. Its use is limited to such work, however, by its high first cost, high maintenance costs, slow speed (100 m.p.h.) and small range (100 to 200 mi.).

Fixed wing craft stay aloft for longer periods (a whole day), fly at speeds up to 300 m.p.h. and are more economical to operate.

Medium and larger Ansons are favorites. The small Cesna is a good craft for low flying. Beachcraft and Lodestars are others used in this work.

The B-17 can fly all day at 30,000 ft. and is used for economy on large jobs

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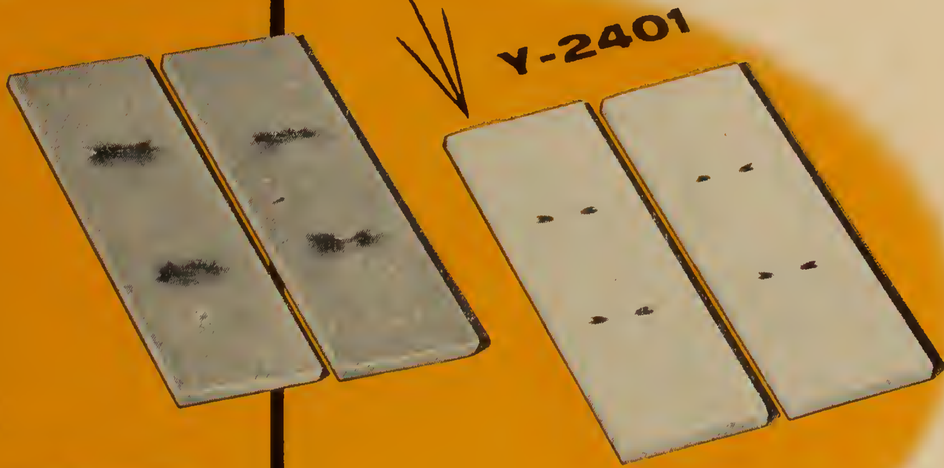


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With an ordinary band saw, operator saws out a Y-2401 part to be used in an oil circuit recloser.

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The P-38 Lightning converted to carry two people is favoured. Dacotahs are used extensively by other firms and although they have a lower ceiling than the B-17 there are compensating advantages.

In Canada, Mr. Eliel said, aerial surveys are employed in many fields, including timber cruising, water power development and the search for oil.

#### Methods

The methods used in aerial survey are fundamentally simple, says Mr. Eliel. A 50 thousand square mile area is covered in strips by the aircraft flying back and forth. These strips overlap each other thirty per cent and are therefore automatically stereoscopic, and contouring is possible. Various instruments are used, ranging in price from $300.00 to 50 or 60 thousand dollars each. The commonly used Multiplex costs from 5 to 10 thousand dollars. Say it is desired to make a map of 1:1000 scale. Pictures are taken at say 1,000 feet centres, each of which has 2/3 of its area appearing on adjoining pictures. The film is projected at the same angle as that from which the picture was taken with projectors set up at 1/1000 of the field centres (in this case 1/1000 of 1000 equals one foot.) Thus the original view is re-created at 1/1000 of the original size. Various devices are used to scale the detail. A stereoscope with the right eye piece shaded red and the left blue, is used to separate the two images.

A slotted template, consisting of a pencil having a disc above it with a point of light, is used to trace the contours. In use the template is raised until the light touches the ground at the calculated contour height. The light with screen is then raised to the next contour height and the process repeated. A planimeter is used to trace streams, etc.

Aero surveys have been made in the following countries: Canada, Mexico, Guatemala, Panama, Equador, Holland, Ceylon, Afghanistan, Rhodesia, Libya, Colombia, Australia, British Guiana, India, U.S. Alaska, Cuba, Honduras, Venezuela, Peru, Burma, Cyprus, Kenya, Italy, Sumatra, China, and New Guinea.

#### Question Period

A question period followed this address in which several facts were brought out. When the surveying plane is travelling its strip it may have to head into a cross wind. In such a case the camera is turned in its mount to keep in line with the actual direction of flight. Some pilots become so sensitive to this drift that they are able to automatically correct for it and stay on course. In Canada it is customary to employ a navigator whose whole job is to keep the aircraft on course. A device known as a sun compass is sometimes used. The instrument is sighted on the desired line of travel, and adjusted so that sunlight falling on two photo electric cells connected to galvanometers generates no current. A slight divergence from course causes a current to be induced in one of the galvanometers telling the pilot to correct his course right or left.

By this means the pilot will not be more than one-half mile from his correct position at the end of a run. As already mentioned, the pictures are lapped laterally on the average about 30 percent. Over mountainous country the overlap would be considerably more.

#### Favourable Weather Necessary

Because this work can only be carried out under the most favourable conditions, weather prediction plays a tremendous part in the financial success or failure of a project. For instance, in Panama one good photographic day is worth 100 thousand dollars to the aerial photographer. Accordingly, each days "take" is developed and checked for omissions, etc., as soon as possible. Usually a field laboratory accompanies the expedition. On a New Guinea job, where there were no such facilities, a pilot performed the wonderful feat of flying 14 days, 20 to 30 rolls of film, without having his pictures developed. Although the strips had not been flown concurrently and he had had to remember the limits of previous strips, not a single gap was found when the pictures were developed.

#### Sirran-Radar System

The Sirran system of survey is being used more and more. The Sirran-Radar-means for blind flying have been adapted to survey work. An electrical signal travelling at 186 thousand miles per second is reflected from two ground stations. The time taken for this signal to return to the aircraft is a measure of the distance the plane is from the two ground stations. The Sirran dials are photographed with each ground picture and locate it accurately. A Sirran survey controlled net (not contoured) is currently being made across Canada.

Contour interval is dependent upon the function of the plan for which the survey is being made. For city surveys of scale 1" to 500' the usual contour interval is five feet. Some are made at two foot intervals.

Timber surveys are often at 25' contours. The largest plan scale survey by Aero Surveys was 1" to 20' with 1' contours and on the other extreme is a 1/250,000 scale topographical map with contours of 50', 100' and 200', depending on terrain.

The speaker was thanked on behalf of those present by John D. Anderson, division engineer, Canadian Pacific Railway Company.

The meeting adjourned for refreshments and further informal discussion.

**Left: A group picture taken at the time Col. L. F. Grant visited Acadia University in Wolfville, N.S. Front row, left to right: J. E. Clarke, D. F. Toms, W. R. Lewis, F. H. Sexton, Hon.M.E.I.C., O. N. Mann, E. C. Parsons, B. N. Cain, R. E. Haines. Back row, left to right: D. F. Baird, C. S. Wilson, H. R. Lumsden, J. S. Hamilton, A. R. Leahey, L. F. Grant, Hon.M.E.I.C., K. G. Putnam, W. C. Flemming, G. C. Baker. S. A. McNaughton was present at the meeting but absent when the picture was taken. Right: The president's visit to Sault Ste. Marie. Left to right: A. B. Platt, secretary-treasurer; President Dobbin, W. T. Butler, chairman; J. A. Ogilvy, assistant field secretary, G. A. Brown.**

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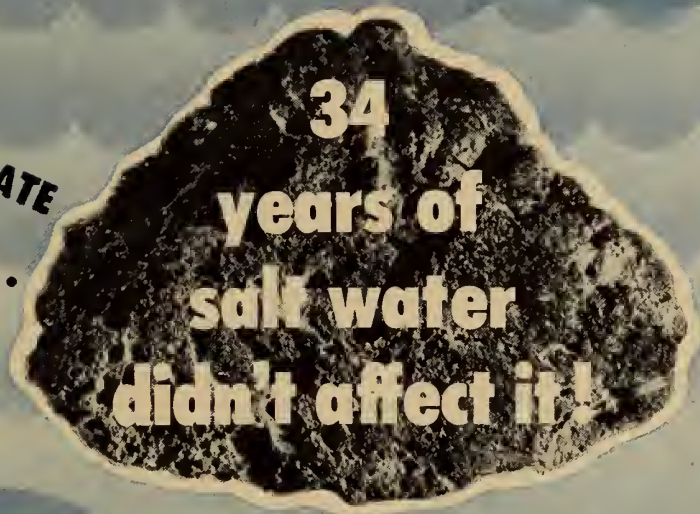


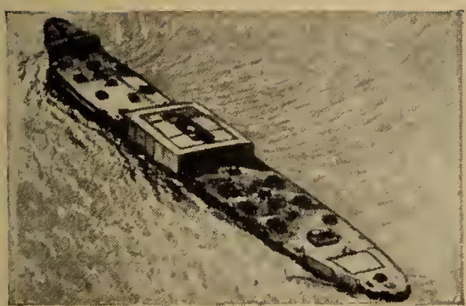

Near Galveston, Texas rests the hull of the "HAYDITE" concrete ship "Selma" launched in 1919 and beached some years later. For 35 years the "HAYDITE" concrete in the hull had endured thousands of cycles of wetting and drying. In 1953, physical examination showed that "... the concrete was in excellent condition and the reinforcing steel showed no deterioration whatsoever even though in most places it had only 5/8 inch cover".

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### BOOK REVIEW

**Les terrains perméables.** 2e éd. A. Mayer. Montreal, Fomac, 1954. 148 pp., figs., $4.40.

Many members of the Engineering Institute will remember with pleasure the visit to Canada in the summer of nineteen fifty-three of Dr. Armand Mayer of Paris. Dr. Mayer was able to speak with a number of groups throughout Canada, and attended the annual meeting of the Institute in Halifax.

Dr. Mayer is not only a well-known consultant in the field of foundation engineering and soil mechanics, but has published also many papers and two books in this field of work. His first book, "Sols et Fondations", was published in nineteen thirty-nine and was one of the earliest contributions to the literature of soil mechanics.

A second edition of another of his books has recently been published in a well-known series of French technical text books. The title, as given above, does not give a true indication of its contents. As an English title "Groundwater" would be a more accurate guide to the interesting treatment which this book contains of the theory and practice of dealing with the movement of groundwater in permeable soils.

It is always interesting to see the approach made to a technical subject by those trained in different countries, since much can be learned by such international exchange of ideas. In Dr. Mayer's book, for example, it is significant to note the close attention which is paid to the theory of groundwater movement, in preference to the more practical approach in corresponding books published in North America.

The volume under review starts with a general discussion of the occurrence of groundwater, although little is said about the determining geological conditions. A discussion of the principles of laminar flow follows, and this is applied to various groundwater conditions. It is a little surprising to find only two pages devoted to the subject of flow nets and their calculation and determination by electrical means.

A treatment of wells and bore holes follows, together with a discussion of the corresponding flow patterns, and this leads to a brief discussion of the various methods of dealing with groundwater construction by means of well points, sheet piling, injections, etc. The concluding chapters deal briefly with infiltration problems and drainage.

The book is clearly written and well presented. It includes a brief bibliography, but the contents of this list are probably the most surprising feature of the book. Twenty-five references are given, of which ten are American, five German and ten French. There are no cross-references to the text. It is surprising to find no reference to Tolman's well-known handbook and to see listed no one of the many publications of Dr. O. E. Meinzer.

Correspondingly, the European references will be new to many readers in North America. It is hoped that by the publication of this review of Dr. Mayer's book in a Canadian journal another step may be taken towards bridging this unfortunate gap which still exists between the engineering practice of Europe and that of North America.

Reviewed by R. F. Legget, M.E.I.C.,
Division of Building Research,
National Research Council,
Ottawa.

### BOOK NOTES

**Prepared by the Library**
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*Book notes marked by an asterisk have been provided through the courtesy of the Engineering Societies Library in New York.

***Absorption towers.** G. A. Morris and J. Jackson. Toronto, Butterworth, 1953. 159 pp., figs., $5.00.

Simple types of laboratory absorption equipment are considered first as a starting point for the design of full-scale packed towers. Special attention is paid to the transfer unit method, to mechanical features of design, and to economic factors. Absorption involving chemical reactions is also treated, and a collection of calculations is included to illustrate applications of design methods. There is a glossary and a list of references.

**Aide-mémoire Dunod. I Métrologie appliquée (méthodes et instruments de mesures),** 2e. éd. M. Denis-Papin et J. Vallot. Paris, Dunod; Montreal, Fomac, 1954. 300 pp., figs., $2.25.

Issued as a companion volume to Métrologie Générale, this aide stresses the essential principles of modern electronic metrology, and will be of use both to professional engineers and to students. It is also well indexed.

**Aide-mémorie Dunod. 2 Travaux publics.** Ch. Mondin. Paris, Dunod; Montreal, Fomac, 1954. v. I, 234 pp.; v. 2, 256 pp., figs., $2.25 ch. tome.

Two more convenient handbooks in the Aide-mémoire series, these will be of value to architects, and contracting and consulting engineers as well as to students in any way interested in civil engineering and public works.

***Annual report on the progress of rubber technology, volume 17, 1953.** T. J. Drakeley, ed. Cambridge, Heffer, for the Institution of the Rubber Industry, 1953. 173 pp., 21/-.

As in previous years, a general statistical and historical review is followed by surveys written by specialists, of significant advances in the various fields. Essentially, the publication is a selective and critical summary of the literature, including patents.

***Les applications pratiques des rayons infrarouges,** 3e. éd. Maurice Déribéré. Paris Dunod. Montreal, Fomac, 1954. 435 pp., illus., $16.65.

The major part of this book is devoted to practical applications of infrared radiation: photography; industrial heating and drying processes; photoelectric cells; and physiologic and therapeutic applications. The introductory chapters deal with basic aspects: the production of infrared to practical applications of infrared radiation; separation of diverse radiations; and the transmission, reflection, and absorption of infrared.

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***Applied electronics,** 2d ed. T. S. Gray. New York, Wiley, 1954. 881 pp., $9.00.

Explains the physical phenomena involved in electronic apparatus, the way these combine to determine the nature and limitations of electronic devices, the applications common to several branches of electrical engineering, and the final part covers semi-conductor devices, primarily the transistor. The text has been revised in line with current developments, the material on the transistor and its applications is new, and the bibliographies have been brought up to date.

**Architectural lettering for plans and ornamental design.** A. E. Burke and T. C. Buss. Chicago, American Technical Society, 1953. 187 pp., illus., $6.50 (U.S.).

The author of this book states that "good architectural lettering . . . should communicate thought and express feeling."

No matter how good a flair for design a prospective letterer may have, a knowledge of the fundamentals is necessary for its execution.

Lettering should be designed to be in keeping with the product or article to be advertised or announced, or the idea presented in a name.

This book develops these ideas, explaining and illustrating methods, mediums and tools from the simplest, to the more ornate types.

It will be an excellent volume for the library shelves of all architects and draughtsmen, and the multitude of people in many walks of life interested in lettering or poster production.

***Billings and water power in Brazil.** A. J. Ackerman. New York, American Society of Civil Engineers, 1953. 129 pp., illus., $7.00 (U.S.).

An account of the career of one of the foremost hydroelectric engineers. There is a brief mention of his construction work in the United States, Spain, and for the Navy in the first World War, and more detailed information on his work on the hydroelectric systems of Rio de Janeiro and São Paulo.

**Clay mineralogy.** R. E. Grim. Toronto, McGraw-Hill, 1953. 384 pp., illus., $10.80.

In this volume the author has attempted to summarize available data on the various clay minerals whose identities have been reasonably well established. He has not, however, included the aluminum and ferric iron hydrate minerals found in some clay materials.

The text covers the classification, nomenclature and structure of the clay minerals, and their origin and occurrence. Also considered are shape and size, properties, ion exchange, changes taking place on heating, and X-ray diffraction data.

Although there is no bibliography, there are numerous bibliographical footnotes and references at the ends of the chapters.

This book should prove of value not only to geologists, but also to manufacturers of ceramics and paper, oil engineers, construction engineers, agriculturists, and others concerned with the properties of the earth.

***The closed die forging process.** P. E. Kyle. Toronto, Macmillan, 1954. 140 pp., illus., fold., diagrs., $1.50.

A description of drop forging processes of possible use as supplementary reading for engineering courses in forging, metal processing, and machine design, and also as a review of the processes for design engineers and users of forgings. The essential steps in producing drop forgings are outlined and some of the uses of closed die forgings are discussed. Fundamentals of hot working and the properties of forged metals are also covered. A glossary of forging terms is appended.

**Étude de la lubrification et calcul des paliers.** Lucien Leloup. Paris, Dunod; Montreal, Fomac, 1954. 296 pp., figs., $9.50.

An analytical study of the hydrodynamic theory of lubrication of plain bearings, with special attention to friction effects, but restricting the treatment to static load conditions. Both partial and full bushings are treated, distribution and circulation of the oil are considered, and film characteristics are taken into account. Calculations of dimensions, temperatures, and friction coefficients are carried out for several cases.

**Flying saucers have landed.** Desmond Leslie and George Adamski. London, Werner Laurie, 1953. 232 pp., illus., 12/6.

Definitely a fabulous type of exposée of flying saucers, this book is divided into two parts.

The first one hundred and seventy pages are written by Desmond Leslie. He records innumerable authenticated cases of flying saucers seen both in the air from the ground, in the air from planes, by both passengers and pilots, and landed on the earth.

He compares their fantastic, but sometimes silent, sometimes musical, speed through the air (officially recorded and up to 42,000 miles per hour, but the average speed being 10,000 to 15,000 miles per hour) to the secret of the atmosphere as presumably discovered by the ancient dwellers of Poseidonis and Atlantis.

George Adamski, a cafe keeper on the grounds of Mount Palomar observatory writes the second part of the book. He it is who claims to have seen and talked with a man from another planet. His hobby is watching and photographing flying saucers and a number of his photographs are reproduced here.

Stuff and nonsense ? If you dismiss it as that, well, we think you may probably find yourself a back number in a few years time. But we know you will miss a lot of fun.

The Daily Sketch in London, says of this volume. "An amazing book, to understate matters. If Adamski and the six companions who swore an affadavit to this Space Man encounter are not trying to pull off a gigantic hoax, then this is quite possibly the greatest story ever."

***Heating, ventilating, air conditioning guide, 1954.** New York, American Society of Heating and Ventilating Engineers, 1954. 161 pp., diagrs., fold. maps, $10.00 (U.S.).

Chapters on a wide range of topics are grouped under the following broad headings: fundamentals, human reactions, heating and cooling loads, combustion and consumption of fuels, systems and equipment, special systems, and instruments and codes. Important changes have been made throughout in accord with recent developments, and a chapter on residential summer air conditioning has been added.

***Heat resisting steels and alloys.** C. G. Conway. Toronto, British Book Service, 1953. 160 pp., $5.00.

This is a compilation of data giving the high temperature properties of commercial steels and alloys produced in the United Kingdom and the United States. The steels and alloys are grouped in six classes: carbon, low alloy and martensitic steels; bolt steels; valve steels; U.S. cast steels; standard austenitic steels; and special heat-resisting steels and proprietary alloys. Given for each class are typical composition, common uses, advantages and disadvantages, graphical and tabular creep data, and physical and mechanical properties.

**Le matériel de travaux publics, t.2 Engins de terrassement,** 2ème partie. R. Pagni et al. Montreal, Fomac, 1954. 102 pp., figs., $7.90.

This volume considers vehicles used principally for earthwork, including caterpillar and pneumatic tractors, scrapers, dump trucks, belt conveyors of various types, road rollers, and rooters.

Information is given on the various types of machine, and the work for which they are best suited, and also on the characteristics of the material which is to be worked. Much of this information is given in tabular form, and there are also illustrations of the types of machine under discussion.

The book is really a compilation of material which previously appeared in La Technique Moderne-Construction.

**Prestressed concrete design and construction.** F. Walley. London, H.M.-S.O., 1953. 279 pp., illus., figs., $5.00.

The author of this book, who is employed by the Ministry of Works in Great Britain, has drawn on his experience and on his discussions with British and European designers in writing this book. His aim is to present in a simple way the principles upon which the design and manufacture of prestressed concrete units are based.

After brief chapters on the history and development of prestressed concrete, and the methods of prestressing, the author discusses the actual design problems, dealing principally with statically indeterminate structures, although one chapter is concerned with special design problems. Other chapters cover the behaviour of prestressed concrete under load, materials and allowable stresses, losses in prestressing, pre- and post-tensioning, and various tests on prestressed concrete units. Several systems and methods of design are discussed, namely Freyssinet, Magnel-Blaton and Lee-McCall.

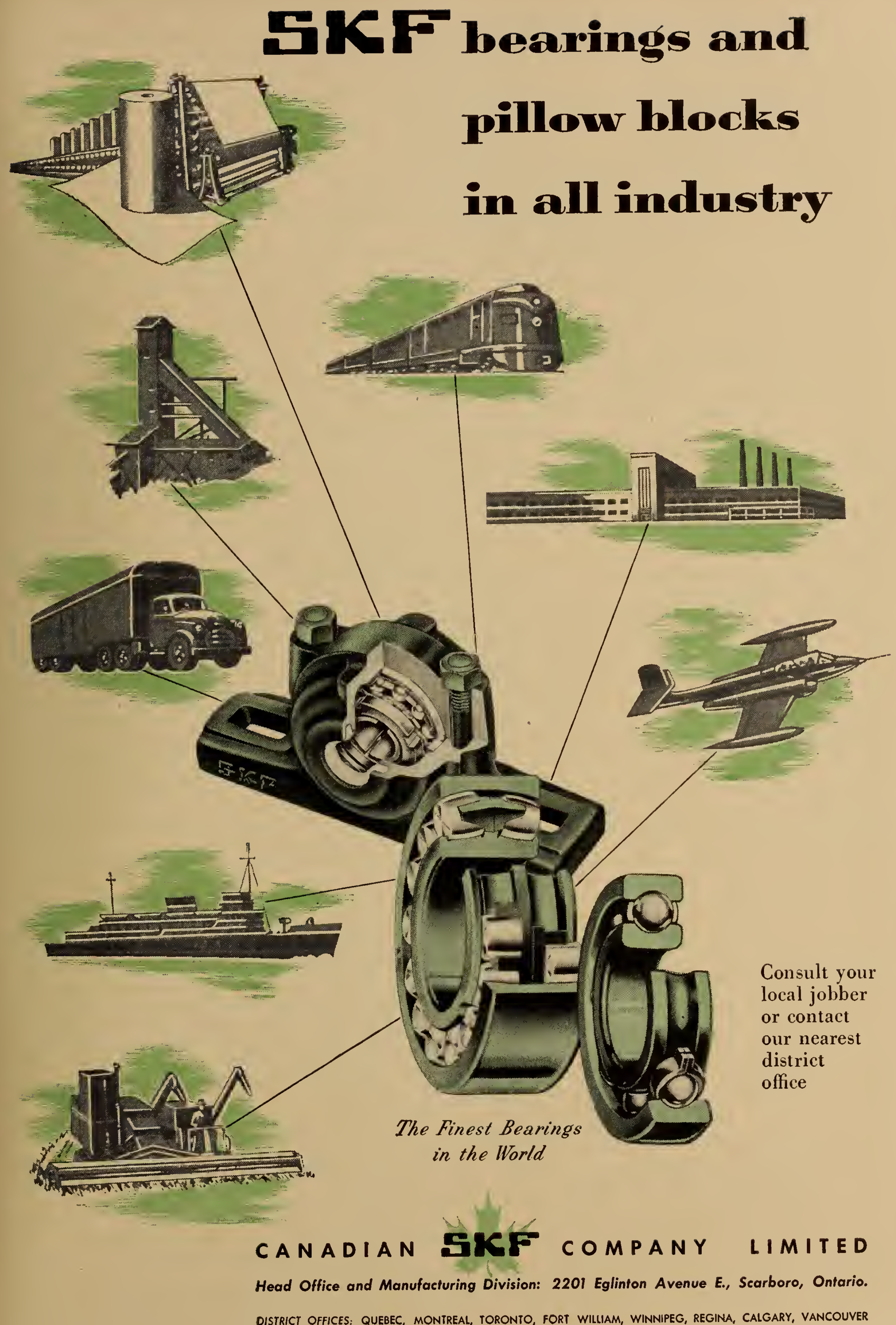
The work is illustrated with many diagrams, photographs and tables, and there is also a bibliography of works referred to in the text. This book will be of great interest to all members connected in any way with prestressed concrete construction, whether they are designers or students.

***Probability and information theory, with applications to radar.** P. M. Woodward. Toronto, McGraw-Hill, 1953. 128 pp., $5.40.

One of a series of monographs reporting on research in electronics and applied physics, this volume presents the essentials of probability and information theory in a condensed form. The first two chapters review probability theory and waveform analysis and noise, while the third summarizes the fundamentals of information theory. Chapters four and five deal with problems of detecting signals in noise, and the last three chapters are devoted to a mathematical treatment of radar along the lines suggested in the preceding pages.

**Radio troubleshooting guide book,** Volume 1, J. F. Rider and J. R. Johnson. New York, Rider, 1954. 156 pp., illus., $2.40. (U.S.).

Intended primarily for the service technician, this book discusses the various



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defects which cause trouble in radio receivers. It is divided into three parts, superheterodyne receivers, fundamental troubleshooting and common symptoms and remedies. Many wiring diagrams and illustrations are included.

**Receiving tube substitution guide book,** 2nd supplement. H. A. Middleton New York, Rider, 1954. 41 pp., illus., 99 cents. (U.S.).

This second supplement to the Receiving tube substitution guidebook is concerned primarily with tubes found in television receivers, and considers both receiving and picture tube substitutions. The supplement also includes a cumulative index listing all the tubes mentioned in the original volume and the first and second supplements.

**Reinforced concrete water towers, bunkers, silos, and gantries.** W. S. Gray. 3rd ed. rev. by G. P. Manning. London, Concrete publications, 1953. 223 pp., illus., $2.80.

This third edition has been revised by G. P. Manning, after the death of the author in 1947, although he states in his preface that such revisions as he has made take the form of additional notes, rather than actual textual alterations.

The book deals with the design of water towers, bunkers, silos and gantries in reinforced concrete, and also covers such related topics as wind stresses, aids in estimating, apparatus for handling and discharging materials, and notes on construction of the structures. Appendices give the Institution of Civil Engineers code of practice, and working stresses and specifications.

There are many illustrations, diagrams and tables. This book should prove very useful to all those concerned with the design of this type of structure in reinforced concrete.

**Space travel.** K. W. Gatland and A. M. Kunesch. New York, Philosophical library, 1953. 205 pp., illus., bibliographics, $4.75 (U.S.).

Like a reservation on a space ship to Mars?

Working from the opposite point of view to that of FLYING SAUCERS HAVE LANDED, this volume tells of developments in space travel from Earth to some other planet.

Tracing the development of rockets from the earliest times to the present, the writers develop their theme to guided missiles and artificial satellites, the problems of atmospheric pressure and of suitable clothing to combat pressures as estimated by present day scientists.

Both authors are experts in their field, but the language is not so technical as to be beyond the understanding of the interested reader.

Detailed illustration of potential and actual developments are included, and additional reading is listed in a three page bibliography at the back.

This should appeal both to the space travel enthusiasts, and to the skeptics.

**The synchronous induction motor.** J. Griffin. London, Macdonald, 1954. 136 pp., diagrs., 18/-.

"The synchronous induction motor is basically a machine designed to start as a wound-rotor induction motor and to run synchronously, combining the excellent starting properties of the induction motor with the high efficiency and the desirable power factors obtainable with the synchronous machine." Although invented in 1900, little has been written about it, and the author's aim in this volume is to provide an overall review of present day practice, with special reference to the various developments which have occurred since the last important survey of the motor, which, according to the bibliography in this book was in 1922, although other articles on the subject have since been written.

This book should be of interest to practising engineers and to students, as it deals with the theory of the cylindrical-rotor type of synchronous machine, and correlates the induction and the synchronous methods of operation of polyphase alternating current machines.

**TV troubleshooting and repair guidebook,** volume 2. R. G. Middleton. New York, Rider, 1954. 156 pp., illus., $3.30 (U.S.).

Another in the series of guidebooks issued by this publisher, this volume presents further information on the troubleshooting and repair of television sets. It deals with front-ends, picture i-f amplifiers, video amplifiers, sound i-f amplifiers and detectors, and audio amplifiers. The book is well illustrated with photographs and diagrams, and will be useful to all those interested in trying to repair their own television sets.

**Technical aspects of sound,** volume 1. E. G. Richardson, ed. Houston, Elsevier, 1953. 544 pp., diagrs., $11.00 (U.S.).

The contributors to this volume were all chosen as being experts in their own fields, and are drawn from England, the United States, Holland and Germany.

The aim of the book is to cover the technical aspects of acoustics and present a survey of the applications of this branch of physics.

This volume deals with the sonic range, and airborne sound. It is divided into six sections: acoustic measurements and materials, acoustics of buildings, noise, speech and hearing, sound reproduction and the analysis and synthesis of sound and the design and performance of musical instruments. The second volume, to appear later this year, will cover the ultrasonic range and its applications, including underwater transmission.

There are extensive bibliographies at the end of each section, and this book will be very useful to all our members interested in all the various aspects of sound.

**Technologie professionnelle d'électricité.** Raymond Merlet. 2e éd. Paris, Dunod. Montreal, Fomac, 1954. 386 pp., illus., $3.95.

Brought completely up to date in this its second edition, dated nineteen fifty-four, this volume treats of incandescent, luminescent, fluorescent, and electric arc lamps, photo electric cells, electric computers, and the installation of numerous types of telephone bells and intercommunication systems.

It is illustrated and has a detailed table of contents.

**Theory of machines.** B. B. Low. Toronto, Longmans, 1954. 472 pp., figs., $4.50.

Originally published under the title Engineering Mechanics, in nineteen forty-two, this book was re-issued three times, and is now being published in a completely revised form with a new title.

Eight additional chapters have been added, and information includes the analytical treatment of brakes, and the theory given for brakes with external-contracting pivoted shoes. The level of the book is the average university engineering course.

Exercises are included at the ends of the chapters, and in some cases, a short bibliography; there is a brief index.

**Le titane et ses composés dans l'industrie.** Maurice Déribéré. 2e éd. Paris, Dunod, Montreal, Fomac, 1954. 278 pp., figs., $7.75.

Originally a very rare and costly metal, titanium is now recognized for its many commercial uses, both in metallurgical techniques and dielectrics, and in steel and numerous alloys.

These uses are fully discussed in this volume, so as to make it of value not only to engineers and metallurgists, but also to industrialists, craftsmen, technicians and sanitary engineers.

## BOOKS RECEIVED

**Air conditioning, refrigerating data book, 1953-54.** New York, American society of refrigerating engineers, 1953. irreg. paging, diagrs., $7.50 (U.S.)

**Beton-Kalender, 1954.** Berlin, Ernst, 1954. 2 vols., figs., together 16 DM.

**Canadian government publications, 1953 consolidated annual catalogue.** Ottawa, Queen's Printer, 1954. 578 pp., $1.00.

**Cathode ray tubes.** M. G. Say, ed. Toronto, British Book Service, 1954. 216 pp., figs., $4.25.

**Chamber's shorter six-figure mathematical tables.** New York, Chemical Publishing Co., 1954. 387 pp., $6.50 (U.S.)

**Characteristics and applications of resistance strain gages, proceedings of symposium held November 1951.** United States, National bureau of standards. Washington, G.P.O., 1954. 140 pp., figs., $1.50 (U.S.) (Circular No. 528).

**Climate and architecture.** J. E. Aronin. New York, Reinhold, 1953. 304 pp., illus., $12.50 (U.S.)

**Concerning the nature of things.** Sir William Bragg. New York, Dover, 1953. 231 pp., illus., pa. $1.25 (U.S.)

**Dry rot and other timber troubles.** W. P. K. Findlay. Toronto, McGraw-Hill, 1953. 267 pp., illus., $5.50.

**Electrical earthing and accident prevention.** M. G. Say, ed. Toronto, British Book Service, 1954. 248 pp., illus., $4.25.

**The electromagnetic field in its engineering aspect.** G. W. Carter. Toronto, Longmans, Green, 1954. 360 pp., $6.30.

**Electronics.** G. F. Corcoran and H. W. Price. New York, Wiley, 1954. 459 pp., figs., $7.00.

**Electronics: a textbook for students in science and engineering.** T. J. Brown. New York, Wiley, 1954. 545 pp., figs., $7.50.

**Elements of structural engineering.** New York, Ronald, 1954. 505 pp., illus., figs., $7.00 (U.S.)

**Foundations of potential theory.** O. D. Kellogg. New York, Dover, 1953. 384 pp., pa. $1.90 (U.S.)

**Graphics in engineering and science.** A. S. Levens. New York, Wiley, 1954. 696 pp., illus., $7.00.

**Highlights of color television.** J. R. Locke. New York, Rider, 1954. 44 pp., diagrs., pa. 99 cents.

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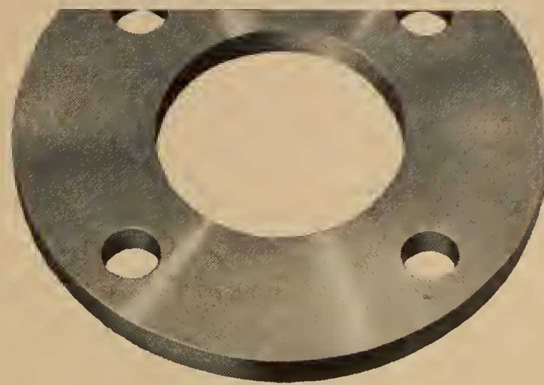

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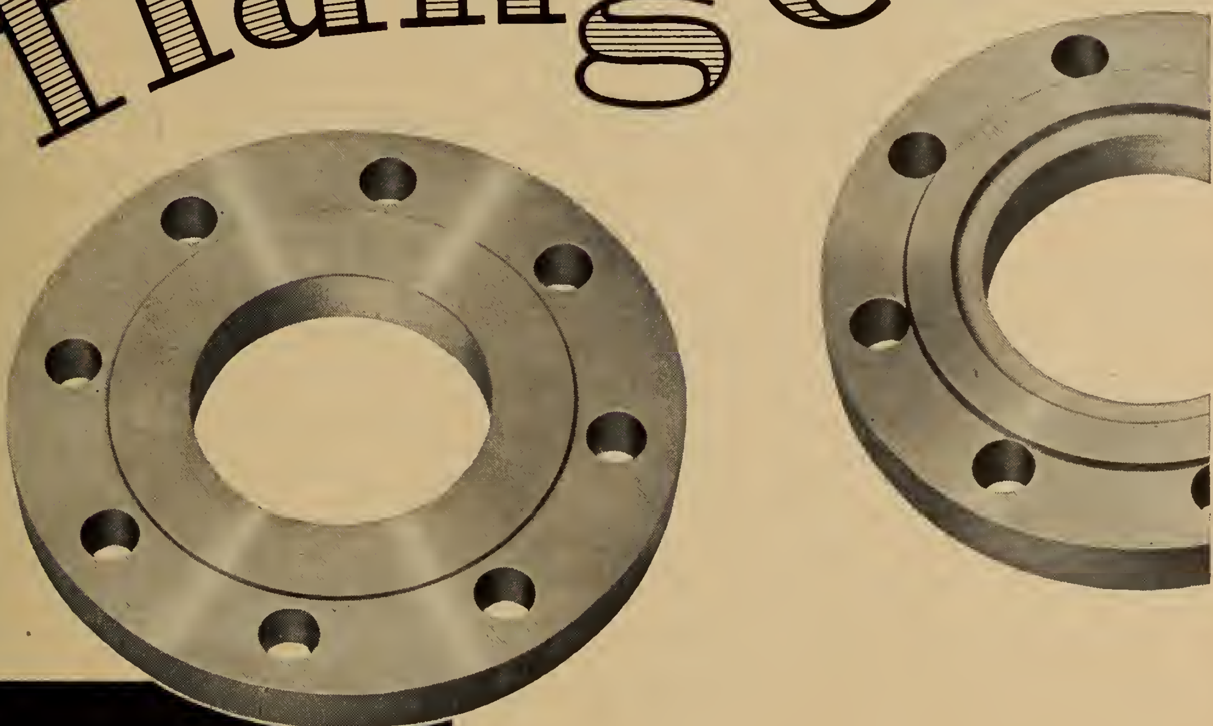

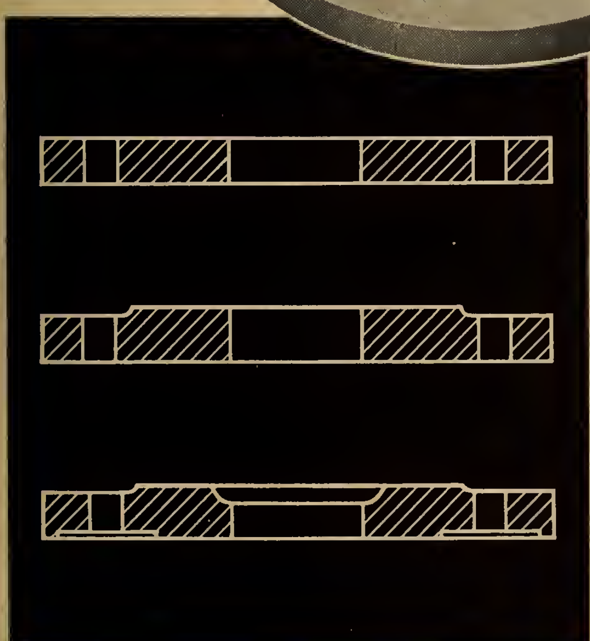

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**International year book and statesman's who's who, 1954 ed.** London, Burke's Peerage, 1954. 1,125 pp., £8.8.0

**Introduction to color TV.** M. Kaufman and H. Thomas. New York, Rider, 1954. 140 pp., illus., $2.10 (U.S.)

**Lubrication of industrial and marine machinery, 2nd ed.** W. G. Forbes and others. New York, Wiley, 1954. 351 pp., illus., $6.50.

**Magnetic amplifiers and saturable reactors.** M. G. Say, ed. Toronto, British Book Service, 1954. 198 pp., figs., $3.60.

**Metals engineering—design.** American society of mechanical engineers, ed. by O. J. Horger. Toronto, McGraw-Hill, 1953. 405 pp., illus., $12.50.

**Modern wiring practice, 2nd ed.** W. E. Steward. Toronto, British Book Service, 1954. 228 pp., illus., $3.00.

**Nature of light and colour in the open air.** M. Minnaert. New York, Dover, 1954. 362 pp., illus., pa. $1.95 (U.S.)

**Out of the earth: the mineral industry of Canada.** G. B. Langford, Toronto, University Press, 1954. 126 pp., illus., $3.50.

**Power and process—steam plant.** E. Molloy, ed. Toronto, British Book Service, 1954. 184 pp., figs., $3.00.

**Principles of physical optics.** Ernst Mach. New York, Dover, 1953. 324 pp., illus., pa. $1.75 (U.S.)

**Radio receiver design, part 1.** K. R. Sturley. Toronto, British Book Service, 1953. 667 pp., figs., $9.75.

**Relays for electronic and industrial control.** R. C. Walker. Toronto, British Book Service, 1953. 303 pp., figs., $7.25.

**Rotating amplifiers.** M. G. Say, ed. Toronto, British Book Service, 1954. 152 pp., figs., $3.00.

**Specialized home and portable radio manual, v. 8.** New York, Rider, 1954. 96 pp., diagrs., $1.65 (U.S.)

**Specification writing for architects and surveyors.** A. J. Willis. London, Crosby Lockwood, 1953. 88 pp., spiral binding, 7/6.

**Statistical yearbook, 1953.** United Nations. Toronto, Ryerson, 1953. 582 pp., $7.50.

**The superhet manual.** F. J. Camm. Toronto, British Book Service, 1954. 143 pp., diagrs., $1.30.

**TV manufacturers' receiver trouble cures, v. 5.** M. S. Snitzer. New York, Rider, 1954. 120 pp., diagrs., $1.80 (U.S.)

**Tables of barometric pressures at varying temperatures.** J. D. W. Ball. Toronto, Longmans, Green, 1953. 23 pp., $1.25.

**Theory and practice of reinforced concrete, 3rd ed.** C. W. Dunham. Toronto, McGraw-Hill, 1953. 499 pp., illus., $8.50.

**Theory of plasticity for engineers.** Oscar Hoffman and George Sachs. Toronto, McGraw-Hill, 1953. 276 pp., figs., $7.80.

**Vector and tensor analysis.** G. E. Hay. New York, Dover, 1953. 193 pp., pa. $1.50 (U.S.)

**Vegetation and watershed management.** E. A. Colman. New York, Ronald, 1953. 412 pp., illus., $7.00 (U.S.)

**Who's who in British science.** London, Hill, 1953. 292 pp., 42/-.

**Workshop calculations, tables and formulae, 11th ed.** F. J. Camm. Toronto, British Book Service, 1953. 186 pp., figs., tables, $1.30.

# TECHNICAL BULLETINS AND PAMPHLETS RECEIVED

**American society for testing materials:**

Bibliographical abstracts of methods for analysis of synthetic detergents. (Special technical publication No. 150)—Papers on soaps and other detergents, by L. F. Hoyt and others. (Bulletin reprints)—Resistance of cast Fe-Cr-Ni alloys to corrosion in oxidizing and reducing flue-gas atmospheres, by J. H. Jackson and others. (Transactions reprint)—Symposium on porcelain enamels and ceramic coatings as engineering materials (Special technical publication No. 153).

**American vocational association:**

Definitions of terms in vocational and practical arts education. 25 cents.

**American society for testing materials Special technical publications:**

No. 143—Symposium on light microscopy. No. 145—Symposium on non-destructive testing.

**Bituminous coal research:**

Economical operation of the small steam plant. 50 cents.

**British Insulated Callender's Cables Limited:**

Trolley-bus and tramway overhead equipment. 1954. (Publication No. 337).

**British standards institution:**

A purity guarantee for zinc alloy die castings.

**British welding research association:**

Projection welding of mild steel. 1954. 3/6.

**Canada. Dept. of resources and development. Water resources paper:**

No. 112—Surface water supply of Canada: Atlantic drainage, climatic years 1950-51 and 1951-52.

**Canada. National research council. Government specifications board. Specifications:**

1-GP-3A—Turpentine. 1-GP-50B—Thinner; for nitrocellulose finishes ester type. 1-GP-109—Paint, exterior white for use particularly on wood. 31- GP-100P-Coating; vinyl, pretreatment (for metals) (provisional) 37-GP-18-Cutback; distilled tar unfilled for waterproofing and dampproofing. 37-GP-22—Recommended methods for application of unfilled tar cutback foundation . coating. 37-GP-23—Recommended methods for application of coal tar cutback plastic cement. 37-GP-24—Recommended methods for application of unfilled coal tar cutback roof coating. 37-GP-25—Recommended methods for application of filled coal tar cutback roof coating. 43-GP-15—Excelsior; wood. List of specifications revised to 31 December 1953.

**Canada. National research council. National building code of Canada, 1953:**

Part 8: Construction safety measures.

**Canada. National research council. Canadian government specifications board. Specifications:**

1-GP-1a—Oil, linseed; raw, unrefined. 1-GP-4a—Thinner; petroleum spirits, type 1. 1-GP-5A—Thinner; petroleum spirits, type 2. 1-GP-110—Thinner; for nitrocellulose finishes. 22-GP-41—Mop sticks (a) screw clamp type (b) spring lever type. 23-GP-la—Metallizing gun sets; wire-gas. 45-GP-2—Drills; electric, portable.

**Canada. National research council. Canadian government specifications board. Provisional specifications:**

1-GP-81Pa—Primer; alkyd, air drying and baking types (for metals). 1-GP-84Pa—Primer; alkyd, for hard wood. 1-GP-92P—Thinner; 100 per cent aromatic (xylol), type A. 1-GP-94P—Thinner; 100 per cent aromatic (xylol), type B. 1-GP-98P—Enamel; alkyd, air dry and baking, gloss (green 3-13) 1-GP-105P— Primer; quick drying. 1-GP-108P—Paint, acid-proof, black. 1-GP-111P—Lacquer; flat, hot and cold spray. 1-GP-112P—Lacquer; stencil. 1-GP-114P—Enamel; styrenated, alkyd, quick drying, flat. 1-GP-115P—Ink; paste. 1-GP-116P—Enamel; modified alkyd, quick drying, gloss (green 3-13). 1-GP-117P—Enamel; modified alkyd, quick drying, semi-gloss (green 3-113).2-GP-9P—Compound; scouring. 2-GP-20P—Compound; dishwashing, for use in mechanical equipment. 2-GP-40P—Soap type cleaners for use on asphalt tile floors. 2-GP-41P—Non-soap type cleaners for use on asphalt tile floors. 2-GP-42P—Compound, destaining; plasticware. 2-GP-140P—synthetic detergent type cleaner for use on asphalt tile floors.

**Federation of manufacturers of contractors' plant:**

British construction equipment, catalogue for 1954.

**Franklin institute. Journal. Monograph:**

No. 1—Exhaust turbocharging of internal combustion engines; its origin, evolution, present state of development, and future potentialities. A. J. Buchi.

**Hydraulic association:**

Hydraulic machinery and equipment.

**Indian forest bulletin:**

No. 168—Wood preservation in India, past, present and future, by A. Purushotham, J. N. Pande and Y. G. Jadhav.

**Institute of civil engineers. Code of practice:**

No. 4—Foundations. (Available from Canadian standards association, Ottawa, Canada.)

**Ireland. National University:**

Calendar, 1953.

**Louisiana State University. Engineering experiment station:**

List of publications.

Proceedings of the sixteenth annual short course for water and sewerage plant superintendents and operators, 1953. (Bulletin No. 41).

**Mackintosh-Hemphill Company:**

Rolling mills, rolls, and roll making; a brief historical account of their development from the fifteenth century to the present day. $5.00.

**Mellon institute of industrial research:**

Summary report of Commonwealth of Pennsylvania (Department of health) Industrial fellowship Nos. 1 to 7 incl. (From August 20, 1946 through December 31, 1953).

**Municipal purchasing index, 1954,** K. E. Lyall, comp. Montreal, Lyall, 1954.

**Municipal year book, 1954,** K. E. Lyall, comp. Montreal, Lyall, 1954.

**Quebec. Dept. of Mines. Mineral deposits branch. Preliminary reports:**

No. 287—Mining properties and development in the Chibougamau region, Abitibi-East and Roberval Counties during 1952, by R. B. Graham. No. 288—Southwest quarter of McKenzie Township, Chibougamau region, Abitibi-East County, by J. R. Smith. No. 290—Waconno River area, Saguenay County, by R. A. Blais.

**Quebec. Dept of Trade and Commerce:**

Statistical year book, 1953. Quebec, Queen's Printer, 1953.

**Thermix corporation, project engineers:**

Catalogue.

**Union of South Africa. Dept. of forestry:**

Annual report for the year ended 31st March 1952.

**United States. Dept. of the interior, Bureau of reclamation. Technical memorandum:**

No. 646—Pressure grouting.

**United States. National research council. Highway research board:**

Bibliography No. 14—Automobile parking in the United States. (Publication No. 297). Current road problems, No. 9-3R—Recommended practice for snow removal and treatment of icy pavements

**United States. Dept. of health, education, and welfare:**

Engineering enrollments and degrees, 1953. (Circular No. 387).

## STANDARDS REVIEWED

**American welding society, 33 West 39th Street, New York 18, N.Y. D10.2-54T - Recommended practices for repair welding of cast iron pipe, valves and fittings. (Tentative)** 50 cents.

The repair of iron castings by welding has now become an established means of economically reclaiming them. This condition is the result of carefully worked out procedures to assure that the defects have been removed and replaced by sound weld metal. These Recommended practices, just published by the American welding society, give practical details of the repair methods which should be used.

Materials covered include gray iron, white cast iron, chilled cast iron, malleable iron, alloy cast iron and nodular cast iron. The welding processes for which procedures are given include are welding with nickel electrodes, mild steel electrodes, cast iron electrodes and copper-base electrodes; oxy-acetylene welding and braze welding; and carbon arc welding. This publication tells how to prepare a casting for welding: veeing, preheat, etc. It also tells what postweld heat treatments are required and describes the effects of welding on castings.

These Recommended Practices are equally applicable to all castings, although written specifically for pipe, valves and fittings.

**American society for testing materials, 1916 Race Street, Philadelphia 3, Pa. Specifications and tests for electrodeposited metallic coatings. pa. $1.85.**

This publication has been compiled to bring together in convenient form for the use of the industry all of the ASTM Specifications and methods of test pertain-

ing to electrodeposited metallic coatings on metals.

ASTM Committee B-8 on Electrodeposited metallic coatings and the American electroplaters' society prepared jointly the specifications and tests in this latest edition. The AES is officially represented on Committee B-8, which includes in its personnel many of the country's leading authorities representing those concerned with production of the coatings and use of the materials thus treated. The committee has followed closely a number of various research projects and has participated and sponsored atmospheric and other exposure tests.

The book contains: Specifications for electrodeposited coatings: zinc on steel, cadmium on steel, nickel and chromium on steel, nickel and chromium on copper and copper-base alloys, nickel and chromium on zinc and zinc-base alloys, lead on steel, chromate finishes on electrodeposited zinc, hot-dipped galvanized and zinc diecast surfaces. Methods of testing: local thickness of electrodeposited coatings, salt spray (fog) testing, Recommended practices for: chromium plating on steel for engineering use, preparation of the following, low-carbon steel for electroplating, high-carbon steel for electroplating, zinc-base die castings for electroplating, copper and copper-base alloys for electroplating, and preparation of and electroplating on aluminum alloys and stainless steel.

**British standards, British standards institution, 2 Park Street, London, W.1. British standards are available from the Canadian standards association, National research building, Ottawa.**

**B.S. 376: Part 2: 1954—Railway signalling symbols. Wiring symbols and written circuits, 2nd ed. 12/6.**

The revision of Part 1 of this British standard 'Schematic symbols' was published in 1951.

The publication of the revision of Part 2 now brings this British standard up to date.

It includes railway signalling symbols for wiring diagrams and written circuits and also explains a system of labelling wires in such a manner that each wire can be readily identified with that shown on the circuit diagram.

Notes and recommendations on the nomenclature for wiring diagrams, written circuits and the labelling of wires are included, together with examples of common combinations.

In drafting written circuits it is important that there shall be no doubt to which terminal of a piece of apparatus a wire is connected and the method of ensuring this is shown.

The symbols included in this standard are for railway signalling systems and are not intended for power lines, commercial electrical engineering machinery or telecommunications.

This British standard should prove invaluable to all those connected with railway signalling.

**B.S. 638: 1954—Arc welding plant and equipment, 3rd ed. 7/6.**

The British standards institution has recently published the above revised British standard. It deals with both d-c. and a-c. equipment and includes requirements for heavy duty multiple arc a-c. equipment for heavy constructional work, which was previously dealt with in the war emergency B.S. 1071. The basis of rating used in the two previous issues of this British standard has been retained and the only major modification is the introduction of maximum hand welding current which, together with a definition of arcing time factor, should enable the user to select with greater accuracy the correct capacity of welding plant or a given duty. Provision is made for a type of single operator plant, which, when operated at a lower arcing time factor than that assumed in the standard rating, can be used to supply currents in excess of the maximum continuous hand welding current. Such plant is required to be fitted with a warning plate stating the value of this maximum current.

**B.S. 907: 1954 — Dial gauges for linear measurement (excluding lever type).** 3/–.

This is a revised edition of this standard.

Dial gauges are among the most widely used of engineers' precision tools and many developments in design have taken place since B.S. 907 was first published in 1940. The present revision takes account of this in specifying standards of performance and incorporates a number of modifications which experience of working to the previous standard has shown to be desirable. It also makes provision for the back plunger type of dial gauge now in very general use.

In English measure, two types of dial graduations are provided for: those divided unto units of 0.001 in. (sometimes subdivided into half units of 0.0005 in.) and known as one-thousandth inch gauges, and those divided into units of 0.0001 in. and known as one-ten-thousandth inch gauges.

In metric measure, the standard is confined to dials graduated in units of 0.01 mm.

Recommended dimensions, methods of testing and notes on the care and use of dial gauges are given in appendices.

**B.S. 1193: 1954 — Sizes of sensitized material for recording instruments.** 2/6.

The British standards institution has recently published British Standard 1193: 1954 which supersedes B.S. 865: 1939 as well as B.S. 1193: 1945. The perforation pitch of the 70 mm. film previously dealt with in B.S. 865 has been brought into line with that for the other film sizes.

Another new feature in this edition is the inclusion of 80 mm. films used in mass radiography; this size is suggested as the preferred standard for future recording apparatus requiring a width of film of the order of 70-120 mm.

In addition, the method of specifying dimensions for perforated material has been revised to conform to the method of measurement used in their production.

**Canadian standards, Canadian standards association, National research building, Ottawa, Canada.**

**C.S.A. B97-1954 — Limits and fits for engineering and manufacturing,** 2nd ed., $2.50.

This Specification, replacing B97-1948, Part I, is a considerably enlarged edition and includes complete data on the selection of fits between plain (non-threaded) parts as well as definitions and revised preferred basic sizes and tolerances.

The Specification was prepared by the CSA Committee on Limits and Fits organized in 1945 to participate in the Conference on unification of engineering standards held in Ottawa in September of that year and attended by representatives from the Standards bodies of Great Britain, the United States and Canada.

The first edition published in 1948 covered definitions, preferred basic sizes and tolerances as agreed upon at the 1945 Conference. The second edition is the result of continued study by both Civilian and Defence Service representatives from Canada, Great Britain and the United States. Further Conferences were held in 1950 and 1952 and, in 1953 at New York, agreement was reached at an ABC (America-Britain-Canada) level covering the range of sizes .040 to 20 inches.

This second edition includes all fits agreed to by the three countries at the 1953 Conference and has been extended to specify fits for the size range 20 to 200 inches.

It is believed that the majority of industrial applications will be covered by the fits specified and that the Standard will have wide application in industry.

**C.S.A. C22.2 No. 14 — 1953 — Construction and test of industrial control equipment for use in ordinary (non-hazardous) locations, 3d** ed., $1.00.

This Specification replaces the second edition issued in 1942 (re-affirmed in 1949) and applied to control and protective devices for industrial electrical equipment, including motors, generators and heating apparatus, for potentials up to and including 2,500 volts between conductors on ungrounded systems and 4,500 volts between conductors on grounded neutral systems, and intended to be employed in accordance with the Rules of Part I of this Code.

In this new edition general requirements, construction, marking, and tests are thoroughly covered. The Specification is intended for use in ordinary (non-hazardous) locations.

**C.S.A. C22.2 No. 18 — 1953 — Construction and test of outlet boxes, conduit boxes and fittings, 2d ed.** $1.25.

This second edition replaces the first which was issued in 1934. Its title has been changed, and its scope has been enlarged to include additional box types and associated fittings. This Specification applied to metal boxes not exceeding 100 cubic inches in volume, designed to be employed in accordance with the rules of Part I of this Code. It includes not only devices which are known to the trade as "outlet boxes", and "conduit boxes" but also includes armoured-cable boxes, concrete boxes, flexible-non-metallic-tubing boxes, floor-outlet boxes, flush-device boxes, junction boxes, non-metallic sheathed-cable boxes, pull boxes, extension rings, covers, threaded and threadless fittings, cable and conduit straps, clamps and hangers, entrance caps, connectors for wire and cable, locknuts, bushings, and reducing washers. The devices are intended for use in non-hazardous locations.

The Appendix lists coating requirements for ferrous materials used in a metal box.

**C.S.A. C22.2 No. 53 — 1953 — Construction and test of electric washing machines, 2d ed. $1.00.**

This Specification applies to portable and stationary electrically-operated domestic and commercial clothes-washing and dish-washing machines equipped with motors and/or controls, and with or without water heaters, for potentials of 600 volts or less between conductors, designed to be employed in accordance with the rules of Part I of this Code.

It includes conventional gyrator-and-wringer machines, oscillating-tub machines, semi- and fully-automatic clothes- and dish-washing machines and extractors of the centrifugal type.

This Specification does not cover dry-cleaning equipment for hazardous locations.

"TWIFLEX"

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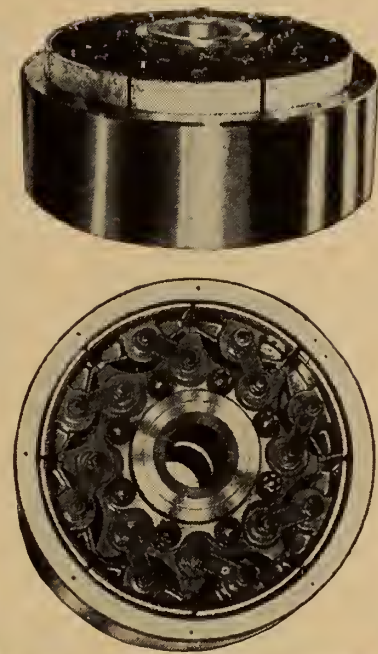
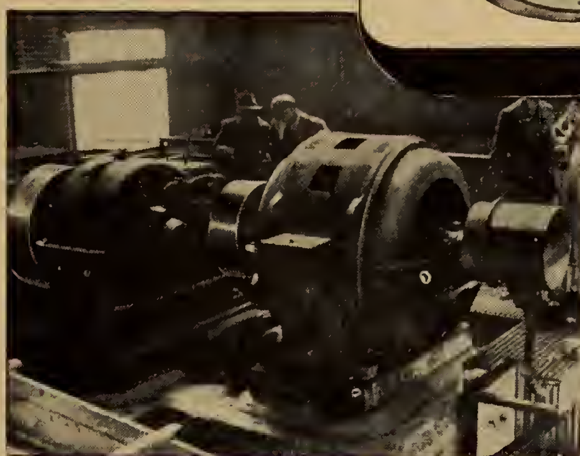
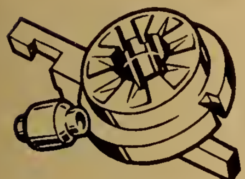
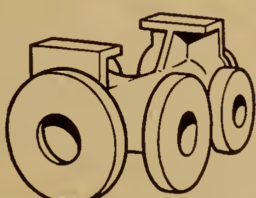
This Automatic Clutch and Flexible Coupling combines in one simple mechanism a centrifugal clutch with adjustable engaging speed and a very efficient flexible coupling with no backlash. TWIFLEX couplings *eliminate* torsional vibrations, excessive torque peaks, prolonged high starting current, and provide *shockless* power transmission for compressors, generators, travelling cranes, pumps, crushers, etc. Easily installed. Manufactured at Guelph in sizes from fractional to 5000 H.P. Write for literature and selection data to Dept. EJ3.



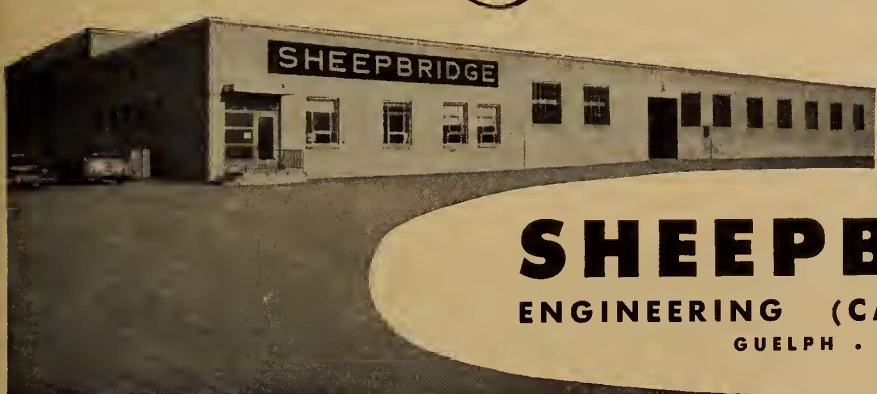




Sheepbridge powder metal division is designed for high speed production of powdered metal parts in brass, bronze, iron and steel, giving high precision parts at low unit cost.



Sheepbridge produces castings of mild, stainless, heat resisting steels and nickel base alloy by cement, shell, centrifugal and conventional methods at competitive prices.




*The new Sheepbridge plant at Guelph, Ontario.*

**SHEEPBRIDGE**

**ENGINEERING (CANADA) LIMITED**

**GUELPH . ONTARIO**

5403

# *Business & Industrial Briefs*

## *A Digest of Information*

*received by*

## *The Editor*

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## Appointments and Transfers

**Walter A. Cole.**—To coordinate Canadian General Electric Company's sales in the expanding telecommunication's market, Walter A. Cole has been appointed Manager, microwave sales, in the company's electronic equipment department.

Mr. Cole is responsible for the sale of microwave radio systems, telephone and telegraph wire line and radio carrier multiplex equipment and associated products and services, including supervisory control telemetering and teletype equipment.

Philip D. Wallace

**English Electric.**—J. M. Hahn has been appointed works manager of the English Electric Company of Canada Limited.

Mr. Hahn has been associated with the John Inglis Company since 1941 and joined the English Electric Company in 1950. Since then he has spent two years with the English Electric Company in their various works in England.

**New Address.**—The new address of W. W. Timmins and Company Ltd., is 51 Hillside Avenue, Montreal 6, P.Q.

**Reliance Electric.**—Formerly associated with the Toronto office of Reliance Electric & Engineering (Canada) Limited, Philip D. Wallace recently became sales engineer for the company's Calgary office.

**C. A. Dunham Co. Ltd.**—A. J. Dickey, president of the C. A. Dunham Company Limited, has announced two new staff appointments. R. E. L. Johnson becomes vice-president in charge of manufacturing, and R. M. Mitchell becomes vice-president in charge of sales.

**Lloyd S. Jamieson.**—The appointment of Lloyd S. Jamieson as general manager, Robertsteel (Canada) Limited, is announced by T. A. Irwin, president. Mr. Jamieson was formerly assistant general manager of the company.

**Canadian Westinghouse Company Limited.** — A. A. McArthur, has been appointed manager of the Canadian Westinghouse Company's power products division. He formerly held the post of sales manager for that division.

Lloyd S. Jamieson

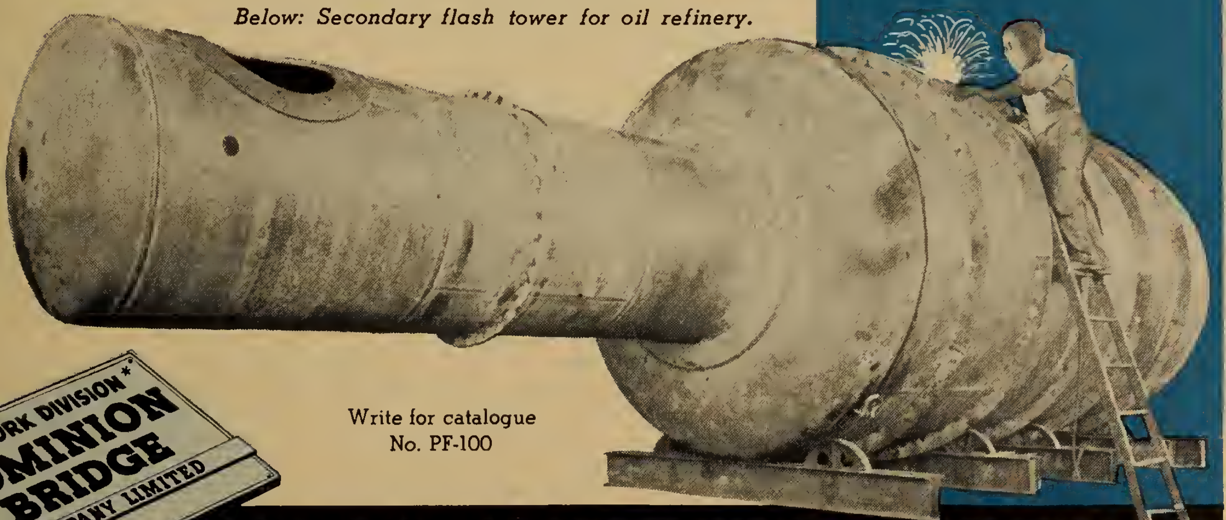
# PLATEWORK

*There is more than one kind of platework!*

Two of the three illustrations represent examples of *steel* platework . . . completely fabricated by welding, with techniques pioneered in Canada by Dominion Bridge. By continuous research and development, the Company has maintained a premier position in the welding industry.

Any of our 13 plants stands ready to solve *your* platework problems—large or small.

ILLUSTRATED: *Above: Continuous welded girder bridge, believed to be the longest of its type in the world.*
*Below: Secondary flash tower for oil refinery.*



PLATEWORK DIVISION* DOMINION BRIDGE COMPANY LIMITED

Write for catalogue No. PF-100

*OTHER DIVISIONS: STRUCTURAL, MECHANICAL, BOILER, WAREHOUSE

**Plants at: MONTREAL, OTTAWA, TORONTO, WINNIPEG, CALGARY, VANCOUVER**

**Assoc. Company plants at: AMHERST, N.S., QUEBEC, SAULT STE. MARIE, EDMONTON**

R. J. Tremblay    J. L. Henderson    D. S. Harper

**Trane Company.** — H. M. Treleaven, sales manager, Trane Company of Canada, Limited, announces the appointment and staff additions to three branch offices. Real J. Tremblay to Montreal office; Donald S. Harper to Hamilton office; John L. Henderson to London office.

●

**Ferranti Electric Appointment.** — Ferranti Electric Limited announces the appointment of Thomas C. Good, to their Montreal sales office. Mr. Good will assist C. E. Begin, Quebec district manager of the company.

●

**Canadian General Electric.** — W. F. Wansbrough has been appointed manager of Canadian General Electric's major appliance department, according to an announcement by W. G. Ward, general manager of the company's appliance division.

Mr. Wansbrough's headquarters are in the company's Montreal Works at 5781 Notre Dame Street East, Montreal.

●

# New Equipment and Developments

**Canadian Aviation Electronics, Ltd.**— C.A.E.'s new plant in Montreal was officially opened by Rt. Hon. C. D. Howe at a ceremony held at the plant on June 15. The new plant is designed to produce many types of precision devices and to provide facilities for the installation, maintenance, repair and modification of electronic equipment.

C.A.E. is an all-Canadian company which provides electronic products for the armed forces, the exploitation of natural resources, manufacturing industries, agriculture, medicine and science, for Canada and many other countries throughout the world.

●

**Compressed Air Floodlight.**—An ingeniously designed compressed air driven floodlight, is now being offered by Canadian Copco Ltd., Dorval, P.Q.

Fitted with a 12 volt 150 watt bulb and reflector, this portable light gives a wide field of illumination and is unusually suitable for road work and other operations where electrical power is not available. For underground work, and especially where mine gas may be present, it provides a degree of safety not possible with electric lighting. The air supply to the ball mounted turbo generator is conducted through the pressure insulated reflector chamber and should the lens be broken, the pressure ceases and the generator stops immediately. Excessive voltage variations are prevented by a special reducing valve which keeps the generator running at constant speed regardless of pressure changes in the primary air supply.

Identified as Copco-Atlas TGB-41, the floodlight weighs 22 pounds, consumes only 32 c.f.m. air and can be operated on any pressure from 60 to 100 lbs. per sq. in.

●

**Dominion Bridge Boilers Now Made in Vancouver.** — Fully equipped facilities for the manufacture of a complete range of low pressure heating boilers are now available at the Vancouver plant of Dominion Bridge Company Limited.

The Vancouver plant will fabricate the range of Robb-Victor Boilers, originally developed by the Robb Engineering Works Limited, which has been manufacturing boilers in Canada for over 100 years. This plant will also manufacture the Scotch Dry Back Boiler, including a "package unit" recently developed at the Lachine Works of the Dominion Bridge Company from this type.

●

**Construction Equipment**—Innes Equipment Limited, 930 Millwood Road, Toronto, and Innes Equipment Quebec Limited, 55 Decarie Blvd., Montreal, have been appointed to sell and service the Michigan line of excavator cranes and tractor shovels, products of the Construction Machinery Division of Clark Equipment Company, according to an announcement by Clarence E. Killebrew, Clark vice-president.

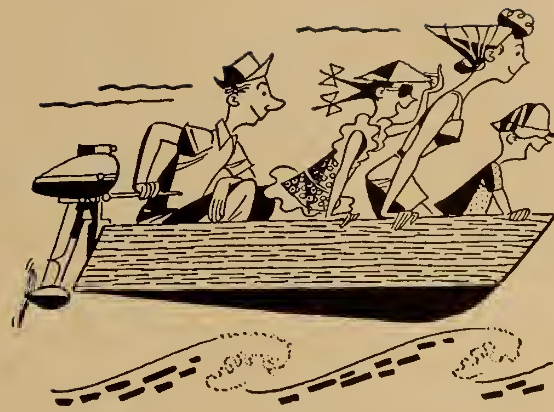
Innes Equipment Limited will handle the Michigan line in the entire province of Ontario. Innes Equipment Quebec Limited, will handle the equipment in the entire province of Quebec.

●

**Chemists; New Ideas.** — Any chemist with a new idea, a new material, a new device or a new observation waiting for fame and fortune is invited to submit it to the 8th National Chemical Exposition for its Chemical Trail Blazers' Exhibit.

Since 1944, the exhibit has been part of the biennial national show, which

turn maintenance time...



into working time

# Install TECALEMIT automatic lubricating equipment

**This 75 ton hot metal crane is one of several in the Hamilton plant of Dominion Foundries and Steel, Limited,** depending wholly on a Tecalemit Line-O-Matic system for constant, efficient, trouble-free lubrication. Maximum operating efficiency is ensured . . . throughout every shift, every week, the year round; with minimum time out for maintenance.

Tecalemit systems increase production and profits by reducing breakdowns by up to 80%. They are designed to supply grease or oil under pressure, in predetermined quantities to bearings and friction areas in every type of industrial machinery and power equipment.

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Pipher-Holden Machine & Tool Co., Windsor

T-4-54

this year will be held in the Chicago Coliseum, October 12 to 15. Space is made available free for any kind of chemical novelty and all the hopeful chemist need do is send his request for space to Dr. Paul E. Fanta, Trail Blazer chairman, at the Illinois Institute of Technology, Chicago 16.

●

**Material Handling.** — The introduction to the Canadian market of the Scheidt "Grapple", an effective material-handling device, is announced by Joy Manufacturing Company (Canada) Limited, Galt, Ontario. The "Grapple" is a multi-tined digging bucket, suspended in the conventional manner from a crane boom or similar machine support when used to handle loose material on normal applications.

For example broken rock and ore, scrap metal, gravel and similar material, can be handled quickly and effectively by the unit, which is available in wide-tine style, providing full closure of the bucket; medium-tine style, providing effective containment of average sized material; and narrow-tine style, for handling coarse material.

●

**Electric Motors Built to New Standards.**—Canadian General Electric Company recently unveiled the first polyphase induction motor to be built to the new revised standards of the Canadian Electrical Manufacturers Association. The motor was displayed for the consumer public at the Canadian International Trade Fair.

For the consumer, the new C.G.E. motor means a smaller, lighter, more compact power plant for less money.

It was agreed that no Canadian motor manufacturers would offer their versions of the new frame size for sale in Canada until July, 1954, and that an interval of five months should elapse between each succeeding consecutive frame size offering. It is expected that in due course all members of the C.E. M.A. will follow the new standards, although it is non obligatory.

●

**Bulldog Electric Affiliated.** — Affiliation of their parent companies in the United States recently will not affect individual organization or sales operations of Eastern Power Devices Limited and BullDog Electric Products Co. (Canada) Ltd., it was announced in a joint statement issued here today by W. J. Gilson, Eastern Power Devices Limited, president, and R. R. Farrell, vice-president of BullDog Co. (Canada) Ltd.

Closer co-operation between the Canadian companies to improve their service to this country's electrical market is under study, however. Shop facilities of both plants will be made available to each on a broad co-operative basis.

●

# Publications

**For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.**

**Please mention *The Engineering Journal* when writing.**

**Apparatus for Industry.** — A 14-page catalogue describing General Electric motors, motor control, adjustable speed drives, welding equipment and accessories—has been released by the apparatus division of Canadian General Electric Company.

The well-illustrated, two-colour catalogue offers easy reference to this representative group of apparatus products built to meet the specifications of Canadian industry. Designated AAD 24801, the catalogue is available on request from Apparatus Division, Canadian General Electric Company, 212 King Street West, Toronto.

●

**Welding Text and Reference Book.**— A new book, "Metals and How to Weld Them"—by T. B. Jefferson, Editor, The Welding Engineer, for the welding operator, supervisor, instructor, engineer, designer, and manager; explains in clear, logical, readily understood steps the structure and properties of metals and how to weld them. Covers the fundamentals of metallurgy and their significance for welding metals. Gives procedures for welding mild, medium and high carbon steel, alloys, cast iron, hardfacing, stainless and high chromium steels, austenitic manganese steels, tool and die steels; how to make good welds, trouble shooting, welding terms and useful data. 322 pages, over 170 drawings, photographs and tables; stiff board, cloth covered binding, gold embossed, price $2.50 per copy. Lincoln Electric Company of Canada Limited, 179 Wicksteed Road, Leaside (Toronto 17), Ontario.

●

**V-Belt Catalogue.** — An up-to-date V-Belt catalogue has been made available by the industrial products division of B. F. Goodrich in Canada.

B.F.G. patented Grommet belts in standard and high capacity constructions are highlighted in the free booklet. New horsepower rating tables permit the design or re-design of V-belt drives at reduced cost.

For further information on this release, write Press-radio Relations Representative, B. F. Goodrich, Kitchener.

●

**Nickel and Nickel Alloys.**—Three new Canadian listings of current technical publications available from The International Nickel Company of Canada, Limited describe the contents of a total of 294 pieces of literature on the uses of nickel and nickel alloys.

List "A" is of particular interest to Canadian production men, design engineers, metallurgists and metal users. It describes 156 publications dealing with nickel alloy steels, stainless steels, nickel brasses and bronzes, nickel cast irons and nickel plating. Industries in which these nickel alloys are used include the aircraft, automobile, petroleum, pulp and paper, mining, glass, electrical, machine tool and shipbuilding industries. Applications discussed range from light tubing to heavy gears and castings.

List "B" describes 116 current publications on uses of monel, "R" monel, "KR" monel, "S" monel, nickel, duranickel, low carbon nickel, inconel, inconel "X" and incoloy. In addition to information on general applications, several of the publictions in List "B" give technical information on the engineering properties, and corrosion and heat-resisting characteristics of these alloys. There are publications of particular significance to those with special training in architecture, chemistry, electricity and electronics, food processing, furnace and heat treating, hospitals, leather tanning, transportation and power fields.

The third of the new Canadian lists available, List "D", describes 22 publications on the properties and applications of ductile iron. Among these are publications on the hardening characteristics, wear properties and heat treatment of ductile iron, and its application to engineering, casting, gear materials, farm implements, heavy machinery, forgings, waterworks construction and joining.

Copies of either of these three new lists, "A", "B", and "D" are available without charge from The International Nickel Company of Canada, Limited, Room 1815, 25 King Street West, Toronto 1.

●

**Gear Units.**—A new Gear Unit Bulletin has been issued by Dominion Engineering Company Limited, P.O. Box 220, Montreal.

The 40 page illustrated book describes new designs and an extended range of sizes, including high speed units. In conjunction with technical data the booklet also contains rating and dimension tables for all units. When writing request Bulletin No. 368-53.

●

**H. R. C. Fusegear**—An article on "What the H.R.C. fuse means to the electrical contractor" is the main feature in the May-June issue of The English Electric Company of Canada Limited's magazine 'Spotlight'. It is by R. J. A. Behan, the company's fusegear specialist.

The article points out the advantages, from the point of view of reliability in operation, and economy in purchasing, installation and maintenance of the H.R.C. fuse. The fuse is a revolutionary device which provides an inexpensive and effective means of protecting equipment against destruction from electrical faults and protecting operators from the hazards of explosions of inadequately rated interrupting devices. Requests should be addressed to the company at St. Catharines, Ontario.

●

**Rubber Products Industry.** — Reprints of an article from Chemistry in Canada, on the "Rubber Products Industry of Canada", are now available.

This 11-page article outlines the story of the rubber products industry in Canada from its background to its personnel. Topics covered in detail include: rubber products, rubber and plastics, exports and imports, raw materials, rubber reinforcing agents, rubber chemicals, other chemicals, production techniques, and research and development.

Copies are available without charge, from The Chemical Institute of Canada, 18 Rideau Street, Ottawa, 2, Ontario.

●

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 37 MONTREAL, AUGUST 1954 NUMBER 8

PUBLISHED MONTHLY BY
THE ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET - MONTREAL
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"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

*16,200 copies of this issue printed*

# CONTENTS



*Indexed in The Engineering Index*

# Canadian Hydro Electric Developments on The Niagara River

by

Dr. R. L. Hearn, M.E.I.C.

*General Manager,*
*Ontario Hydro Electric Power Commission,*
*Toronto, Ont.*

This paper, presented before the 68th Annual Meeting at Quebec City, sketches the early history of power development on the Canadian side of the Niagara River and records the early discussions regarding public ownership of power leading up to the creation of the Ontario Hydro Electric Power Commission in 1906.

The main features and the construction of the Sir Adam Beck-Niagara Generating Stations Numbers 1 and 2 are described and compared. When completed in 1956, the Sir Adam Beck-Niagara G.S. No. 2 will have a total capacity of 1,260,000 hp.

The history of the Niagara River and Falls dates back some 200,000 years to the ice age, when glaciers thickly covered the Great Lakes area. As the glaciers melted and retreated, vast lakes and drainage systems developed which were the forerunners of the present-day geography of Southern Ontario.

The Falls themselves and, in fact, the upper Great Lakes, owe their existence to the hard limestone strata which forms the Niagara river bed and the crestline of the Falls. This hard rock formation has prevented Lake Erie from draining completely into Lake Ontario.

Following the scoring and gouging of the earth's crust, the glaciers melted. A lake was formed in the Erie basin, which found an outlet over the Falls to Lake Ontario. Most of the Upper Lakes water flowed down the Ottawa River, which extended far up the St. Lawrence valley.

When the level of this body of water fell below the divide of the Ottawa, large volumes of water began to flow over the flats of what are known as the St. Clair and Detroit rivers. So today, the Niagara River is "backed" by a large natural headpond, comprising four lakes formed by the glaciers—Superior, Huron, St. Clair and Erie.

Dependability of flow is an extremely important factor in determining the value of a river with respect to the production of hydro-electric power. In this regard the Niagara River, with its vast storehouse of water to draw upon, ranks with the best, as indicated by the comparative table (daily mean flows):

*St. Lawrence River*—Outstanding for its dependability and uniformity of flow, with a maximum to minimum flow in the ratio of less than 2:1.

*Niagara River*—Maximum to minimum ratio of flow, excluding diversion factor, is 3:1.

*Ottawa River*—Maximum to minimum flow ratio is 12:1.

*Columbia River*—Maximum to minimum ratio of flow is 28:1.

### Industrial Progress Hinges on Electricity

In the latter part of the nineteenth century, industry in southern Ontario faced a crisis; where to find a cheap dependable source of power to keep the wheels of industry turning. The timber line was fast receding, and it had become uneconomical to haul wood for steam operated plants. Coal from the United States was too costly for sound operation.

Even the use of localized water-power plants to produce electricity was not entirely satisfactory, since their output was confined to a small radius, and the denuding of the forests meant heavy spring run-offs with consequent low water flows for the rest of the year.

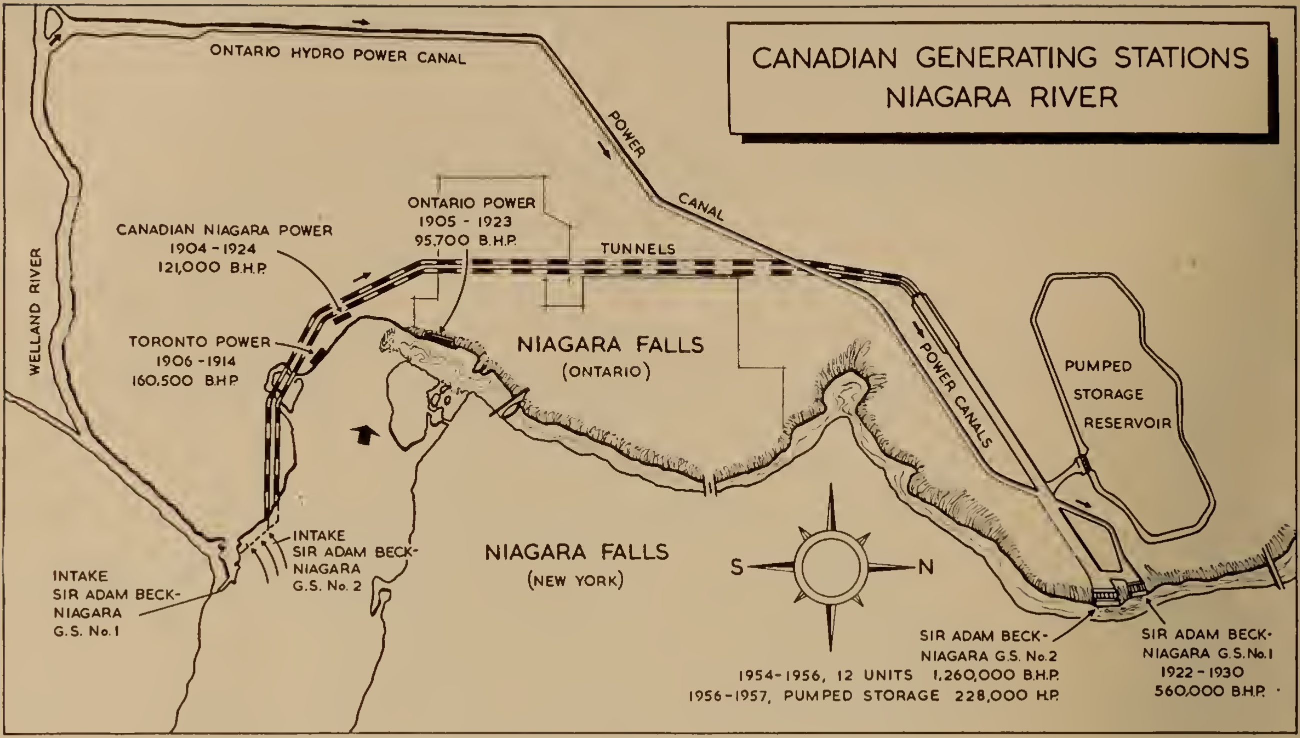
The answer to future progress was the utilization of dependable river flows, such as the Niagara River, to produce electricity and transmit it to the growing manufacturing centres. For more than 60 years, the waters of Niagara have been used to generate the electricity which has been one of the chief factors in the economic strength and growth of Ontario.

In order to ensure the best use of Niagara waters for power production, and to maintain the scenic beauty of the Falls, various treaties have been signed between the United States and Great Britain, and Canada.

### International Boundary Waters Treaties

The Boundary Waters Treaty of 1909-1910 was signed between Great Britain and the United States. As it relates to Niagara, this treaty permitted, for power purposes, the permanent daily diversion from the Niagara River above the Falls of 20,000 cubic feet of water per second to the United States, and of 36,000 cubic feet per second to Canada.

During World War II, Ontario Hydro obtained an additional 5,000 c.f.s. of water for power purposes at Niagara Falls through the Long Lac-Ogoki diversions. Additional temporary diversions were obtained




through an exchange of letters between Canada and the United States of America in the years 1941 1944 and 1948.

These temporary diversions amounted to 15,500 c.f.s.,—2,500 c.f.s. of which was available only during the non-navigation season,—and enabled the Commission to operate all of the plants on the Canadian side to their maximum capacity. It might be mentioned that the power companies on the United States side of the Niagara River also obtained additional diversions under temporary permits, to enable them to operate their plants at full capacity.

In order to maintain a proper pool level above the Falls, a submerged weir was built just below Chippawa and above the Rapids, during the years 1942 to 1944. This submerged weir assisted in maintaining the level of the Grass Island Pool, even at times of increased diversion for power purposes. At the same time it increased the flow over the American Falls, thus enhancing the scenic effect considerably.

After the cessation of hostilities, negotiations were entered into by Canada and the United States with a view to revising the 1909 Treaty to permit re-development of power on both the Canadian and American sides of the Niagara River. These negotiations resulted in the signing at Washington on February 27, 1950, of a new treaty known as the Niagara Diversion Treaty.

The significant feature of the new treaty was that, instead of a definite amount of water being designated for power as in the 1909 Treaty, a definite flow over the Falls was stipulated to preserve and enhance their scenic beauty. The balance after allowance for domestic, sanitation and navigation purposes is allowed to be diverted for power production,—50 per cent to each country,—exclusive of the 5,000 c.f.s. Ogoki diversion which belonged entirely to Canada.

When the 1950 Treaty was ratified on October 10, 1950, Ontario Hydro was in a position to start immediately on the redevelopment of the Niagara River with the construction of the Sir Adam Beck-Niagara Generating Station No. 2, the details of which will be covered later in this paper.

#### First Diversion of Water for Power Purposes

The first diversion of water for power purposes on the Canadian side was the small plant constructed in 1893, to operate the International Railway Company's electric line from Chippawa to Queenston. This plant was operated under a head of 62 feet, with an ultimate capacity of 3,000 hp. in 2 units. In 1932, on the expiration of the 40-year lease, the railway was dismantled and the plant abandoned.

At the turn of the twentieth century, hydro-electric power development at Niagara Falls on the Canadian side received a tremendous impetus when three large power stations were in the course of construction at the same time, namely, those of the Canadian Niagara Power Company, the Ontario Power Company, and the Electrical Development Company.

#### Canadian Niagara Power Company

The Canadian Niagara Power Company was the first to begin construction operations in 1901. The plant has an operating head of approximately 135 feet. Between 1904 and 1924 eleven vertical type units were placed in service, with an installed capacity of 121,000 horsepower.

This plant followed the same design as the Adams plant of the Niagara Falls Power Company on the American side. The water is obtained from the Niagara River by means of a gathering weir, and is carried to the water turbines by penstocks at the bottom of the wheel pit. The discharge from the draft tube is taken back to the Niagara River by a long tail-race tunnel.

#### Ontario Power Company

The Ontario Power Company in 1900 acquired a charter granted by the Dominion Parliament in 1887, and began work in July, 1902.

The design used by this company for its development showed a radical departure from the two plants mentioned earlier. While water was diverted from the Niagara River by a gathering weir, it was carried underground across country from this point through three pipelines, 6,500 feet long, to the top of the escarpment just below the Canadian Falls and from there down through penstocks to the power house, situated on the bank of the river below the Falls.

By this arrangement, the Ontario Power Company was able to obtain an operating head of 180 feet. The present equipment in this plant consists of 15 units,—the horizontal type with double runner turbine units. The rated capacity of the plant is 195,700 horsepower. In August 1917, the station was purchased by Ontario Hydro.

The plant is of particular engineering interest, as it was on this development that one of the largest steel conduits, 18 feet in diameter, was installed. The second pipeline was one of the largest oblate reinforced concrete pipes ever constructed in Canada. The third pipeline, put in as an emergency measure during World War I, is one of the largest wood stave lines in the Dominion. This 13-foot diameter wood stave pipe was covered with concrete on the outside, and is still operating. The steel bands of the wood stave pipe are being used for taking the tension, and the concrete on the outside is used for water tightness and stability.

It was for this development that the late R. D. Johnson invented, designed and installed the first Johnson differential surge tank in the world. It was also for this plant that he designed and installed the Johnson differential valve, and designed and built one of Canada's largest reinforced concrete tanks at that time.

The Ontario Power Company plant has an interesting historical background. It was twice flooded with water and ice, caused by ice jams in the Niagara River. The last flooding occurred in January 1938, when the ice below the Falls reached a level some 58 feet above normal at the south end of the plant. It was at that time that the Upper Steel Arch Bridge was destroyed.

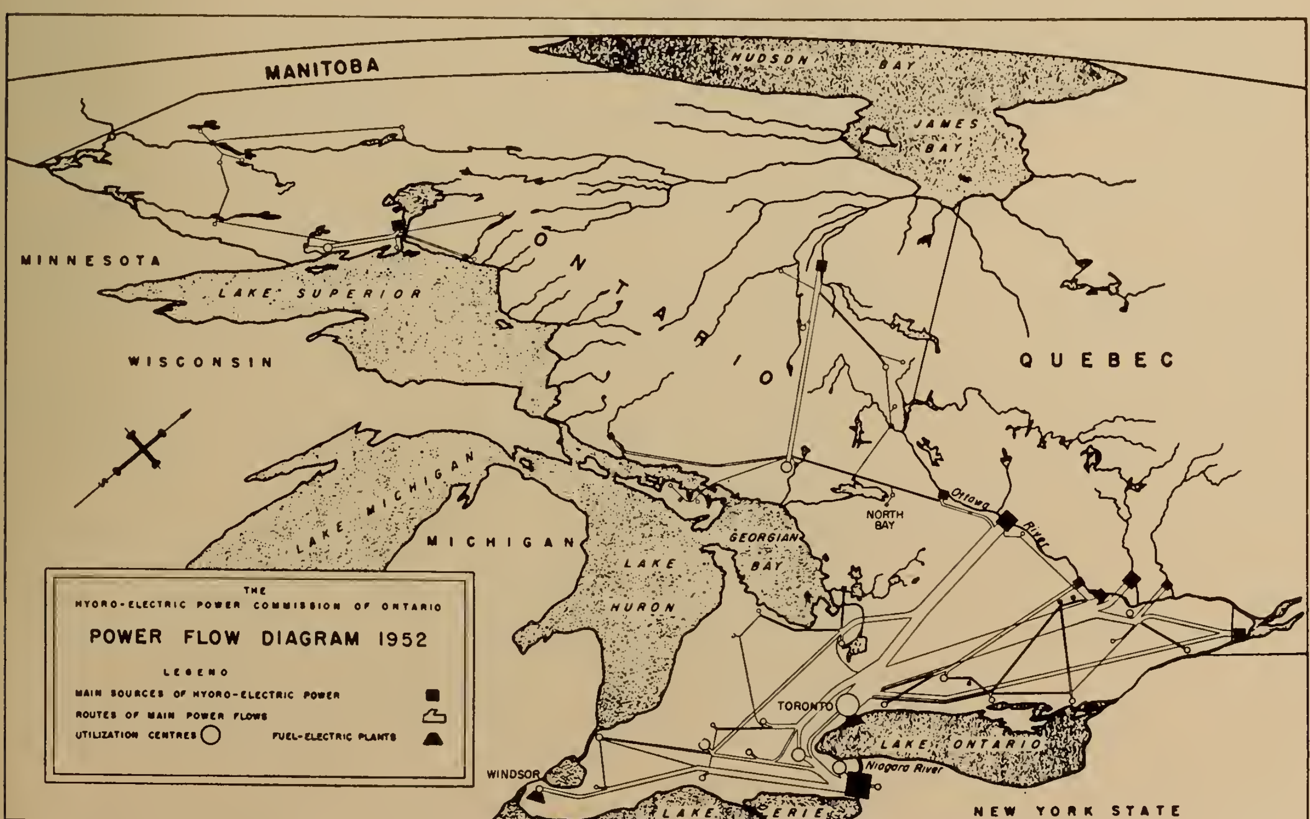
#### Electrical Development Company

The Electrical Development Company plant, later the Toronto Power Development, was built simultaneously with the Canadian Niagara and the Ontario Power Company developments. Work began in 1903 with the installation of the eleventh and final unit in 1914. This plant is the same type as the Canadian Niagara. It is situated just upstream with an operating head of 137 feet, and has an installed capacity of 160,500 horsepower.

The Electrical Development Company was leased by the Toronto Power Company in 1908, and was operated by them until acquired by the Ontario Hydro in 1922. Since that date it has been known as the "Toronto Power" plant. It was from the Toronto Power Company, incidentally, that the city of Toronto first received electricity generated from the waters of the Niagara River.

While Niagara was being harnessed by these three companies, industrialists and leading businessmen in Toronto and Western Ontario were advocating methods whereby this power could be generated and transmitted to the industrial centres in Southern Ontario at economical rates, and thus provide energy for industrial expansion and the improvement in the living conditions of the people.

On February 17, 1903, in the Y.M.C.A. Hall, (Berlin) Kitchener, 67 persons gathered to discuss the idea of public ownership of hydroelectric power. These men included



**Above: Exterior view of Canadian Niagara Power Company, a private power company located on the upper Niagara River.**
**Below: Interior view of the generating room of the Canadian Niagara Power Plant.**

representatives from manufacturers' associations, boards of trade and municipal councils of municipalities.

This was the first meeting, in connection with the power movement, attended by Adam Beck who, at the time, was Mayor of London and a member of the Ontario Legislature, as well as a prominent manufacturer in his own right. From the time he appeared as a supporter of the low-cost power movement, he assumed a position of leadership.

As a direct result of the efforts of these men who led a general movement on behalf of cheaper hydro-electric energy, The Hydro-Electric Power Commission of Ontario was created by a special act of the Provincial Legislature in 1906.

#### Ontario Hydro Delivers Niagara Power to Southern Ontario Municipalities

On May 4, 1908, fourteen municipalities made the first Hydro contract for a total of 26,235 horsepower. Those municipalities were Kitchener, Hespeler, Galt, Preston, Waterloo, New Hamburg, Toronto, London, Guelph, Stratford, St. Thomas, Woodstock, St. Marys, and Ingersoll.

This municipal enterprise was begun by purchasing power by public tender from existing companies which had extensive plants already erected at Niagara Falls. Consequently, in 1908, the Commission on behalf of the municipalities, entered into a contract with the Ontario Power Company for the supply of 100,000 horsepower at 12,000 volts at $9.40 per horsepower-year up to a load of 25,000 horsepower, after which the price would be $9.00 per horsepower-year.

The Commission proceeded to build transformer stations and transmission lines for the distribution of this power to the contracting municipalities, and by the end of 1910, approximately 1,000 horsepower was being distributed to a number of municipalities.

This small load increased until by 1915 the Commission reached the limit of its contract with the Ontario Power Company for 100,000 horsepower. The Commission arranged for additional power supply from the Canadian Niagara Power Company of 50,000 horsepower and from the Toronto Power Company of over 25,000 horsepower.

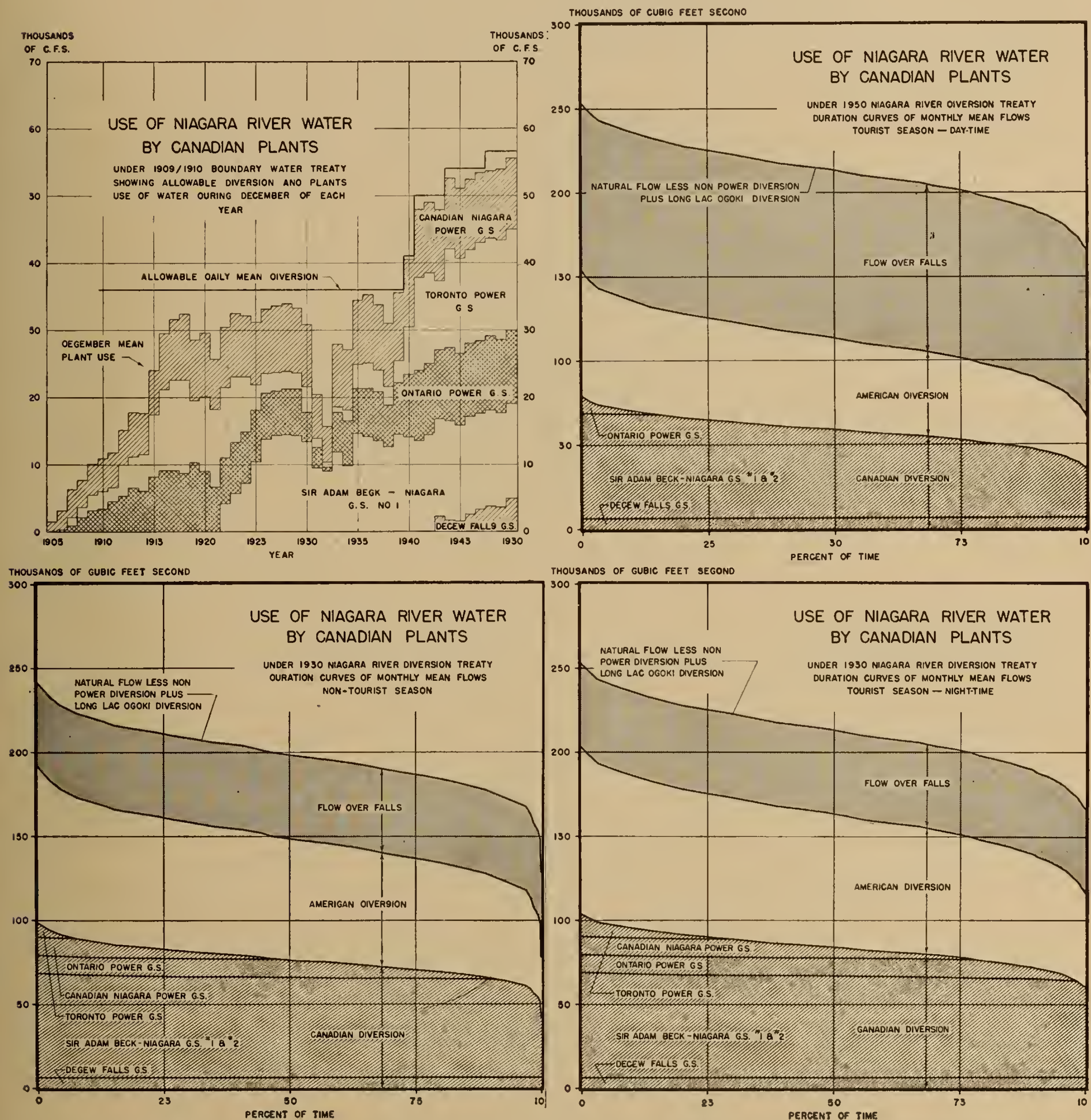
#### Queenston Development

In 1914, Ontario Hydro first considered a power development at Niagara Falls that would use the maximum economical head between Lake Erie and Lake Ontario. As a result of these studies construction of the Queenston-Chippawa Development, now known as Sir Adam Beck-Niagara Generating Station No. 1, was started in 1917. The first units were put into operation in 1922 and the tenth unit in 1930. At the time this plant was built, it was the largest hydro-electric development in existence.

The general scheme of development comprises an intake structure at the junction of the Welland and Niagara Rivers at the town of Chippawa. At this point, water is drawn from the Niagara River through the intake, and into the Welland River whose flow was reversed for four miles.

From this point, a canal was constructed across country on the west side of the city of Niagara Falls and through the township of Stamford to a point on the Niagara escarpment, a mile south of Queenston. The 8½-mile long canal was

**Above: Composite view of the Sir Adam-Beck Niagara Generating Station No. 2 on the left, and the original Sir Adam-Beck No. 1 plant.**
**Below: Interior view of the generating room at the Sir Adam-Beck Niagara No. 1 plant.**




**The upper left graph shows the use of water of the Niagara River by Canadian plants during the period 1905 to 1950 and the allowable diversion under the Boundary Waters Treaty 1909/1910. The amount of water in thousands of c.f.s. used by each plant is shown by the areas below the line identified with the name of the plant.**

**The other diagrams show the monthly mean flow of the Niagara River and the allowable use of this water under the 1950 Niagara Diversion Treaty, during the daytime in the tourist season, during night-time in the tourist season and during the non-tourist season.**

**Table I — Comparison of Various Elements in Plants No. 1 and No. 2**

| | *Sir Adam Beck-Niagara G.S. No. 1* | *Sir Adam Beck-Niagara G.S. No. 2* |
|---|---|---|
| Intake | Open type—Bulk head. Length 630 feet. | 2—slot type. 500 feet long. |
| Waterways | 4 miles of Welland River enlarged and flow reversed. 8½ miles canal through earth and rock. Capacity 16,000 c.f.s. | 2 tunnels—concrete lined 45 ft. finished diameter. 5½ miles long. 2¼ miles of open cut, 185 ft. to 200 ft. wide. Depth of water—approx. 25 ft.-30 ft. Capacity 20,000 cfs. each. |
| Gate House | 550 long. 10 plate steel penstocks. Units 1-5 —16 ft. tapered to —14 ft. diam. 6-10—16 ft. diam. | 16 units—length 880 ft. 16 plate steel penstocks approximately 492 ft. long. 19 ft. diam. |
| Power House | 590 ft. long. 135 ft. wide 10 units—52,500—58,000 hp. Transformers inside. Low and high tension switching in back part of generating station. High tension voltage 130,000. | 1150 ft. long. 63 ft. wide 16 units—105,000 hp. Transformer outside—back of generating station. High voltage switching outside located between forebays of No. 1 and No. 2 stations, on escarpment above power house. Voltage—220,000. |
| Earth Excavation | 13,300,000 cu. yd. | 5,834,000 cu. yd. |
| Rock Excavation | 4,700,000 cu. yd. | 11,417,000 cu. yd. |
| Concrete | 500,000 cu. yd. | 1,907,000 cu. yd. |
| Earth and Rock Removal | Earth and rock removal by electric and steam shovels by means of railway equipment. | Earth and rock removal by means of electric and gas shovels and truck equipment. |
| Time | Time required for construction for first units in operation 4½ years. | Time required for construction first units in operation—3½ years. |
| Total Installed Capacity | 560,000 hp. | 1,680,000 hp., in main generating station; 236,000 hp. in pumping generating station. |
| Maximum Number Employed | Approx. 10,000. | 7,000 |
| Work Week | 6 days. | 5 days |
| Work per shift | 10 hours. | 9.6 hrs. tunnel worker. 8.8 hrs. surface worker. |
| Cost | $76,900,000. | Including pumped storage, estimated at $343,700,000. |

one of the largest hydraulic power canals when constructed, and in its design presented many interesting hydraulic problems.

The units in the power station vary from 52,500 to 58,000 horsepower, and are of the vertical type. At time of installation, they were the largest hydraulic generating units ever constructed. A few years later, however, the Niagara Falls Power Company on the American side put in some 70,000 horsepower units. Power generated in the Queenston plant is sent as far west as Windsor and Sarnia, a distance of 240 miles.

It will be noted, in studying this power station, that the transformer and low-and high-tension switching are all enclosed in the back part of the power station. During the past 32 years since this plant was built, there has been quite a radical change in the switching and transformer layout. These elements of the station now have been placed outside, to eliminate the hazards present with an inside installation.

Further details of this plant may be obtained readily from many earlier publications. It should be noted, however, that in laying out this plant, Ontario Hydro engineers were able to develop it under a gross head of 300 feet out of a possible 326 feet, which is the normal difference in level between Lake Ontario and Lake Erie. The type of turbine and generator setting used in the plant set the pattern that is used today in practically all large hydraulic generating plants.

On the completion of the Queenston-Chippawa Development, further developments in the Niagara River were not possible with the amount of diversion permitted under the 1909 Treaty referred to earlier. It was not until the 1950 Treaty was ratified that Ontario Hydro could start on further development on this famous Niagara River.

**Sir Adam Beck-Niagara G.S. No. 2**

In spite of an all-system expansion program, begun in 1945, Ontario Hydro found itself in a situation where even the completion of the development of Ontario's share of the Ottawa River would not be sufficient to take care of the Province's rapidly growing power demands brought about by the phenomenal industrial expansion and increase in population. In addition, the development of the St. Lawrence was still tied up in red-tape and international political differences, and could not be started in time to supply these growing demands for additional power.

Therefore, the Commission in the Fall of 1950, immediately on ratification of the latest Niagara Treaty, put the wheels in motion for the development of the Sir Adam Beck-Niagara Generating Station No. 2. Work was started in the Fall of 1950 on the preparation of the roads and camps, and actual construction of the development itself was started in the early Spring of 1951.

It is expected that the first unit will be generating power by April 30, 1954, and that five units will be in operation at the end of this year. Six additional units will be in operation in 1955 and another one in January, 1956, making a total of twelve 105,000 horsepower units, or an installed capacity of 1,260,000 horsepower.

When the construction work on this plant was originally laid out, it was planned to install one intake, one tunnel with a capacity of 20,000 c.f.s., an open section of canal which could carry 40,000 c.f.s. or the capacity of two tunnels, and a headworks, penstocks and power works for six units. Work on this initial part of the development proceeded until mid 1952, when it was found that the power demands were growing so rapidly that it was necessary to set our sights higher.

It was decided to construct a second intake, a second tunnel and an additional six units, making twelve units in all. During 1953 the Commission amended the program of work at Sir Adam Beck-Niagara G.S. No. 2 to provide for a pumped storage scheme and later, when required, for four additional generating units.

**Pumped Storage**

A storage reservoir of about 15,000 acre-feet, and adjacent to the forebay, will be created by a dyke and a pump-turbine plant will be built to raise water to the reservoir. The pump-turbine plant will operate as a generating station when water is being discharged from the reservoir, and will have a capability of up to 170,000 kilowatts.

By virtue of this scheme, optimum use will be made of the Sir Adam Beck-Niagara Generating Stations, since the storage reservoir can be filled at night and the impounded water can be used during the daytime by generating units which would otherwise be idle because of increased flows of water over the Falls under terms of the Treaty. The pumped storage is expected to come initially into operation in the Fall of 1956, and to be completed in 1957.

The canal and forebay are now being enlarged and part of the headworks for the four additional units is being constructed. Later the powerhouse will be extended to accommodate the additional units. However, these four units will not be installed until high load-factor resources, such as the St. Lawrence project and thermal power plants, have been developed.

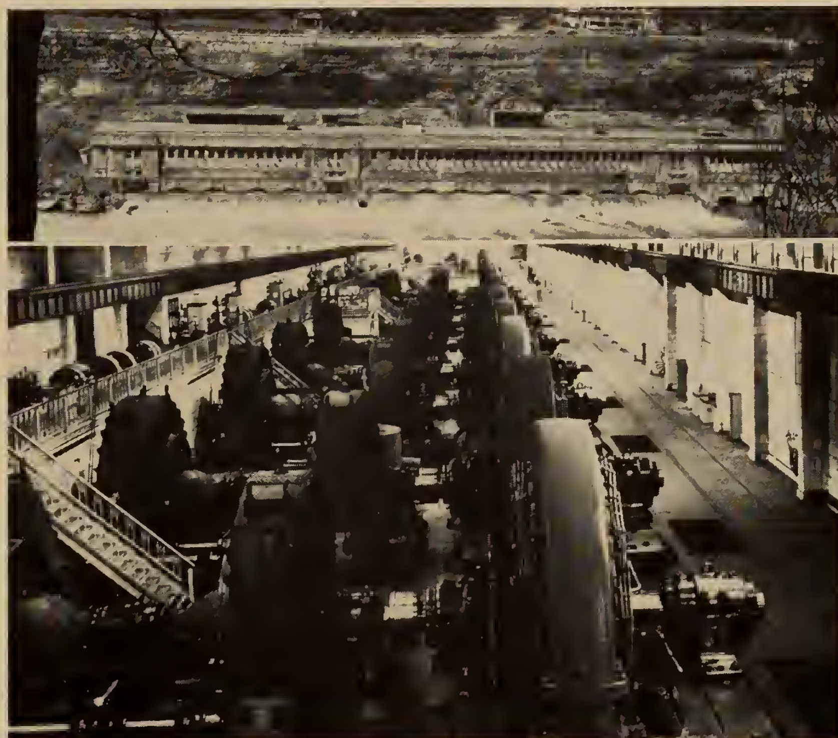
One of the features that made the pumped storage economical in connection with this development at Niagara Falls was the terms of the 1950 treaty that stated in part:

Required Flow over Falls
Tourist Season
April 1st to Sept. 15th—
8 a.m. to 10 p.m. = 100,000 c.f.s.
10 p.m. to 8 a.m. = 50,000 c.f.s.
Sept. 16th to Oct. 31st—
8 a.m. to 8 p.m. = 100,000 c.f.s.
8 p.m. to 8 a.m. = 50,000 c.f.s.
Non-Tourist Season
Nov. 1st to Mar. 31st = 50,000 c.f.s. at all times.

### The Slot-type Intake

There are some interesting engineering aspects in connection with the development of the Sir Adam Beck-Niagara Generating Station No. 2. The type of intake structure used for this development was first developed by the Commission and its Consultants, the late R. D. Johnson and P. Wahlman of New York, at the time the Sir Adam Beck-Niagara Generating Station No. 1 was designed, and was known as the Johnson-Wahlman slot type of intake.

It was an intake developed for the purpose of obtaining a large amount of water from a shallow river, such as the Niagara, at a minimum cost and with the ability to prevent surface ice, a very definite problem in the Niagara River, from entering the water conduits. This type of



Exterior view of the Ontario Power Plant, and an interior view of the generating room.

Above: Exterior view of the Toronto Power Plant.

Below: Generating room in the interior of the Toronto Power Plant.

intake was used by the writer when he was associated with the H. G. Acres & Company, Consulting Engineers, during the period 1925 to 1931.

This company, in collaboration with Messrs. Johnson and Wahlman, designed and supervised the construction of three such intakes: one was at Gordon Creek for the Riordan Paper Company at Temiskaming, Ontario. One was on the Grand River, New Brunswick, on the Grand Falls Development for the International Paper Company, now controlled and operated by the Gatineau Paper Company. The third was at Chelan, Washington, U.S.A. for the Washington Water Power Company on the Chelan River, a tributary of the Columbia River.

Intakes of this type were also constructed by the Shawinigan Water Power Company in Quebec, under the design and license of Mr. Johnson and the Montreal Engineering Company in Nova Scotia. Until the development of the Sir Adam Beck-Niagara Generating Station No. 2, Ontario Hydro had not found a development in which this intake was suitable and economical.

### Control Dam in the Niagara River

Looking ahead, to the full operation of the new plant and the development of the United States side of the River, it has been found necessary to construct a remedial dam in the Niagara River. This will be built just below the two intakes for the Sir Adam Beck-Niagara G.S. No. 2, in order to regulate the variations in the flow as prescribed by the Treaty.

It will also maintain the Grass Island Pool on the Niagara River, above the intakes, at a level that will enable the water to be withdrawn without affecting the levels on the upper stretches of the Niagara River itself. This 1,550-foot long dam consists of thirteen 100 ft. steel submersible gates of the Bascule type.

Another interesting phase of the design of the Sir Adam Beck-Niagara G.S. No. 2, was the twin concrete-lined tunnels, 5½ miles long, under the City of Niagara Falls. These tunnels were excavated at 51 feet diameter, and lined with concrete to a finished diameter of 45 ft.

The tunnels connect to the intake structures on the bank of the Niagara River, and carry the water under the City of Niagara Falls, underneath the canal of Sir Adam Beck-Niagara G.S. No. 1, and come to the surface at the Whirlpool Gorge on the west side of the canal feeding the Sir Adam Beck-Niagara G.S. No. 1. From this point to the forebay of the No. 2 plant, a distance of 2¼ miles, the waterway was constructed in open channel 200 feet wide.

Our studies indicated that the economical location for the power house of the Sir Adam Beck-Niagara G.S. No. 2 was to the south of the No. 1 station. This meant that the open canal for the No. 2 station had to cross the canal for the No. 1 plant approximately 3,000 ft. above the point where the No. 1 canal entered the No. 1 forebay.

Design studies also revealed that it was desirable and economical to operate hydraulically the forebays of both stations at the same operating level. To accomplish this, the two canals cross, and the forebays of the stations are connected through an open channel at the east end of the two forebays, close to the screen house of the two developments.

The design of the intake, the tunnel entrance and exit, the cross-over between the two canals, the cross-over between the two forebays, and the shape and dimensions of forebay No. 2, were finalized by model tests in the hydraulic laboratory constructed by the Commission outside of Toronto, and the hydraulic laboratory of the University of Toronto.

Details of the design of these features will be the subject of several papers that will be prepared by the staff of the Ontario Hydro for future presentation to the Institute.

It may be of interest to make a parallel comparison between these two stations, setting out the main features and the overall quantities of excavation, concrete and other materials used in the two developments. This comparison is shown in Table 1.

### Over 1¼ Billion Dollars Spent Since 1945

The frequency of the Sir Adam Beck-Niagara Generating Station No. 2 will be 60 cycles, while the Sir Adam Beck-Niagara Generating Station No. 1 operates at 25 cycles. With the completion of the major phase of the Niagara project in 1956, The Commission's dependable peak capacity will have been increased by 6,342,900 horsepower, or 144 per cent over the 1945 figure.

On the completion of the No. 2 station, the expansion program of the Commission since 1945, including the generating stations, the transmission lines and the substations necessary to deliver this power to the municipalities and the direct customers, will involve an expenditure of $1,266,000,000. A really formidable sum. This expenditure has been necessary to supply the people of the Province of Ontario with the electrical energy that they require for their industrial expansion, and for the needs of their homes and farms. √

# Transmission Lines from the Canadian Niagara Developments

by

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This paper gives a history of power transmission lines built in Ontario, from the 10,000 volt lines in use at the beginning of the century, to the 230 kv. double circuit lines from the Sir Adam Beck-Niagara G.S. No. 2 development, being built today. The tenfold increase in the designed loads, from 20,000 kw. in 1910, to 200,000 kw. today, shows clearly the advances made in the design of transmission lines over a period of years. The paper was presented before the 68th Annual Meeting of The Engineering Institute of Canada at Quebec City in May, 1954.

The first electrical transmission line in the Niagara area to carry more than 10,000 volts was the 22,500-volt line from DeCew Falls to Hamilton, a distance of about 35 miles.

In 1897, The Cataract Power Company of Hamilton decided to proceed with the development of power at DeCew Falls. The project had been under discussion for years before this date, and the main problem was the transmission of power from DeCew Falls to Hamilton.

This presented a seemingly insurmountable obstacle, as no transmission of energy such a long distance for commercial purposes had been undertaken up to this time. The largest electrical concerns in Europe and America were consulted but the limitations of 10,000-volt transmission precluded undertaking the transmission of power by any of these companies. It is reported that Lord Kelvin advised that power could not be transmitted this great distance.

The power company did not feel warranted in going ahead with the project because of the high cost of transmission at 10,000 volts, and suggested a voltage of 22,000 volts. After about a year of discussion, the company consulted J. A. Kammerer of the Royal Electric Company of Montreal, who agreed to design and build the transformers for a working pressure of 24,000 volts. Power was initially turned on at the DeCew Falls plant on November 12, 1898. The transmission line was 2 phase, 4 wire, at 22,500 volts.

The route of the transmission line was from the powerhouse along a road due north to the Grand Trunk Railway, thence along the railway right-of-way to the substation inside the city limits of Hamilton. The conductors were 4 No. 1 medium hard drawn copper, supported on insulators on a 4-pin crossarm at 18-in. spacing.

"The pins were of a special design, holding the insulator 2 in. higher from the crossarm than standard practice, to avoid trouble from snow and sleet". This is a quotation from *The Electrical News* of December 1898, and shows that even at that early date engineers worked to standards. The pins were fastened to the crossarm with a wooden pin instead of being nailed, so as to use as little iron as possible.

Poles were 8 in. top, 35 ft. long, and the line was graded—that is, the contour of the wires was kept as even as possible by use of different heights of poles. Pole spacing was 90 ft. On the top of the poles was placed a galvanized iron barb wire, grounded at every pole by means of a metal plate for lightning protection. Below the power wires a 2-pin arm was placed, carrying 2 No. 10 galvanized wires for telephone. These wires were transposed at every fifth pole.

Interruptions to the customer received top priority even in these early days, as an incident related by one of the old-time operators indicates. He says, "on one occasion during a violent thunderstorm, lightning struck the transmission line and one of the wires was burnt off, falling on a farmer's wire fence. This completed the circuit and the power company placed a man on guard until repairs could be made, so that there was no interruption to the customer."

In 1905, the Canadian Niagara Power Company was distributing approximately 10,000 horsepower to Fort Erie and Buffalo at 12,000 volts.

### 60,000 Volt Line from Toronto-Niagara Power

In 1906, the Toronto-Niagara Power Company built a double

Fig. 1. T.N.P. power lines — 60,000, 44,000 and 99,000-volt lines.

circuit 60,000-volt pin-type line from Niagara Falls to Toronto, a distance of 75 miles, to carry the power developed by the Electrical Development Company at Niagara Falls. The towers had a base of 12 ft. x 14 ft., and were made up essentially of 2-A frames connected with bracing. Structures were about 46 ft. high, made of galvanized steel bolted together in the field (Fig. 1).

This transmission line crossed Burlington Beach. From the canal crossing to the Burlington shore, a distance of 1 mile, a 4-circuit rivetted tower was erected on the concrete base. These towers, eleven in all, were located on the edge of the lake, actually in the water at that time (Fig. 2).

The towers were 125 ft. high, and in 1952 the heads of the towers were revamped for suspension insulators. This is now part of the important 115-kv. double circuit line between Burlington T.S. and Hamilton Beach T.S., using 605,000 c.m. A.C.S.R. conductor.

This original T.N.P. company line had a standard span of 400 ft. with conductors made up of 6 strands of No. 6 copper on a hemp core. The total conductor was 190,-000 cm. in area. The line was divided into four sections practically equal in length for operating and patrol purposes. At the dividing points division houses were erected.

In each of the three division houses was installed a 60,000-volt lightning arrester, manufactured by a Canadian company. It contained 240 air gaps between brass cylinders, and 60 carborundum rods all in series from line to earth. The complete arrester was mounted on porcelain insulators and was 25 in. wide and 19 ft. long. The conductors were given four complete spirals in each section.

In 1913 a 90,000-volt line using pin-type insulators was built paralleling the original line. About 1928 the 90,000-volt insulators on a section of this line were replaced with a 110,000-volt pin-type insulator, and the line operated at the latter voltage for several years.

The insulator (Fig. 3) is essentially of tandem type with a 60,000-volt standard unit on top. In later years this insulator gave considerable trouble through flashover due to fog and moisture, especially in the early mornings. Its use has since been discontinued.

### New Triangular Tower

In 1906, the Ontario Power Company was distributing power locally and to Welland over 12,000-volt lines. They were also building duplicate 60,000-volt lines from Niagara to Rochester, a distance of 160 miles. This was considered the highest voltage practical at that time. The structures were triangular, the legs were 4½ in. wrought iron pipe with clamp joints. The conductors were 820,000 cm. aluminum slightly over 1 in. in diameter, supported on pin-type insulators weighing about 75 lbs., the largest in the district at that time.

The normal span was 550 ft. This Niagara-Rochester transmission line crossed the Niagara river at a low level just upstream from the site of Sir Adam Beck-Niagara G.S. No. 2 powerhouse. The crossing-span conductors were 2/0 copper. There were two spans per circuit, and they were arranged to operate singly or in parallel.

Upon inspection of the triangular towers shortly after purchase by the Ontario Hydro, it was found that the pipe legs were split in several places, mostly near the base or at obstructions in the pipe, apparently due to frost action. Clamps were

Fig. 2. T. N. P. Co. Towers, Burlington Beach.

installed over the split sections and an attempt was made to fill the pipes with concrete.

The injection of concrete was not very successful, as it was found later to have consolidated in lumps, leaving many sections empty. A close watch was kept on these towers for several seasons. The splitting seemed to have stopped, hence no other repairs were made. In 1921, before this line was re-insulated, the towers were tested and found satisfactory. The head of the tower was re-designed to carry suspension insulators and is operating today.

#### Initial Transmission by Ontario Hydro

From 1906 on, considerable thought was given to the insulation of transmission lines, and the disc insulator was developed, allowing for power transmission at higher voltages. At this time Ontario Hydro undertook to transmit power from Niagara Falls to Toronto, a distance of 88 miles, and around the "North Loop" to Kitchener (Berlin).

Berlin being the first municipality to receive hydro power, it was decided to build a 110,000-volt,

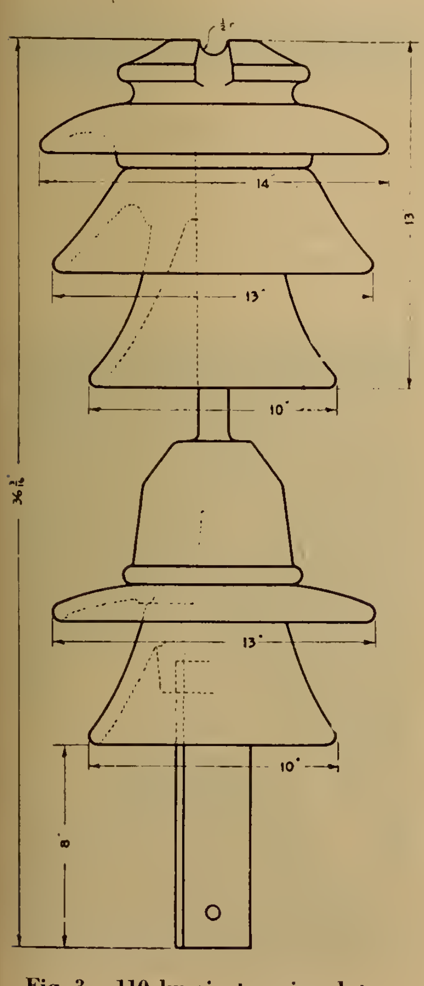

Fig. 3. 110-kv pin type insulator.

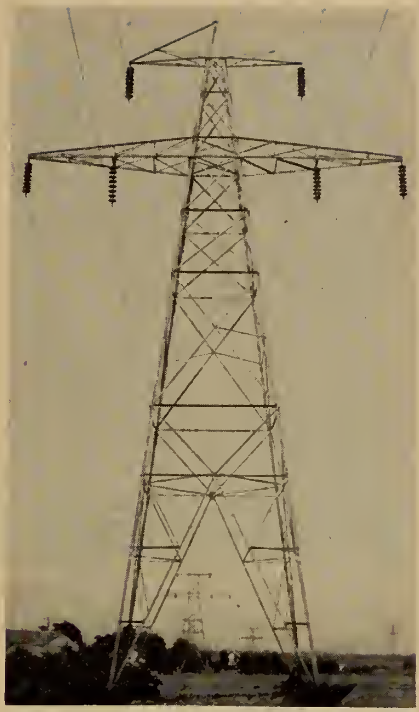

Fig. 4. McGuigan type 110-kv tower.

double circuit transmission line using disc insulators. At that time this system of lines, covering 250 miles, had the highest transmission voltage on the North American continent.

The tower was known as the "McGuigan" type (Fig. 4). The engineers were very conscious of lightning troubles and the tower, as originally designed, carried its conductors in triangular configuration. It had 5 ground wires, 3 on the top arm like an umbrella, and 2 on the second arm between the phases (Fig. 5).

It was soon found that these ground wires were more of a hazard than protection. The light conductors which were 4/0 and 3/0 aluminum, later changed to A.C.S.R. conductors, would blow into the ground wires, which were much heavier. This caused numerous outages and the ground wires were progressively eliminated, until one remained at the peak of the tower.

The insulator strings were made up of a series of eight discs. These were obtained in Germany and the U.S.A. These insulators operated satisfactorily until 1913. In May and June of that year numerous outages occurred, and the climax was reached one hot day in July when it was impossible to find 3 phases out of the 6 that would carry power.

As telephone lines were inoperative, it was necessary to get clearance, etc. over the Grand Trunk telegraph facilities, which were often a considerable distance from the transmission lines. All the staff was sent out on patrols to spot broken insulators. The first objective was to find 4 good discs in a string, since they would permit the line to operate. The insulators were subsequently replaced as soon as more modern types could be obtained.

The conductors on these lines were changed to 312,000 cm. A.C.-S.R. and 336,400 cm. A.C.S.R. in 1918. The joints at that time were made with twisted sleeves. In 1941, the original line from Niagara Falls to Dundas was removed. The towers were sold for scrap to help the war effort, and the conductors were used on a wood pole line to the Steep Rock Iron Mines in Northwestern Ontario. These conductors are still in use.

In 1915, the circuit from Niagara to Toronto was reinforced by the erection of another double circuit 110-kv. line, using a different type of tower (Fig. 6). This tower, known as the "AA" type (shown on the right) has the conductors in practically vertical configuration.

The conductors on this line from Niagara Falls to Dundas were 4/0 copper, strung at a maximum tension of 5,000 lbs. From Dundas to Toronto 6/0 copper conductors were specified, but copper was not available and the towers stood idle from 1915 to the end of World War I. In 1919, as the loads had increased considerably, it was decided to string 500,000 c.m. A.C.S.R. on these towers, the sags and tensions being adjusted to fit the spans.

#### Power from First Development at Queenston

In the period 1920-22, during the construction of the Queenston development, Ontario Hydro built several circuits, all 110-kv., to distribute

Fig. 5. Conductors swing in the wind.

the power generated at the development now known as Sir Adam Beck-Niagara G.S. No. 1. The first 110-kv. line connected the Queenston plant to the Hydro system at Niagara transformer station. This is a short tie-line through Niagara Falls, following the route of the 60-kv. Niagara-Lockport lines (Fig. 6). The tower was similar in design to the lines built in 1915, having a span of 550 ft. and conductors of 500,000 cm. A.C.S.R.

About this time transmission engineers were very conscious of a phenomena occurring when power conductors became coated with ice, causing the conductors to whip or "gallop" at certain periods. In many cases the loops would travel as much as 20 ft. vertically, and observers stated that one phase would be "galloping" and the others quiescent, or that all could be "galloping" at different periods of oscillation.

**Fig. 6. 60,000-volt line of O.P. Co. and 110,000-volt H.E.P.C.**

Hence, in the design of future circuits from this plant, the middle arm was given a 4 ft. off-set in an attempt to allow the conductors to pass one another when "galloping". The design and manufacture of insulators and hardware had progressed to such a degree that it was decided to increase span lengths, thereby obtaining a more economical transmission line.

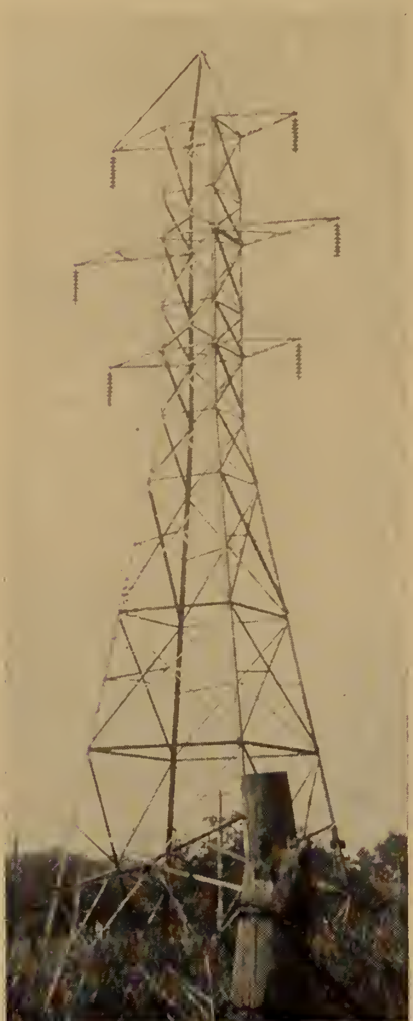

**Fig. 7. 1920 type tower.**

The "1920" type tower was developed (Fig. 7) with standard span length of 880 ft. and a conductor of 605,000 cm. A.C.S.R., under a maximum tension of 8,000 lbs. The normal load carried for this circuit was 50,000 kw.

The joints in the conductor were of the old type compressed joints, screwed together in the centre, the steel core being joined by the use of a twisted sleeve. Some of these joints have been removed but the majority are still in service.

#### Improved Clamps

As the spans were lengthened and the tension in the conductors raised, a satisfactory dead-end clamp became a problem. There were several designs on the market, most of which required the snubbing of the steel core separately. This meant the steel core would have to be removed from a certain portion of the conductor, snubbed around a snubbing post and the aluminum joined in the loops by use of parallel groove clamps or other connectors.

As difficulties had been experienced with parallel groove clamps and connectors, it was thought there would be a great advantage in having a clamp which did not require cutting the conductors at the dead-end towers. A long steel clamp was developed, with set screws on top (Fig. 8), which would develop the required tension with-

**Fig. 8. Steel dead-end clamp.**

**Fig. 9. Aluminum dead-end body.**

out snubbing the steel core, thus allowing the conductors to be continuous through the loop.

After a few years of service it was found that the conductors at the end of the clamp crystallized, and strands broke due to conductor fatigue caused by aeolian vibration. These dead-end clamps were later replaced by aluminum compression dead-end bodies, which had been developed in the interim (Fig. 9).

Over a period of years, vibration dampers had been investigated by various companies and others, but it was not until 1940, when Ontario Hydro's Research Laboratory developed the dumbbell dampers, that they were first erected on the Queenston line.

In 1929, a double circuit 110-kv. line from Queenston to St. Thomas was erected to take care of the load increase in the western section of the province. This line was designed for 1,056 ft. spans, using 605,000 c.m. A.C.S.R. conductors.

In general, it was the "1920" type tower, with an extension on the bottom to take care of the increased sag in the conductors, the tensions remaining as before at 8,000 lbs. It was found, however, that the head of this tower was not satisfactory for such long spans, consequently modern design provides more generous clearances for "galloping", etc., while retaining the same span length.

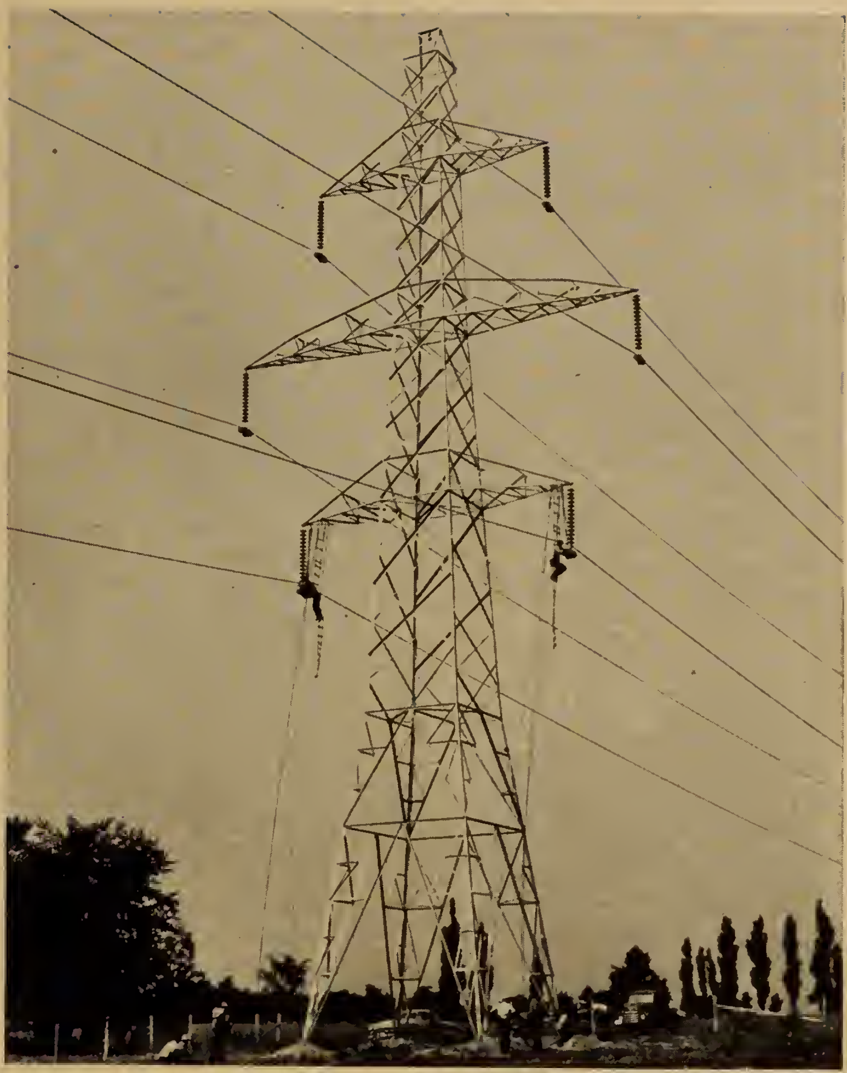

Fig. 10. 230-kv. double circuit tower.

**230,000 Volt Line from Sir Adam Beck-Niagara G.S. No. 2**

The transmission lines constructed from the Sir Adam Beck-Niagara G.S. No. 2 development will be operated at 230-kv. on double circuit towers. Five circuits will be presently erected, with an ultimate of seven. The power will be delivered by overhead lines from the powerhouse at river level to a switching structure on top, where the transmission lines will originate.

At present 3 double-circuit tower lines are under construction on a common right-of-way extending westwards from the switching station. The structures are spaced 111 ft. laterally near the plant due to congested right-of-way, and the spans decreased accordingly. The latter also gives greater ground clearances for roads crossing the right-of-way. The standard spacing is 125 ft. in open country with 1,000 ft. spans. The transmission lines extend to existing terminal stations, where the power is absorbed in the 115-kv. and 230-kv. network.

The conductors previously used on our 230-kv. lines had been standardized at 795,000 c.m. A.C.S.R. Due to the multiplicity of lines from this plant a study was made to arrive at an economical conductor size. It was found that by enlarging the conductors to 1,192,500 c.m. A.C.S.R. one circuit could be eliminated, the saving in losses paying carrying charges on the extra capital cost and also improving the voltage regulation. The larger conductors were specified, the normal load being of the order of 200,000 kw. The maximum conductor tension is 15,000 lbs. with a loading of ½ in. of ice and 8 lbs. of wind on the conductors.

The towers used on four of these circuits are similar to the 275-kv. line of the British grid (Fig. 10), with a slight revision in weight due to the extension of the middle arm to allow for movement of conductors under sleet conditions. The towers were designed and manufactured in England.

Whereas towers in this country are ordinarily made up of structural variety carbon steel (CSA Spec. G.40.4), these towers contain about 40 per cent of high tensile steel, thereby reducing the over-all weight by a considerable amount. The structure was designed for concrete footings, which have been slightly modified to fit our conditions. Footing resistances have been reduced below 25 ohms by the driving of ground rods in the bottom of the excavation, the ground rod being connected to the tower leg by a copper conductor.

It is interesting to note the design loads of the various transmission lines. The lines built in 1910 were designed to carry about 20,000 kw., the 1922 lines 50,000 kw.; and the 1953 lines 200,000 kw., or a tenfold increase, thus showing clearly the advances made in the design of transmission lines over a period of years.

# Discussion

**H. F. Beique, M.E.I.C.**[1]

I was particularly interested in noting that as far back as 1898, standards were already established in the electrical industry.

The establishment of these standards so far back has certainly not prevented progress in the industry. This is an excellent answer to those who nowadays oppose the establishment of standards on the grounds that they may delay progress.

Mr. Sproule has shown, I think, that a good many of the original transmission lines built in the early days are still useful; most of them have been modified, and the very early ones have become, in nearly every case, part of the distribution system.

The one transmission line device of the early days that did not seem to perform as well as the supports and the conductors, was the insulator. It is a fact that insulators on nearly all early transmission lines had to be replaced at one time or other due to weaknesses. We, of the electrical industry, should be grateful to the manufacturers for having fully overcome this very serious shortcoming.

The three double circuit tower lines issuing from the Sir Adam Beck No. 2 Station and now under construction, are quite modern in their design.

The conductors of 1,192,500-cir. mil. are certainly unusual in size. The use of high tensile steel to the amount of 40 per cent in these towers, to reduce overall weight, is certainly something quite new in this country. It will be interesting to watch the effect of strain and low temperatures on these members.

I imagine that this type of steel has been used in Europe under conditions corresponding to those met here.

While listening to Mr. Sproule's description of the evolution of transmission methods in Ontario, I could not refrain from recalling parallel developments in the Province of Quebec. The speaker will forgive me for bringing them out as he still has, I am sure, much interest in this province where he has built so many transmission lines.

Here in Quebec City, Mgr. Laflamme, professor of physics at the Séminaire de Québec, had been conducting electrical experiments since 1875. He managed to generate electricity by means of a steam engine and an Edison dynamo in Delisle's printing shop, located where to-day we see Laval's Monument, opposite the Post Office, just outside this building. He had copper wires strung from this shop to the University Promotion Hall and during a conference on March 1, 1884, he demonstrated the superiority of electric lighting over gas lighting which was then in use. This experiment proved also the feasibility of transporting this electric energy at some distance, and to the audience filling the hall, he predicted the hydraulic future of Montmorency and Chaudiere Falls.

As can be seen, Quebec was not far behind since the first hydro electric station in North America was installed in Appleton, Wisconsin, in the year 1882.

This very same year in which Mgr. Laflamme demonstrated the electric light, Quebec streets were lighted by means of arc lamps fed from steam units located in the Military Barracks, near St. John's Gate.

The following year, the first development at Montmorency Falls was started and in October 1887, electric energy was transmitted to Quebec for street arc lighting. In 1889, two 100-kva. generators of 1,000 volts, 130 cycles, single phase, were installed and power transmitted direct to Quebec City to light Quebec homes at 52 volts.

From 1893 to 1895, a new power house was built (to-day's location) and three 500-kw., 5,500-volt, 2-phase, generators were installed. They marked the start of 24-hour service. This was, at the time, the highest generating voltage on the continent.

In 1895 also, there was energized between St. Narcisse Power House and the City of Three Rivers, the first high voltage transmission line in Canada and in the British Empire. This line was 17 miles in length, carried a total of 1,200 h.p., at a voltage of 11,000 volts. It is from the copper conductor of this line that the CEA resuscitation medals are made.

In 1903, two transmission lines, 86 miles in length operating at a voltage of 50,000 volts were placed in service between Shawinigan Falls and Montreal, this distance and voltage being the highest in North America at the time.

Throughout this period, electrical engineers in Canada, the United States and many other countries, have been from the very start pushing back the frontiers of knowledge and creating new achievements on this vital problem of transmitting electrical energy from the generating plant to the user of electricity.

This is still true to-day. As we have seen from Mr. Sproule's remarks, new things are constantly being tried. Another good example of this, is the Bersimis project.

Great strides are being made in Europe, particularly so in Sweden, and there is no reason why this will not go on as long as our civilization is in progress.

Quebec province, being particularly gifted with hydro electric sites, is vitally interested in the problems of transmission due to the remoteness of the remaining sites. In the Province of Ontario, it is reasonable to believe that 220 kv. will be sufficient for many years, whereas here, already in the fall of 1956, the Bersimis lines will be put into service at 287 kv.

There seems to be no doubt that in all probability, we will see transmission lines at still higher voltages within many years.

Following the frequency change from 25 to 60 cycles in Ontario, one can well imagine that their high-voltage network system will be solidly interconnected with the one existing in this province, thus giving a power pool extending from Detroit on the Great Lakes to Bersimis and Gaspe on the Lower St. Lawrence; no doubt, to become one of the world's outstanding achievements towards the reliability and cheapness of electric power.

[1]General Superintendent, Power Division, Quebec Power Company.

**A. S. Runciman**[2]

It is interesting to note that poles were protected from lightning and power follow-up by galvanized iron barbed wire on the earliest constructed long lines. Pole grounding was adopted early by the Shawinigan Water and Power Company. The only alterations over the years have been the introduction of a tube in the ground lead which sets up hot air pressure when a flash occurs which assists in reducing the amount of follow-up current, even at times putting the arc to ground out without clearing the line. Some 18,000 of these tube grounded poles are in service—at the present time with no

[2]Consultant Engineer for Communication and Transmission Division, The Shawinigan Water and Power Company.

*(Continued on page 956)*

# Testing of Columns with Uniformly Distributed Transverse Loads

*by*

Paul C. Paris

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**Theory of the Column Formula**

In the "theory of strength" the column problem has been attacked from many angles. For the most part the formulas derived and the theories expounded have been of little value to the design engineer. The beam-column, i.e., a column carrying transverse as well as axial loads, responds even less easily to mathematical treatment. In the field of design, various codes have set up empirical formulas, which the average engineer generally uses.

In March, 1941, *The Engineering Journal* published a paper entitled "Columns Subjected to Uniformly Distributed Transverse Loads," by Prof. J. A. Van den Broek, of the University of Michigan. This paper presents a simple, rational approach to the problem and establishes a highly practical design formula, based on the assumption that a column with uniformly distributed transverse loads has an elastic curve closely approximating a sine curve.

If $L$ is the length of the column, $\Delta$ is the transverse deflection at the centre, and the other symbols have the values assigned to them in Table I:

$$y = -\Delta \sin\frac{\pi x}{L} \quad . \quad . \quad . \quad . \quad . \quad (1)$$

Thus the moment:

$$M = P\left(\Delta \sin\frac{\pi x}{L}\right) + \frac{kwL}{2}x - \frac{kw}{2}x^2 \quad . \quad . \quad . \quad (2)$$

By elastic energy:

> In March, 1941, we published Columns Subject to Uniformly Distributed Transverse Loads, by Prof. J. A. Van den Broek, of the University of Michigan, in which the author derived a formula for such columns from purely theoretical considerations. In this paper, Mr. Paris describes experimental work which he has carried out and which proves that Prof. Van den Broek's formula is correct, and suggests means whereby it can be used in cases where the transverse loads are not uniformly distributed.

$$F\Delta = \int \frac{m\,M\,ds}{EI} \quad . \quad . \quad . \quad . \quad (3)$$

or

$$\left(EI - \frac{PL^2}{\pi^2}\right)\Delta = \frac{5}{384}kwL^4 \quad (4)$$

and the bending stress at the centre:

$$S = Ec\left(\frac{d^2y}{dx^2}\right) max. \quad . \quad . \quad . \quad . \quad (5)$$

$$= \frac{Ec\pi^2\Delta}{L^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

with the elastic-limit stress at the centre:

$$S_1 = \frac{Ec\,\pi^2\,\Delta}{L^2} + \frac{P_1}{A} \quad . \quad . \quad . \quad (7)$$

Solving (4) and (7) for $P = P_l$ when $S = S_l$; and eliminating $\Delta$

$$P_1 = \frac{1}{2}\left[S_1A + P_{cr} - \sqrt{(S_1A - P_{cr})^2 + 5.0734\,kwEcA}\right] \quad . \quad . \quad . \quad . \quad . \quad (8)$$

which is Van den Broek's "Formula II".

From Formula II it is evident that, given the dimensions of the member, the properties of the material, and the transverse loading, the limit-elastic axial load may be easily computed.

**Table I: Symbols**

| | |
|---|---|
| $A$ | Cross-sectional area of the column. |
| $a$ | Distance from the pin end of the column to a concentrated transverse load. |
| $c$ | Distance from the centroidal axis to the extreme fiber of the cross section. |
| $E$ | Modulus of elasticity. |
| $e$ | Maximum strain, at the centre of the specimen. |
| $I$ | Moment of inertia. |
| $i$ | Radius of gyration. |
| $kw$ | Uniformly distributed transverse load. |
| $L$ | Length of column. |
| $M$ | Bending moment. |
| $P$ | Axial load. |
| $P_1$ | Axial load, in addition to transverse load, which induces elastic limit stress, $S_1$, in column. |
| $P_{cr}$ | Euler's load $P_{cr} = \frac{\pi^2 EI}{L^2}$ |
| $Q$ | A concentrated transverse load. |
| $Q_y$ | The maximum $Q$ that a column will support elastically with no axial load. |

$r$ Radius of the cylindrical heads.

$S_1$ Elastic limit stress in compression.

$x$ Co-ordinate length parallel to the length of a specimen.

$y$ Ordinate length transverse to the specimen.

$a$ $Q/Q_y$.

$\Delta$ Transverse deflection at the centre of the column.

Comparison with other methods of design with comparable accuracy shows the applicability of (8). The classical differential equations method yields a solution containing transcendental terms which must be solved by trial and error. Thus, ease of computation proves (8) to be readily applicable to design.

### Testing Theory

To obtain accuracy in testing, the rule to bear in mind is, in essence "simplicity". The most difficult problem in the testing of a beam column is to achieve simplicity in the loading apparatus. Second in difficulty is the problem of gauging.

Application of a uniformly distributed transverse load in unit form presented so many complications that the author rejected it and resorted to the device of applying two concentrated loads to achieve the same end. The axial loading was attained directly by mounting the ends of the specimen in hemi-cylinders (Fig. 1). By allowing accurately machined cylinders to roll freely on carefully ground, parallel surface plates, the axial load may be applied by moving the plates toward one another; the fact that no eccentricity is introduced when the cylinders roll is the outstanding characteristic of this method. This idea stems directly from the work of Van den Broek and his use of hemi-spherical heads for column testing. (See the "Evaluation of Aeroplane Metals", *Engineering Journal*, July, 1945.)

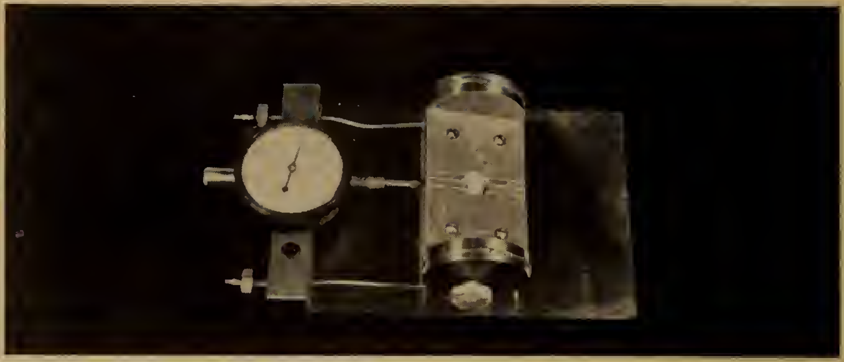

Fig. 1. Cylindrical test head used to attain a "pin-ended column" condition. Note cables used to transmit the reactions of the transverse loads.

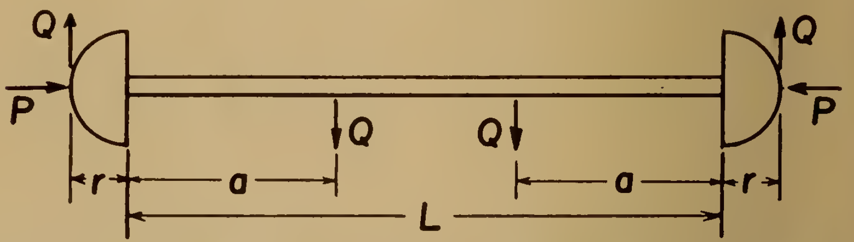


Fig. 2. Loading condition used to simulate a pin-ended column with uniformly distributed transverse loading.

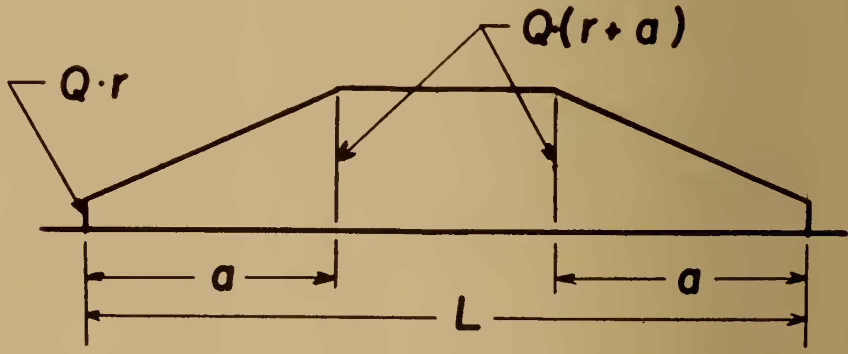


Fig. 3. Moment diagram for the transverse loading used in the tests.

#### *Application of transverse loading*

Since a uniformly distributed transverse load is symmetrical about the centre of the column, the two concentrated loads should be equal and be placed equidistant from their respective ends of the specimen. Applying these loads causes equal and opposite reactions between the heads and surface plates (Fig. 2).

There are two independent variables to consider in the application of this loading to a specimen. These variables are the load, $Q$, and the distance $a$. Having two variables, it is possible to satisfy two conditions. The conditions chosen were: (1) the moment at the centre should be the same as the moment of the simulated uniformly distributed load, and (2) the deflection at the centre should likewise be the same as the deflection produced by the simulated loading. The reason for this choice is that the centre is the cross section of attainment of elastic limit stress. The moment and the deflection at the centre are the controlling factors in this stress.

#### *Computing the values of a to be used*

Setting the moments at the centre of the beam equal:

$$M = Q(r + a) = \frac{kwL^2}{8} \quad . \quad . \quad (9)$$

or

$$Q = \frac{kwL^2}{8(r + a)} \quad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

Setting the deflections equal:

$$\Delta = \frac{Q}{EI}\left[\frac{rL^2}{8} + \frac{L^2a}{8} - \frac{a^3}{6}\right]$$

$$= \frac{5}{384}\frac{kwL^4}{EI} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (11)$$

Substituting (10) into (11):

$$\frac{5}{384}\frac{kwL^4}{EI} = \frac{kwL^2}{8(a+r)EI}\left[\frac{rL^2}{8} + \frac{L^2a}{8} - \frac{a^3}{6}\right] \quad . \; . \; . \quad (12)$$

Solving (12) in terms of $a$ and $L$:

$$a^3 - \frac{L^2}{8}a - \frac{L^2}{8}r = 0 \quad . \; . \quad (13)$$

Given the length of the specimen and using a radius of one inch in the cylinders, $a$ can be computed for that length from (13). Knowing $a$ the proper load, $Q$, can then be computed from (10).

If one compares the properties of this loading with uniform loading, an elastic curve diagram shows the difference between the two elastic curves to be inconsiderable. Since the elastic curve for this loading is a good approximation and the moment and the deflection at the centre are defined to be exactly the same as in the case of a uniformly distributed transverse loading, a simple approximation of a complex loading has been successfully attained.

### *Gauging*

Little gauging was actually necessary to get the required data. The necessary requirements are fulfilled by knowing:

(a) The geometry of the system.
(b) The loads, transverse and axial.
(c) The stress at the centre of the specimen on the compression side.

These points are best brought out in the general procedure of running a test on a specimen. The transverse loads are applied first to simulate a particular uniformly distributed transverse load. Then the axial load is applied and increased until the stress at the centre of the column reaches the elastic limit stress. The axial load is then read, as it is the value, $P$, for the corresponding value, $kw$, in (8). By this method the author has tested a series of specimens of various lengths in order to check the Van den Broek beam-column formula. Thus, in the following data, the most accurately and most carefully found values will be those which are directly connected with this procedure.

The only other data included in this report are the transverse deflections of the centre of the column. The important point is that knowing this quantity and the loads, the stress at the centre of the column may be computed and used as a check on the strain indicator readings. The data may also be used to check the restraint in the testing heads. Neither of the computations has as yet seemed necessary, so they have been left out of this paper.

### Procedural Methods and Equipment

For the most part, the equipment used in tests on beam-columns must necessarily be somewhat specialized. The author was thus faced with the problem of building the necessary equipment. The choice of equipment was limited by many factors, so that accurate data might be gathered over a great range of lengths of specimens. The equipment chosen also defines the possible procedural methods of testing. Consequently, many ideas aiming at ease in construction were rejected in favour of those which attained simplicity in the procedure of testing.

The heads and surface plates were given first consideration in equipment design. Since the specimens to be tested were 5/16-inch square bar stock varying from 5 inches to 18 inches ($L/i = 55$ to 200) in length, the hemi-cylindrical heads were built from 2-inch diameter cold-rolled steel. The determining factors in this choice stemmed from a desire to avoid errors in axial load due to the weight of the upper head, approximately 2 pounds, and to provide for a rational solution of the equation involving $a$, $L$ and $r$. It should be noted in (13) that if $r$ is relatively large and $L$ becomes sufficiently small, the values of $a$ become imaginary. $2a$ must be less than or equal to $L$, and $a$ greater than zero to have a physically possible system. The length of the head cylinders was chosen at 4 inches in order that, under the highest axial loads (3,900 pounds), the deformation in the heads would be small enough to allow the heads to roll freely. As a further aid to freedom in rolling, the heads and surface plates were ground to within a ± .0002-inch tolerance. The 4-inch length of the heads was also sufficient to aid in ease of their alignment on the surface plates.

Next, the balancing of the transverse loads between the heads and surface plates was considered. It was decided to use 1/16-inch aircraft cables stretched between the end block on the surface plates to the heads. A groove was cut in the heads so that the cable could lie between the heads and the surface plates without impairing the rolling freedom of the heads. This feature made it possible to apply the transverse loads without applying any axial load, an important point in getting correct zeros during testing. A total of four of these cables was used, one to each end of each of the heads (Fig. 1).

The upper surface plate was then bolted to the machine and shimmed so that the ground surfaces of the plates were parallel. The bottom was not firmly attached, but fastened in place with one peg. This peg was ample to support the shear between the surface plate and the machine, but left the plate free to rotate. This arrangement eliminated the possibility of torsion in the specimens during tests. A slot 1/2-inch deep and exactly 5/16-inch wide was milled lengthwise in the centre of the head. Jaws were mounted in this slot which held the specimens in place. This proved a satisfactory arrangement. The jaws held the specimen from buckling sideways and the slot insured against eccentricities in the axial loads. The heads functioned properly throughout the tests. The only possible criticism is that the cables stretched slightly upon application of the transverse loads.

The next problem faced was the application of the transverse loads. Through a simple pair of clamps, using pointed thumb screws for bearing surfaces, the load was applied to points on the specimen which were centre punched to insure against slippage. These punch marks were on the longitudinal centre line of the specimen at a distance $a$ from each end. Cables were attached to the clamps and were run over ball-bearing sheaves. Calibrated weights were applied thereon to produce any desired transverse loading (Fig. 4). This rig functioned properly throughout the tests; errors due to it were found to be negligible.

An SR-4 strain gauge was used to measure the strain at the centre of the specimen (Fig. 5). This type of gauge proved its worth in convenience and accuracy of operation. Dial gauges, reading to 0.001-inch, were used to measure the transverse deflections and roll of the heads. A 0.0001-inch dial gauge was used to measure axial deflections. These dial gauges proved to be of insufficient reliability to warrant their use for anything but a rough check of other data.

### *General Procedure*

1. The specimens were placed on a surface plate to be checked for direction of buckling, due to initial curvature. This prediction of buckling direction aided in making the test with zero transverse loads,

because, in order to check the maximum compressive strain and have the dial gauges function correctly, the column had to buckle away from the gauges. In all specimens this buckling was correctly predetermined.

2. After applying the strain gauge and making the punch marks, the specimen was placed in the heads and aligned. This aligning included a three-dimensional check of all parts directly connected to the specimen. An axial load of approximately 500 pounds was then applied to insure the proper seating of the specimen in the head.

3. The loading crosshead of the testing machine was then raised so that the axial load was assuredly zero and the zero strain reading was taken. Axial load was then applied until it was just indicated by the movement of the SR-4 strain gauge. At this point all gauges were set at zero. The transverse loads were then added and the loading scale of the testing machine set at zero to account for them.

4. Axial load was then applied until the elastic limit stress was attained. At this time all gauges and loads were read and recorded.

5. All loads were removed and all gauges were again read to check the zeros.

This completed the test run for a single point shown on Fig. 6.

**Data**

The purpose in the taking of these data was to check the Van den Broek beam-column formula. For this one would need data over a large range of $L/i$ values and for a representative number of transverse loadings for each $L/i$ chosen. Also preferable would be the choice of some parameter such that these points would form curves on an axial load *vs* $L/i$ plot.

If $Q_y$ is the maximum transverse load which a single specimen can carry with zero axial load, and $Q$ is the transverse load to be applied, then let $\alpha$ be defined as the ratio of the two, or $Q/Q_y$. As an example, for a specimen 10 inches long, the maximum allowable transverse load was found to be 39.35 pounds, or $Q_y = 39.35$. Now, to choose the transverse loads to be applied to the specimen:

$$\text{If } \alpha = \frac{Q}{Q_y} = \frac{Q}{39.35} \quad \ldots\ldots \quad (14)$$

$$\text{Then } Q = 39.35\,\alpha \quad (\alpha = 0, \tfrac{1}{4}, \tfrac{1}{2}, \tfrac{3}{4}, 1) \quad . \quad (15)$$

These values of $\alpha$ were chosen to give a representative spread of points.

Equation (15) can now be solved for the five values of $Q$ at which the specimen should be tested. Using these same representative $\alpha$'s in the computation of the $Q$'s to be used for each specimen, one finds each $\alpha$ value defines a curve on an axial load *vs* $L/i$ plot. This was the method used in plotting Fig. 6.

***The $\alpha = 0$ curve, or $P_{cr}$ values***

In the checking of the Van den Broek beam-column formula one is actually interested in checking this formula for values of $\alpha$ not zero. In setting up the test method used, a positive check on geometric values and equipment would be advantageous. In this experiment this is

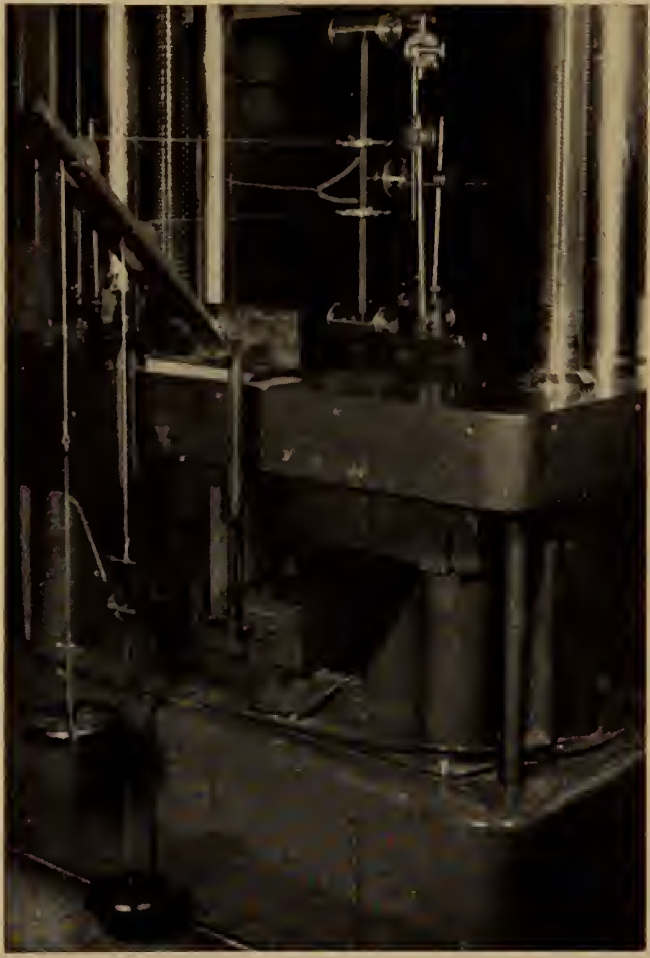

**Fig. 4. View of the test set-up showing the dead weight application of transverse loads.**

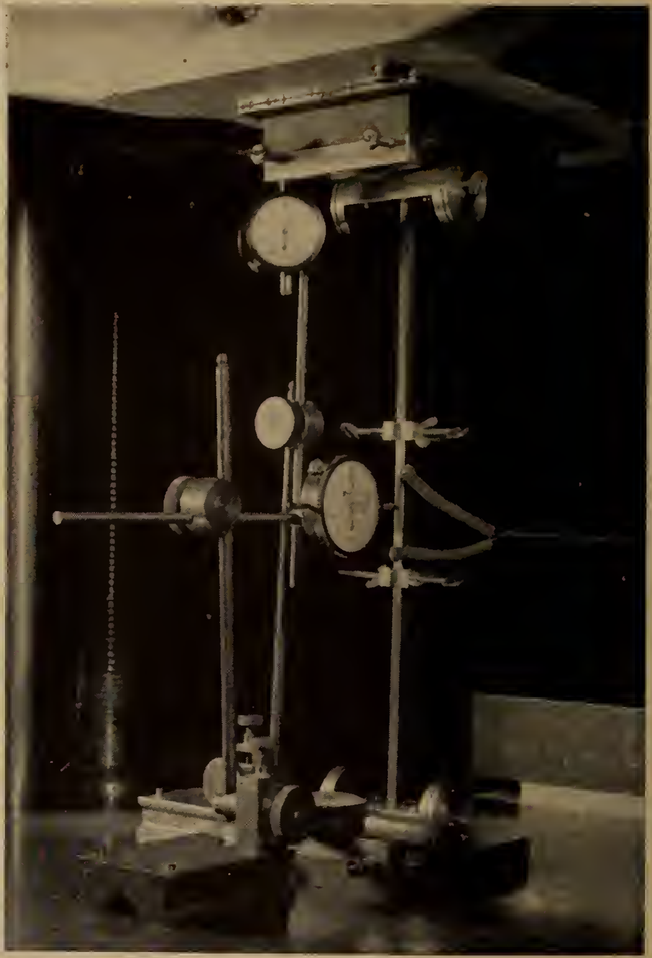

**Fig. 5. Specimen, heads, and gauging, ready to run a test.**

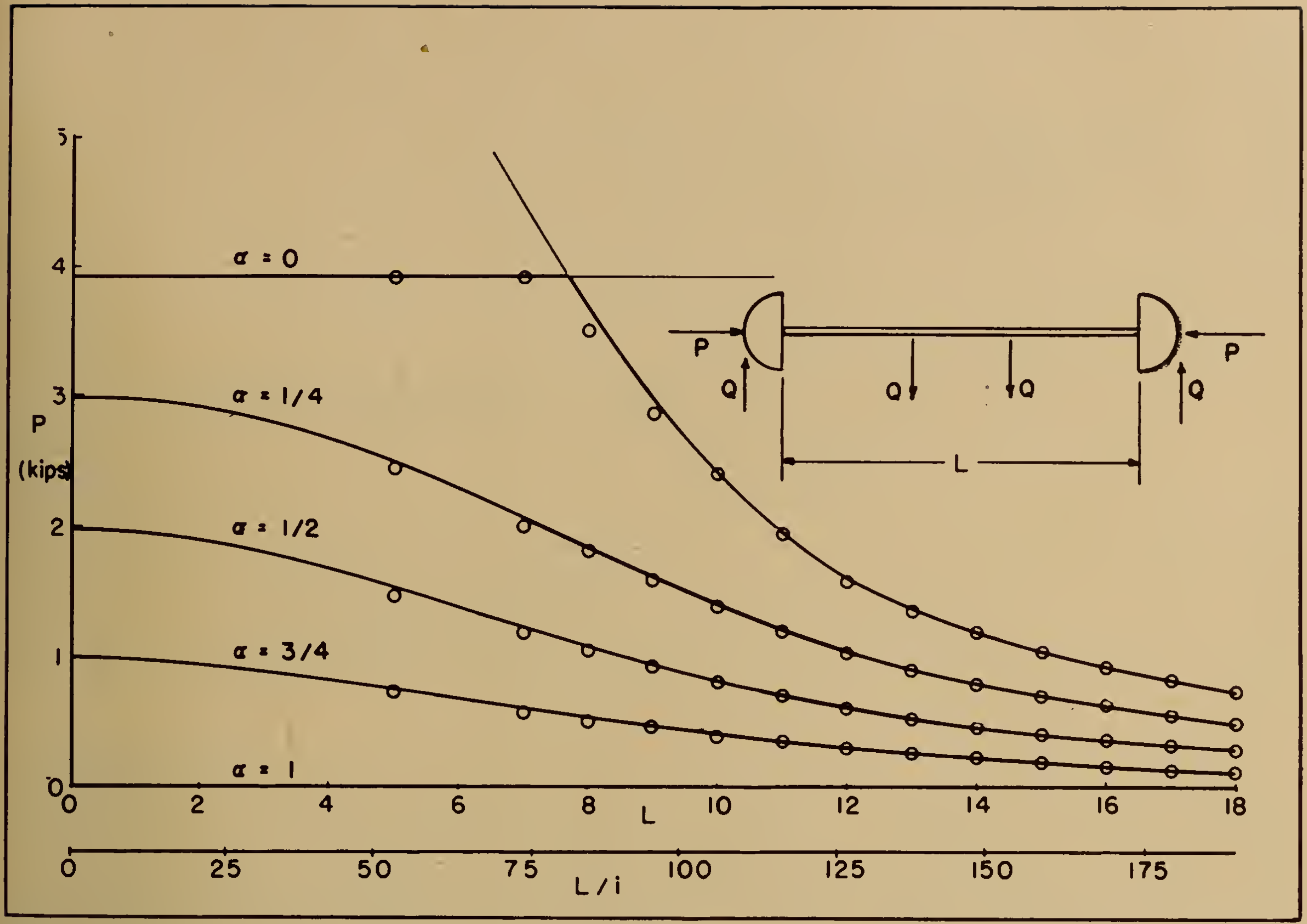


**Fig. 6.** **Beam-column curves (theoretical curves and experimental points) on 5/16″ sq. steel bars. Test data plotted to show close correlation with Van den Broek's formula. Note comparison with Euler's curve (α—0) as an indication of the attainment of pin ends and alignment.**

possible by merely checking each specimen for maximum axial load at $a = 0$, i.e., at no transverse loading. It can be readily seen that since Euler's loads, or the crushing loads, are the most critical values attainable in column tests, the errors in the maximum axial load attainable for any one specimen would be greater at $a = 0$ than for any other value of $a$. Thus, for any specimen one may check the maximum error due to a crooked specimen or alignment errors simply by looking at $a = 0$ in Fig. 6. The theoretical values of this point have already been well established as proven theory. These points have been included in the plot for this reason and show a good and simple check of the set-up used.

### Discussion of Errors

#### *Theory*

The Van den Broek beam-column formula has been shown to be in error only so much as the assumption of a sinusoidal elastic curve contributes to error. This error is shown to be negligible in Van den Broek's discussion of errors in his paper in *The Engineering Journal* of March, 1941. The purpose of this paper is to show it to be negligible by experimental data. Yet, Fig. 6 shows small errors between theoretical and experimental values from $L/i = 55$ to $L/i = 115$.

It may be noted that as the $L/i$ values become smaller, the error increases. As the length becomes smaller, the ratio of $r$, the radius of the head, to $a$ becomes increasingly larger. Most of the error in the simulated elastic curve is due to the $rQ$ end moment on the specimen; therefore, the error in the elastic curve is larger for low $L/i$'s. The author has computed a few of these errors due to simulated loading for the shorter specimens and has found that these errors would account for the errors shown in Fig. 6. This indicates that the errors shown in the figure are not errors in the Van den Broek formula, but errors in testing.

### Conclusions

The results of the tests, as well as Van den Broek's own analysis of the theory in his paper, show the errors of his beam-column formula to be small enough to be negligible in design. Its practicability, as compared to the usual or classic formulas, has been shown in his paper and in this work.

Here a method suggests itself whereby a design engineer might use this formula for transverse loadings other than uniform. A simple example is a beam-column with a concentrated load at its centre. By assuming the elastic curve to be sinusoidal, an analysis might be made to find an equivalent uniformly distributed transverse load. A set of tables might easily be made to give such equivalent loadings for many different actual loadings. These equivalent loads could be substituted in Van den Broek's formula to obtain results accurate within a few percent. Present design formulas often show a far greater range of error because of their empirical form.


### Acknowledgments

The author gratefully acknowledges his indebtedness to Prof. J. A. Van den Broek for proposing the problem and for his suggestions as to testing procedure, to my wife for her aid in the preparation of the manuscript, and to Mr. Milo Kaufman for assistance in constructing test equipment. √

# Underwater TV and Its Application

*by*
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This paper, presented before the 68th Annual Meeting of the Engineering Institute of Canada, at Quebec, describes the development and trials of equipment which has been pioneering a new field in the application of a wired television system. It has provided a means of extending the vision of scientific personnel aboard a surface vessel, into the region below the surface, previously accessible only to trained divers. The main advantages of this device lie in its freedom from human limitations.

In the past, extensive use has been made of underwater photography. This has been accomplished by providing a diver with a camera to record the progress of underwater operations; by lowering cameras to inaccessible spots for recording; or by using cameras in a bathysphere.

In each of these cases, it was necessary to use divers, without whom there would be no guarantee that the views obtained would be satisfactory or useful. After the pictures were developed, it would be difficult to return to the exact spot for further views of importance. With an underwater television camera, however, the view in front of the camera is immediately available on the viewing screen on a surface craft. A continuous watch can be kept on any interesting subject, and the television screen may be photographed.

It is true that the quality of the picture suffers in transmission over the TV link, but improvement in the circuitry is resulting in better displays. We still suffer from line structure in the picture, and are considering the use of a camera attachment on the underwater unit, for use if better definition is desired.

The project was started in the fall of 1949 in the radio and electrical engineering division of the National Research Council. Although it was known that similar attempts had been made by the Americans to submerge a television camera at the Bikini atom bomb trials, information was not available as to the results. During the period of test of our unit, a British unit was used to identify the "Affray", a submarine that was lost at sea.

Due to pressure of other projects the underwater television program was given a low priority, and only one engineer and one technician were assigned to the development work. Design details for the camera casing were carried out by the mechanical design section and the drafting office. Practically all of the mechanical work was done in the sheet metal and machine shops of the division.

### Operating Principles of TV

A complete television system for the reproduction of optical images is referred to as a "chain". One of the most important links of this chain is the camera "head". In the head is located the camera tube or image orthicon. The heart of the whole system of wired television is the image orthicon camera tube.

The type 5820 was chosen for its very stable performance at all incident light levels on the object being televised, ranging from bright sunlight (several thousand foot-candles, to a deep shadow of 1 foot-candle or less). Commercially acceptable pictures can be obtained at incident light levels greater than about 10 foot-candles.

The photo-cathode used in this tube has a spectral response of high blue and green sensitivity, and good yellow and red sensitivity, with no response to infrared. The orthicon has three main sections, an image section, a scanning section and a multiplier section.

### Image Section

The image section contains a semi-transparent photo-cathode on the inside of the face plate, a grid to provide an electrostatic accelerating field, and a target which consists of a thin glass disc, with a fine mesh screen closely spaced to it on the photo-cathode side. Focussing is accomplished by means of a magnetic field produced by an external coil, and by varying the photo-cathode voltage.

Light from the scene being televised is picked up by an optical lens system, and focussed on the photo-cathode. This cathode emits electrons from each illuminated area in proportion to the intensity of the light striking the area. The streams of electrons are focussed on the target by the magnetic and accelerating fields.

On striking the target, the electrons cause secondary electrons to be emitted by the glass. The secondaries thus emitted are collected by the adjacent mesh screen, which is held at a definite potential of about 2 volts with respect to target voltage cutoff. Therefore, the potential of the glass disc is limited for all values of light and stable operation is achieved.

Emission of the secondaries leaves on the photo-cathode side of the glass a pattern of positive charges, which corresponds with the pattern of light from the scene being televised. Because of the thinness of the glass, the charges set up a similar potential pattern on the opposite or scanned side of the glass.

#### Scanning Section

The opposite side of the glass is scanned by a low-velocity electron beam produced by the electron gun in the scanning section. This gun contains a thermionic cathode, a control grid (grid No. 1) and an accelerating grid (grid No. 2). The beam is focussed at the target by the magnetic field of the external focussing coil and the electrostatic field of grid No. 4.

Grid No. 5 serves to adjust the shape of the decelerating field between grid No. 4 and the target, in order to obtain uniform landing of electrons over the entire target area. The electrons stop their forward motion at the surface of the glass. They are turned back and focussed into a five-stage signal multiplier, except when they approach the positively charged portions of the pattern on the glass.

When this condition occurs they are deposited from the scanning beam in quantities sufficient to neutralize the potential pattern on the glass. Such deposition leaves the glass with a negative charge on the scanned side and a positive charge on the photo-cathode side. These charges will neutralize each other by conductivity through the glass in less than the time of one frame.

Alignment of the beam from the gun is accomplished by a transverse magnetic field produced by an external coil located at the gun end of the focussing coil. Deflection of the beam is accomplished by transverse magnetic fields produced by external deflecting coils. The electrons turned back at the target form the return beam. This beam has been amplitude modulated by absorption of electrons at the target in accord with the charge pattern. The more positive areas of the charge pattern correspond to the highlights of the televised scene.

In order to scan the photo target in an orderly fashion, the pencil beam of electrons issuing from the fixed gun is deflected by electromagnetic "sweep" coils. This causes the free end to cross the target area in a series of horizontal lines, termed a "raster". In "interlaced scanning", two complete coverages of the screen are effected so that one raster or "field" lies in the dark spaces between the lines of the preceding field. This completes what is termed a "frame".

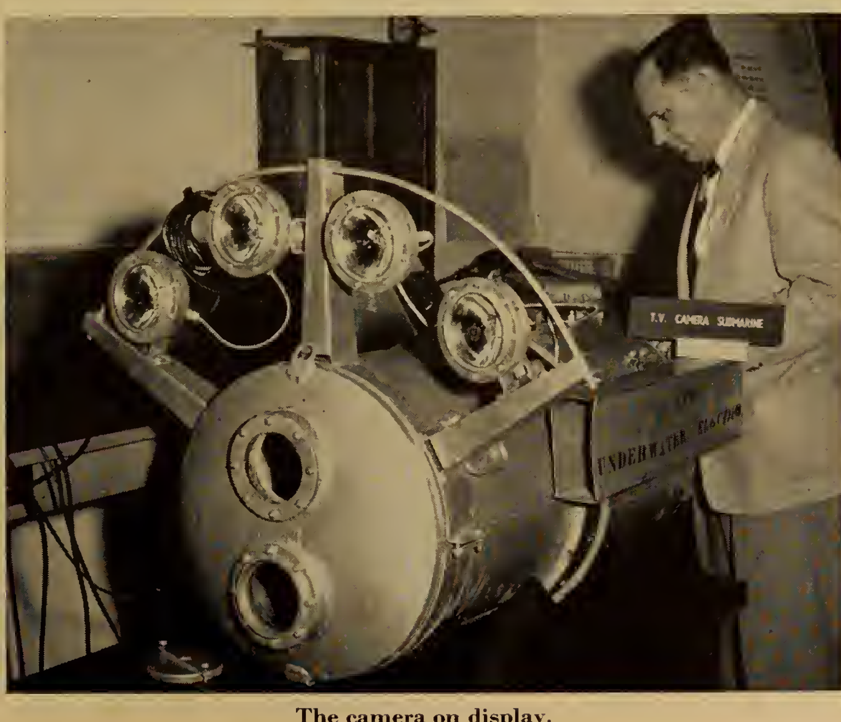
The process is "timed" in practice by electronic counters. These ensure that there are two hundred and sixty-two and one-half lines in one field, and exactly twice this number, i.e. 525 lines in one frame. The accurate timing of each line and each field by a short-duration synchronizing pulse, produces a stable picture. It is also necessary in TV systems to synchronize the sweeps to the primary power source, to prevent spurious shading effects in the picture. The television chain used underwater differs from studio equipment, principally in design of the camera.

The camera tube must be remotely operated from the control equipment over a much longer cable than had previously been attempted. This was complicated by the fact that, since the camera is housed in a casing, not easily opened for servicing, the circuits not essential to it were also placed at the remote position. Remote controls must be supplied over a common cable with the wires for the image orthicon without interfering with the televised picture. A stable counting and following circuit is also necessary to allow for wide frequency variations common to small sixty cycle motor-generator power supplies.

#### Multiplier Section

The return beam is directed to the first dynode of a five-stage electrostatically focussed multiplier. This utilizes the phenomenon of secondary emission to amplify signals composed of electron beams. The electrons in the beam impinging on the first dynode surface produce many other electrons, the number depending on the energy of the impinging electrons. These secondary electrons are then directed to the second dynode and knock out more new electrons. Grid No. 3 facilitates a more complete collection by dynode No. 2 of the secondaries from dynode No. 1.

The multiplying process is repeated in each successive stage, with an ever-increasing stream of electrons, until those emitted by dynode No. 5 are collected by the anode and constitute the current




The camera on display.

The camera in lowering position.

utilized in the output circuit. The multiplier section amplifies the modulated beam about 500 times. The multiplication so obtained increases the signal-to-noise ratio of the tube, and also permits the use of an amplifier with fewer stages.

It can be seen that when the beam moves from a less positive portion, the signal output voltage across the load resistor changes in the positive direction. Hence, for highlights in the scene, the grid of the first video-amplifier stage swings in the positive direction.

#### Description of TV Equipment

The main control unit provides blanking and synchronizing pulses for the system, together with an intermediate video amplifier for picture signals, and sweep currents for the deflection yoke of the image orthicon tube. The front panel is provided with controls for adjusting the electronic and optical focus of the pickup camera. Two meters indicate the focal position and aperture setting of the optical lens. Push-button selection of either a two-inch or a five-inch focal length lens is available on this panel.

A small steering unit is provided, with three-position switch handles that operate electric motors to direct and move the submerged camera. There are two display units, which contain a final video amplifier, a horizontal and vertical sweep generator, and a television cathode-ray tube. The smaller unit provides a picture three by four inches in size, and is used solely for making photographic records on sixteen-millimeter movie film.

The image on the screen is similar to a photographic "negative", so that when the recording film is put through a simple development process, it is available immediately for positive projection. The recording camera was designed so that its frames were synchronized with those on the TV screen, in such a way as to provide uninterrupted movie pictures. The size of the larger TV picture is six by eight inches, and is used for visual observations.

The camera head is a unit which measures approximately 6 by 6 by 20 inches. It contains a video preamplifier, three small electric motors, a number of electronic components and the image orthicon tube. A cylindrical drum was constructed to house and direct the camera when it is lowered into the water. The drum is built of one-eighth sheet steel, and is three feet long and eighteen inches in diameter. The longitudinal axis normally lies in a horizontal position.

The camera is mounted in a fixed position near the bottom of the drum, so that it can look through a glass port four inches in diameter in the front end. The weight of the camera is balanced by electric motors mounted near the bottom at the back end of the drum. Two of these motors are used for driving water propellers at the back of the housing, and one is used in a device for changing the inclination of the camera. Four sealed-beam spotlights are mounted outside the casing on a semi-circular plate, directly above the camera port.

This whole unit weighs three hundred pounds in air, but in water it has a positive buoyancy of about 10 pounds. It is sunk by means of a logging chain, which hangs vertically downward from the center of the cylinder. When a sufficient number of links rests on the bottom, the camera remains at some distance above the water bed. The buoyancy of the drum, its low center of gravity and the logging chain, all form a system which serves the same purpose as a tripod when used with photographic cameras.

The whole camera unit may be turned to the right or left about the axis of the chain, by means of one of the propellers. To incline the unit up or down, the center of gravity is shifted fore or aft by sliding a fifty-pound lead weight along the bottom of the housing by means of a motor-driven lead screw.

The camera is connected to the surface equipment by 500 feet of cable containing 28 wires. The weight of the cable in air is approximately six hundred pounds. In the water, it is buoyed by uniformly distributed floats that make it practically weightless.

It is a simple matter for one man to raise the camera to the surface from its maximum depth. The camera is moved from one position on the bottom to another, with the water propeller. If there is danger of stirring up mud, the unit can be moved by raising it to clear the bottom, and then towing it with the cable.

#### Field Trials in Fresh Water

The first successful field trials of the equipment were conducted in the Ottawa River in the fall of 1951. They were carried out with the aid of the N.R.C. experimental Vessel *Radell II*. The waters of the Ottawa are quite muddy, so vision under water was limited to about two feet, but close-ups of objects on the bottom could be recognized.

The trials were extended to the waters of the Rideau Canal system from Ottawa to Kingston, and also included Lake Ontario and Lake Erie. An amateur "frogman" from the Royal Military College in Kingston assisted in the examination of the old hulk of the HMS *Prince Regent*, which was scuttled as part of the Rush-Bagot Treaty about 1832. This hulk lay in the center of Deadmans Bay in 15 feet of water.

The oak ribs and collapsed planking were clearly visible, as well as many spikes, rock ballast, cannon ball and some cannon. The "frogman" assisted in manoeuvring the camera so the cable would not foul in the ribs of the ship. Further trials at Jones Falls in the Rideau River provided excellent views of fish life alongside the wharf. In Lake Erie, the equipment was used alongside a Department of Transport diver, who was examining the wharf piling at Kingsville.

Further trials were conducted in the fall of 1952. These were arranged through the co-operation of the National Research Council and the Federal Department of Resources and Development. Scientists of the Wildlife Service were particularly interested. They had first become aware of the NRC equipment from a footnote to an article on wired television in the *Reader's Digest* for January, 1952. They had hoped to apply this device to the solution of fish problems in the national parks. The operations were conducted at Lake Minnewanka near Banff, Alberta, from the boat *Peechee* owned by the national parks branch.

#### T.V. Camera Valuable to Scientists

Observations with this TV unit were carried out almost daily, at times ranging from five a.m. until after eleven p.m. A total of about 45 hours was spent in actual observation. The first reaction of the observers was one of enthusiasm as they viewed the bottom of the lake at 100 feet depth, with its sticks, stumps, and rocks.

Several types of observations were carried out. It was found, for example, that on one day, even at depths of 60 feet where the cylinder could not be seen from the boat, the amount of light available was such that artificial illumination was not required to examine the structure of the bottom. On another day the visibility even at depths of 30 feet was nil without the lights.

It was at first believed that some defect in the apparatus was responsible for the decrease in visibility, but it was soon realized that a strong wind had caused a considerable amount of "stirring up" along the shores, so that the water became quite turbid with suspended material. Further examination revealed that areas with gravel bottom did not suffer from such heavy turbidity.

Lake Minnewanka, with a native population of lake trout, had its surface level raised 64 feet in 1941 by construction of a dam for hydroelectric power development. Each winter the surface water level is drawn down about 35 feet. The main questions to be answered by this study were—to what depth do the lake trout spawn, and on what type of lake bottom?

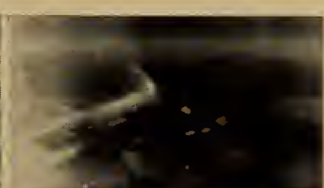
Since the original spawning grounds were now under deep water, the question arose whether these areas or other spawning areas were being used. Because of the drawdown during the winter each year, the spawning which takes place in shallow areas was considered to be lost. Since the young year-classes of lake trout were well represented in the population, successful spawning must have occurred after 1941.

The television tests enabled us to search rock beds for lake trout eggs. After we had learned to recognize lake trout eggs by actually dropping eggs in front of the camera and observing them, the equipment was taken to known spawning areas during spawning periods. Lake trout eggs were then seen lying on top of rocks and beside sticks in water to depths of about 80 ft.

Our problem of determining the extent of potential spawning areas in Lake Minnewanka, and their availability to lake trout, was much simplified by using this television chain.

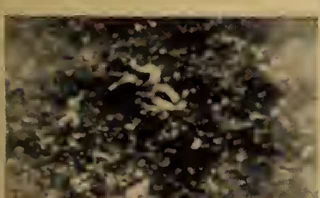
Another problem was the examination and determination of the natural shelter for larval and smaller sizes of fish. Did this lake have the type of bottom favouring the survival of small fish, that is, with rocks and debris which afford them protection and shelter? The answer was

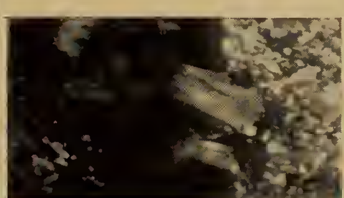

Rockfish

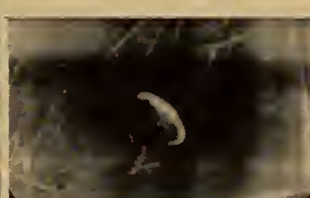

Ratfish

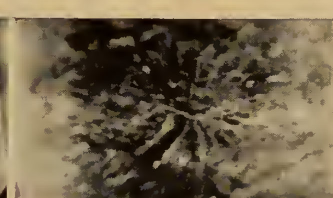

Herring

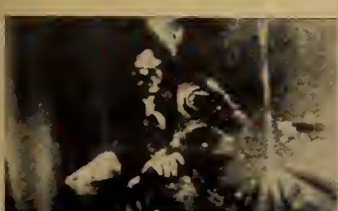

Sun-starfish

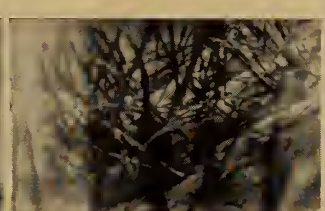

Brittle-starfish

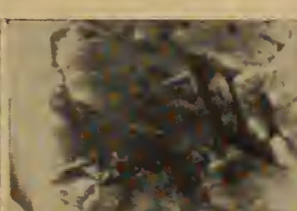

Sea anemone


Jellyfish


Tube worm


Diver on chain sling


Eel grass


Rocky bottom


Sea urchins

obtained simply by looking at the bottom structure. It had been assumed that erosion from recently flooded areas would have covered much of the lake bottom with sand and gravel, to the detriment of small fish.

Direct observation with underwater television showed that no such change had occurred. Many excellent shelters were seen along the shores and in the depths of the lake. This condition explained the large numbers of small fish in the lake, since the newly-hatched fry could immediately find many rocks, stumps and other debris to protect themselves from predation by larger trout.

Examination of the lake bottom by means of TV also made it possible to estimate the distribution of bottom fauna, which could not have been done by any other method. Evidence of feeding activity of fish was noted. Doubtless the scope and variety of observations will be greatly expanded by further experience.

#### Saltwater Trials

Later the Wildlife Service invited the director of the Pacific biological station at Nanaimo, B.C., to send a biologist to Banff to see the underwater television equipment in operation. This invitation was accepted, and as a result, permission was obtained through the Fisheries Research Board to extend the operations to the west coast. This afforded an opportunity of testing the TV camera in salt water and of viewing an unfamiliar ocean life.

The first underwater trials at Nanaimo were disappointing, due to continued interruption of observations when salt water entered the cable gland on the submersible housing. This led eventually to having the naval craft *Glendevon* transfer the TV team and equipment to the Pacific Naval Laboratories (a branch of the Defence Research Board, Ottawa), in Esquimalt. Scientific personnel here were already interested in the television device. Since the mechanical shops were quite familiar with deep water glands, a proper cable feed-through was hastily constructed.

Through close co-operation of the naval craft *Billow* and *Naden*, the possibilities of the underwater television were demonstrated to both civilian and naval personnel. After approximately two weeks at the naval dockyard, we were returned to the biological station. The equipment was transferred to the station's experimental ship the *Investigator* to carry on further trials for the scientific personnel interested in some particular phase of marine life.

One of the interesting biological experiments conducted aboard the *Investigator* was at Nanoose Bay, on a dark stormy evening in November, 1952. The ship was equipped with an echo-sounding instrument, used to locate a school of herring just outside the harbour. As the quieter waters in the bay were reached the echo-sounding record showed a solid school of fish, and it was decided to attempt to locate the fish with the TV camera. The anchor was dropped in ninety feet of water. The camera was lowered to the bottom where only a ratfish was seen.

Later, the lights on the camera were turned off and it was raised about thirty feet. When the lights were suddenly turned on, fish easily identified as herring were seen scattering off the TV screen. When the lights were turned off the depth recorder showed that the fish returned to the region immediately below the ship.

The trials had proven that the equipment was not only novel but also useful in the field of marine biology. In clear fresh water it could be used for study and identification of fish, such as bass and perch, at distances up to twenty feet from the camera. It allowed field limnologists to observe in detail the spawning grounds, and eggs of lake trout, as well as the bottom shelters for these fish.

In salt water, it had shown that lemon sole (a commercial fish living off muddy bottoms and not detected by echo-sounding techniques) could be seen, and indicated that a fish census could be made in this way before any particular area was opened for fishing. All forms of sea life were observed in their natural habitat for close observation by marine biologists.

It has also proven that it could be used in natural harbours, such as Esquimalt, for the inspection and maintenance of underwater gear, through observation of a deep sea diver. From an equipment standpoint, it had been found that the TV units were quite portable and could be operated from a 30 foot boat. The resolution of submerged objects was limited in most cases by suspended particles in the water, and not by the performance of the TV system. Although repeatedly dragged over rocky bottoms, the underwater camera was undamaged.

#### Many Uses in Fisheries Research

The possible uses for underwater TV in fresh water fisheries research are bounded only by one's imagination, and by limitations of equipment and environment. Field research has always been hampered by the fact that direct observation is difficult and often impossible. For this reason sampling techniques and analysis have formed the basis of previous observations.

For example, laboratory tanks are built to study physiological reactions of fish under such conditions as varying oxygen concentrations, temperatures and pressures. These studies can now be made by performing experiments with caged fish in their natural habitat, and observing them with TV.

Another age-old question which arises when fisheries biologists congregate is "Do fish sleep?" Recently, a Wisconsin diver found thousands of white perch lying quietly on the bottom of a lake. He proposes the theory that perhaps they escape predation in this manner. It seems but a simple task now to check this fact by extended TV observation over a much longer period than that possible by a diver.

Aquatic biologists have often doubted the efficiency and accuracy of their sampling devices. Such questions could be easily answered by setting a gill net in the lake and watching the net by television. It would be a simple matter to determine how many fish approach the net and turn away; how many pass around or over the top, and how many fish are not caught because the mesh size is too large. In other words, the efficiency of a net for sampling various species of fish could be estimated.

Similarly, while sampling a muddy bottom with an Eckman dredge, TV can show how much loss of mud there is in sampling the soft flocculent type of bottom, as compared to a harder clay-like bottom or a less cohesive sand or silt bottom. The efficiency of many underwater sampling devices could be determined visually.

The impounding of water by large power dams often produces challenging problems for the fisheries biologist. Annual fluctuations in the water levels may be of less importance than the fact that the spillways, sluice gates and turbines often take a large toll of the fish population. Because of the currents, direct observation near and around these structures becomes extremely dangerous or even impossible for a diver. Underwater TV would permit a look with no danger to human life.

#### Clam Crops and Fish Food

Clam harvesting is an extensive industry along the east and west coasts. One packing company alone employs 35 boats which do nothing but harvest clams. It is difficult to locate the clam beds in water up to 90 feet deep. The boundaries of the bed must be known in order to manage the harvest to best advantage. Underwater TV could probably be applied here with great success. It would seem feasible to study the clam population with a view to forecasting the future crop.

The penetration of natural light, an important physical aspect of aquatic study, could easily be determined by means of underwater TV. A series of coloured discs placed in front of the camera could reveal the range of vision possible by natural light, and the spectral composition of the light at a particular depth. Turbidity at any desired depth could be studied, as well as its effect on the transmission of light.

Another application is the study of aquatic organisms under winter ice cover. Little is known at present concerning the activity of fish, and the activity and distribution of bottom fauna during these periods. Television observations in areas of water with low dissolved oxygen concentration may make it possible to determine whether fish or other organisms can actually detect changes in oxygen content of water, or whether they blunder into areas of low concentration without suspecting it, and are thus killed.

The examination of the structure of lake and sea bottom areas as an entity *in situ* has been considered desirable by many workers. Direct observation is now possible. The determination of rate of deposition of the dead and dying planktonic and other detritus that "fills in" a lake is most important to the chemical-nutrient relationships in a lake. The relationships of these deposits at various depths and at different locations in a lake have received much attention, with limited success.

It may be simple now merely to place markers on a lake bottom and to observe these markers from time to time without any disturbance to the process of settling. Since the underwater unit is self-propelled and can be connected to the control and viewing units by very long cables, it is possible to investigate a large area of water without the use of a boat by locating the above-water units on shore.

Observations made by under water television have numerous advantages over those made by divers, who are limited by pressure, temperature, time and specialized biological knowledge. The element of danger to human life is eliminated also. Under water TV, however, has its own limitations, many of which may be overcome by future refinements.

In the year 1953 the television unit was frequently in use. Some changes to the equipment were needed. The amplifiers in the video channel were not satisfactory for the desired definition, and we also wished to change the design of the under water unit to make it more manoeuverable. However, pressure of demands kept the equipment unmodified during the year.

#### Experiments for the Navy

In May 1953, Naval Headquarters requested us to demonstrate for a group of officers interested in mine disposal work. The equipment was placed on board *Radel II* and moved to Big Rideau Lake. The navy provided two frogmen. The vessel was anchored in 50 feet of water and the TV equipment was lowered to the bottom. A large garbage pail was placed on the bottom, and an attempt made to locate it with the equipment. The ballast chain stirred up so much mud, that it had to be raised, until the mud settled.

The trial was then conducted with the mine (garbage pail) and TV equipment suspended about ten feet above the mud. The divers then pantomimed in front of the camera, and fiddled with the pail to assess the value of the equipment in passing instructions to a diver, from information available on the TV screen. The range of vision was limited to about 15 feet. Within that range details of work being carried out could be understood.

As a result of the trials in Big Rideau Lake, we were requested to carry out trials in Halifax for naval personnel. In August the *Radel II* arrived in Halifax and conducted trials for the following groups.

1. H.M.C. Torpedo Anti Submarine School.
2. Seaward Defence.
3. Naval Research Establishment.
4. Deep Sea Diving and Underwater Training School.
5. Mechanical Training Establishment.

Dock piling, rocks, shells, fish, seaweed, etc. in the area around Sandwich Wharf and McNabs Is. wharf were seen by the naval personnel. An attempt was made to view some harbour defense underwater equipment in a tideway, but the strong currents made the unit unmanageable, further confirming the necessity to redesign the original equipment.

#### Showings for Conventions and TV Networks

In September, we agreed to provide the equipment for demonstrations at the conventions of the American Fisheries Society and the Wild Life Conservation Society, in Madison, Wisconsin. The water of Madison Lake was not clear enough, nor were there sufficient fish available to provide a continuous display. The equipment was moved from the Madison University site to the fish hatchery compounds of the conservation department. This permitted continuous viewing of rainbow trout in the breeding area. Members attending the convention were enthusiastic about the display, and considered it had good prospects of providing them with another means of studying fish life.

Early in the year an attempt was made to broadcast a live program over the CBC from Montreal. The TV equipment was modified to accept control pulses from studio equipment. A broadcast of "Aqua-lung" equipment in use in the Y.W.C.A. swimming pool was considered a suitable subject. Initial rehearsals were excellent, and everything was under control until two minutes after the start of the program, then, due to a small leak in the housing of the camera unit, the lens changing mechanism started uncontrolled operation. The TV camera had to be eliminated from the program.

However, the necessary changes had been made in the equipment to link with standard broadcast studio equipment, and in November the equipment was again set up for a TV broadcast. This time it was in Chicago with the NBC. The stage was set in a training tank of the Great Lakes Naval Training Center.

Submarine nets were placed in the tank, and frogmen, equipped with underwater oxyacetylene torches, demonstrated the operation of cutting the nets. A steel plate was also cut with the torch under water. Three short separate broadcasts were made for each of three time zones across the country.

NBC engineers were pleased with the outcome of the broadcast.

### Applications Almost Unlimited

In addition to the underwater trials conducted with the equipment, trials of the equipment as a standard wired television served in two instances in our laboratories.

The jet engine test laboratory wished to use our equipment in the study of de-icing problems on the intake of a jet engine. This provided a ready means of viewing the de-icing cycle on a TV screen at a safe distance from the danger of an explosion or mechanical failure in the engine, and in a warm and quiet atmosphere. This work is normally done, by viewing the engine with mirrors and field glasses, from behind a steel guard partition. These trials were quite successful and a TV link will be provided for future tests of this kind.

The cosmic ray laboratory also found a practical use for the equipment. In practice a photographic plate with a thick emulsion is exposed to cosmic rays, by raising it in a balloon to great heights. The photographic plate so exposed contains microscopic tracks in the emulsion due to the passage of the rays.

Study of these plates is a tedious process. The plate must be viewed through a microscope, and records taken of the various tracks, as the microscope tangent screws are moved. There is another method of viewing the plate for study, by projecting the negative through the microscope into a viewing screen. This work must be done in almost total darkness, in order to obtain sufficient light on the screen for definition.

We co-operated with our cosmic-ray laboratory in carrying out trials with the TV link. The microscope projection unit was coupled to the image orthicon camera, and the reproduced picture was viewed on a cathode-ray tube. The result was successful. The intensification of the light through the image orthicon and the ease of setting the contrast of the display, produced a picture of the cosmic-ray tracks that could be viewed in a normally lighted room.

The ease in carrying out the analysis of the film was excellent. Strain on the eyes was much less, and the recording of observations could be carried out in a lighted room. The cosmic-ray laboratory are considering the purchase of a commercial unit to continue this work.


#### Acknowledgments

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## Discussion

(*Continued from page 944*)

pole damage from lightning being reported.

The tandum pin type insulator of the slightly different design is again in use on the Shawinigan system with reasonably satisfactory results. No trouble is experienced from the causes mentioned in the paper, fog and moisture. This construction, however, is not recommended except for special cases.

The injection of concrete into pipe structures has often been thought of and we understand is used in Europe, particularly in Switzerland. Evidently great care must be taken to fill the pipes if such processing is considered. Entrapped moisture in steel sections can be hazardous and cause unseen weakness. The conductor enlargement on the McGuigan type tower indicates that engineers were and still are prone to include excessive strengths in their designs which when carefully studied permits carrying larger than the originally proposed conductors. The outstanding example on the Shawinigan system is the Lake St. John-Quebec lines which we considered a good design for 135 kv. which operated at 165 kv. and with the conductors changed from 397,000 cir.mil. ACSR to 715,000 cir.mil. ACSR now operate at 230,000 volts with only minor changes to tower steel.

Mr.. Sproule's mention of disc insulators could well have included the American designer to whom credit is due, namely, A. O. Austin who still retains an active interest in insulator development. On the Shawinigan system approximately 5,000 of the 1910 type disc insulators are in service in their original strings.

The question of joints on ACSR conductors has been under study for many years. On account of the oxide formation on the aluminum heavy current deteriorates the conductor. Aluminum oxide is formed by the heat, thus increasing the resistance and in some cases causing failure of the joint. Modern joints are very carefully made, using the hydraulic press, but some of the older joints were not so well assembled and do cause trouble. A system of measuring the drop across the joint has been in use for two years on the Shawinigan system with satisfactory results. The drop testing device gives a precise reading of the millivolt drop over a joint which when compared with the drop over an equal length of conductor furnishes a ratio figure which, if less than one, gives assurance that the joint is good.

Comments on the use of double circuit lines can hardly be avoided. If one considers what happens when a span 1,100 ft. long is loaded with wet snow or ice with the adjacent span of the same conductor unloaded. Such a condition swings the suspension string approximately 1½ ft. in line direction which drops the loaded conductor by approximately 20 ft., thus permitting flashover with the other phase. Offsetting tower arms will improve this condition to some extent but with a certain wind pressure the conductors again line up. On the other hand horizontal construction is extremely safe and some lines of this design have been known to operate for many years with no outages at all from galloping or lightning troubles. Lightning, of course, is taken care of by first class grounding as indicated by the paper. The addition of continuous counterpoise has proven its worth.

Apologies are necessary for the length of this discussion, but such an interesting paper seems to warrant what we hope amounts to constructive discussion. √

The Editor invites discussion on papers appearing in the *Journal*

# Abstracts of Current Literature

Abstracts of articles appearing in current technical periodicals

### POSSIBILITIES OF A CROSS-CHANNEL POWER LINK

Institution of Electrical Engineers, *The Engineer,* v. 197, iv. 5124, April 9, 1954, pp. 536-539.

#### Vancouver Island Cable Link

It may not be inappropriate to give a few details of the Vancouver scheme. It involves approximately 80 miles of 138 kv pre-impregnated, gas-filled submarine cable. The submarine crossing is in two parts. The longer, from the mainland to Galenaia Island, has a route length of about 15½ miles, and the shorter, from there to Vancouver Island, is about 4 miles. The link is completed by ordinary lines. For three of the shore ends the approach is steep and rocky, and for these situations the cables are to be reinforced with additional rock armour. The fourth land end comes in over shelving sandy ground. The maximum depth is about 100 fathoms. This gives us a pressure of 270 lb. per square inch.

The cable differs from the cable used for the English Channel trials largely in that it has the hollow conductor giving the gas channel. The end sheath clearance is dispensed with and the armouring in this instance is to be of galvanized steel wire rather than aluminium alloy wire. The charging pressure is 300 lb. per square inch in order to preserve at all depths a positive margin of internal pressure for the cable.

### HIGH DENSITY TUNGSTEN ALLOY

*The Engineer,* v. 197 (n. 5131), May 28, 1954, pp. 795-796.

It will be recalled that the basic alloy was first developed by the General Electric Company before the war in its attmpts to use tungsten instead of lead as a radium beam therapy shield. Apart from being too soft, lead was not ideal in other respects.

Tungsten, however, lacked many engineering qualities, had a very high melting point, and was largely unworkable. These difficulties, it was found, could be largely offset by mixing with the tungsten powder up to 10 per cent of nickel and other alloying powders which formed a liquid matrix at a relatively low temperature and filled the voids.

No other use for this alloy was anticipated at that time, but upon the outbreak of the last war it was realized that by its use the mass balances associated with aircraft control surfaces could be located internally thereby effecting a drag reduction. This remains the largest application of the metal.

A new series of alloys is being developed, with densities up to 18 g/c.c. and over, which is approaching the theoretical density of tungsten. All these alloys can be drilled, tapped, turned, ground or machined, and possess mechanical properties comparable with those of the existing alloy. The G.E.C. is also developing an alloy of high density, characterized by higher elongation, with no corresponding decrease in tensile strength.

Before the tungsten, nickel and other constituent powders of the alloy reach the processing plant they have to pass stringent specifications for their chemical and physical properties. They are then mechanically mixed, bonded with a paraffin wax binder, placed in a die, and compressed, pressures being about 5 tons per square inch. The compact is then heated at a carefully controlled low temperature. It is now in the "green" state, and sufficiently consolidated to stand further shaping. It is then placed in an electric muffle furnace in a hydrogen atmosphere and sintered at white heat, approximately 1,450 deg. Cent.

During the sintering process the compact shrinks by nearly 20 percent in volume, with a corresponding increase in density from 10-12 g/c.c. to the final density required. This decrease in volume must be accurately predetermined within close tolerances. Since it is calculable the original dies for the powder can be designed with precision for many required shapes or sizes of sintered product.

The density of the alloy becomes of prime importance in the design of telecurietharphy apparatus, in which very large quantities of radium—or more recently, radioactive cobalt—are used.

An illustration in the general medical field is provided by a larynx collar which has recently been constructed at the Christie Hospital and Holt Radium Institute at Manchester for treating cancer of the larynx. This machine, which is remote controlled and about the size of a large lathe, brings round the neck of a seated patient a heavy-thick lead collar in which are embedded twenty-eight gamma ray sources, containing a total of about 3 grammes of radium. The lead reduces the gamma ray intensity from each of these sources by a large factor in all directions except towards the patient's larynx, in which direction the lead has been cut away to give a radiation beam.

If this collar were made entirely of lead, in order to give adequate radiation protection for the chin, and head above and the shoulders and trunk below, it would be too tall to fit around the neck. The central lead portion of the collar has therefore been sandwiched between two machined pieces of G.E.C. Heavy Alloy, which, because of their higher density, give the required degree of protection with a thinner section, and at the same time provide a firm support for the comparatively soft lead.

Apart from the use already referred to, there are now many more applications, both static and dynamic. One such has been the "G" Restrictor made by British Messier Ltd. This was a unit which warned the pilot when a critical vertical acceleration on the aircraft was reached by imposing a resisting load on the control column. Should the pilot ignore the initial resistance and impose a greater vertical acceleration on the aircraft, the "G" Restrictor developed sufficient force to move the control against the pilot's force and thus reduce the vertical acceleration.

It employed a heavy alloy weight, which would not have been possible to make from lead because of the electrolytic action between the hydraulic fluid used and the component. Nor was steel a practicable alternative, since it would occupy twice the space, increasing the size of the chamber where this was very limited.

An even greater test of the material's strength is that to which it is subjected in aircraft gyroscopic instruments. The stability of gyroscopic movement depends on angular momentum and a maximum mass density at as large a radius as possible within the allowable limitations on physical dimensions and overall weight must be provided.

### ARE CONFERENCES WORTH WHILE?

*The Times Review of Industry,* v. 8, n. 88 (New Series) May 1954, p. 15.

One of the difficulties about the conference as it is today offered to industry is that it is not really a conference at all; it stands somewhere — not necessarily midway — between the conference and the lecture or course of lectures. At the lecture a man who is presumed to have some special knowledge stands on a platform to impart his learning to an audience for the purpose of acquiring it. At the conference, properly so called, an assembly of delegates discuss matters of common interest under the guidance — and, only in so far as the delegates accept their own standing orders, under the direction — of a chairman.

That a conference session may consist of anything from a free-for-all discussion to a completely formal lecture certainly affords a considerable flexibility in theory; in practice it often discourages the conference organizer from thinking carefully about what his conference is really for and treacherously leads him on to the conclusion that "anything does providing there is not too much of it". It appears to be the search for variety for its own sake — in the belief that variety will ward off boredom — rather than the selection of the most appropriate medium for stimulating learning that often governs the form of particular sessions. Thus a conference may consist of a lecture, a lecture plus discussion, and a lecture followed by discussion syndicates followed by reporting back sessions and further, discussions; to all these may be added discussion on films and filmstrips, role-playing, questionnaire filling-in (a source of some most improbable generalizations), unashamed entertainment and, as the background to this hotchpotch, the licensed bar where the organizer fervently hopes personal contacts will be made which will justify his conference however badly he has arranged it.

It would be unfair not to appreciate the difficulties of organizers. For the most part — the adult education institutions which offer conferences for industry are the chief exceptions — organizers must find suitable accommodation. Stretch the meaning of "suitable" as far as you can, that accommodation is limited. Thus the nature of available accommodation has exercised an undue influence on the nature of conferences. More particularly, the break-even point of any particular accommodation has dictated the size of the conference to be held in it, if 150 delegates were required to make a conference pay at the Hotel Splendido-Magnifico, then 150 delegates there would have to be in spite of the fact that the theme and personnel of the conference suggested an optimum size of 80.

Nothing would ease the accommodation problem so much as a severe cut in the number of conferences offered, and more cooperation between organizers would give some relief. Why is it that the organizers seem to have shunned moderation and cooperation? One is forced to the regrettable conclusion that it is because, at least until recently, the running of conferences has been fairly profitable business.

If it is true there are too many (and too many bad) conferences, what can be done about it? First, there should be fewer of them. Only heartsearching of an intensity which is scarcely anywhere apparent is likely to effect a voluntary reduction in the numbers offered. The threat of bankruptcy is a much stronger inducement. If conference-running is coming up against the law of diminishing financial returns that is not surely a matter of regret, though one hopes that organizers will recognize the threat before it becomes a fact. Secondly, organizers should constantly try to improve their conferences should be much more discriminating in patronizing what is offered to it.

The organizers must consider the form that the conference will take and the procedure at sessions that is most appropriate to the subject matter. Correct procedure is important and the value of variety should not be overrated. Speakers, especially, those not in the direct employ of the organizers, should be carefully and forcefully briefed. If a subject is best treated by formal lecture, then a formal lecture there must be. It simply will not do for a speaker to lecture without notes, (not because he is a gifted and orderly impromptu talker, but because he has not bothered to prepare them); nor has a speaker the right, if he has been asked to lecture, to get up and say "I shall talk only for a few minutes and then I thought we would have a good discussion on your questions"; nor should a speaker be invited twice if, with an air of omniscience often belied by his performance, he ends his rambling talk with "well my time is up, although I haven't said half of what I intended".

Organizers should certainly demand from their speakers some concrete evidence that their promised talks will be worth listening to, and they should not shrink from cancelling an advertised lecture if the speaker replies "of course, I am never quite sure what I shall say, until I get up". If there are to be discussion groups, they should be in the charge of people with at least a rudimentary knowledge of controlling and directing a discussion. The selection of a discussion group leader should not be regarded by the organizer as a means of paying a compliment or of inflicting a fatigue nor should it be presented to the group as an exercise in democratic election.

Finally, the organizers should depend more on their own personal efforts and less on badges and the accumulated effect of attendance at the bar for ensuring that the delegates become personally acquainted. The more naturally reserved delegates may, in fact, be precisely the people who never enter the bar.

A firm's first step, on deciding that an offered conference is worth patronage is to determine who shall attend. This task is only slightly simplified when the conference is intended for a closely defined group of people, sanitary engineers, canteen managers or directors. It may be that there is only one canteen manager in the firm, but if he is incapable of benefiting from conference experience (and this may be no reflection on his professional competence) there is no point in sending him. When there is a choice, a firm should select the man most capable of absorbing conference discussion and instruction. It should be made perfectly clear that the firm regards conferences (or at least those which it intends to support) as having an educational value and that selection for attendance does not imply approval of hard work, a better prospect for promotion, that "his turn has come round again" or "he is a single man and won't mind". The prospective delegate should certainly discuss the programme with his superiors before leaving and be given some plain indication of the firm's concern and interest. In certain firms, it is understood, there is a practice where a considerable choice is offered — for a conference of, say, foremen — of allowing the foremen's association to make its own choice. It seems a practice quite without merit.

On returning from a conference a delegate should certainly be expected to report both on the way the conference was run and on the value that he personally found in it. These reports are much the best way of assessing the organization's competence for running conferences and of ensuring that the delegate applied himself to the conference with some diligence.

No doubt there will be many who will object that all this is to be much too severe on the conference delegates, and there are certainly some conference organizers who argue that since delegates will arrive straight from one week's work and return straight to another they ought to limit strictly the conference's intellectual demands. This attitude seems to be wholly mistaken. A conference that does not require a marked intellectual effort is not worth attending, and the relaxations should be provided not by the organizer during the conference but by the firm after it. Furthermore, a casual attitude to conferences on the part of a firm which nevertheless insists on supporting them may have an unfortunate effect on its delegate. The delegate may well resent the money lavished on his attendance at a worthless conference in a relatively luxurious hotel (i.e. one to which he could not afford to take his family), and can scarcely be blamed for regarding cynically future injunctions to raise efficiency and avoid waste.

None of the forgeoing should be taken as decrying the value to industry of educational conferences. But those who, in the recent past, have attended them frequently, must have been impressed by the unevenness of their standards and the low level to which they could fall.

## VACUUM FORMING OF PLASTICS GAINS FAVOR

C. H. Vivian, *Compressed Air Magazine*, v. 59, n. 4, April 1954, pp. 108-110.

Articles composed of thermoplastic materials have commonly been manufactured by melting a powder and injecting the resulting liquid into molds. By a newer method called vacuum forming, which is fast gaining favor, a heat-softened sheet is drawn into a mold by means of suction. In the older equipment designed to do this the sheet is transferred to the mold after being softened, but the Auto-Vac Company, of Fairfield, Conn., has developed a machine in which the sheet is heated while it rests in position on the mold. This has shortened the operating cycle and consequently reduced the production cost.

Vacuum forming has its limitations, of course. The process is not suitable for making all thick or deep articles, or those with complicated interiors or that require molded-in inserts, but it will turn out many items at a lower unit cost than injection molders can meet. Where it is applicable, the newer method has definite advantages. For one thing, it will produce larger pieces than even the biggest injection equipment. Some of the vacuum machines now in service have platens 30 square feet and are capable of forming an object weighing 25 pounds.

The leading products of the Auto-Vac process are advertising and Christmas displays and deep-embossed component parts for industrial and household machines and appliances. Among the many other things being manufactured are toys, air mattresses, suitcases, typewriter and cosmetic cases, rigid handbags, tops for office furniture, aprons, TV masks, shower curtains and bath mats, tablecloths and place mats, as well as doors, ducts, etc., for air-conditioning installations, and reflectors, ceiling panels, decorations, illuminated and unilluminated signs, butter trays, etc. The most important items now under development are packaging materials, visual and profile containers, snap-on-lids, inflatable novelties and lighting fixtures.

As to raw materials, various sheet plastics are suitable, but the rigid vinyl copolymers are most used, especially for making relief maps, store displays, containers, toy parts and lighting fixtures.

Flexible vinyl is utilized for deep embossed products such as bath mats, wallets and ladies' pocketbooks. Components of refrigerators, shower baths, washing machines, radio cabinets and many other household articles are molded from styrene copolymers, while cellulose acetate, straight styrene sheet material and polyethylene and Teflon also are used in varying quantities.

The method is especially advantageous where products are to be decorated with colors because the latter can be applied to the flat sheet before it is formed. In doing this, the design is purposely distorted in such a manner that the different colors will be in their desired places when the sheet is drawn into shape. They are put on either by silk screening or by one of the available printing processes, with lithographing in most common use. As many as may be required can be applied at one time to an area 8 to 10 square feet in size.

An important contribution towards the economy of vacuum forming is the low cost of the molds. Those for relatively small runs are generally made of a hard plaster such as Hydrocal (U.S. Gypsum) or Densite (Certainteed Products) often reinforced with screenings.

After it is cast, the plaster mold is impregnated with a resin such as Bakelite's C8 epoxy, which gives it a hard, durable surface. Molds of this type have remained in good condition after producing 50,000 pieces.

Molds for longer runs are made by spraying metal on a master cast until a shell from ⅛ to 5/16 inch has been built up. This is removed and backed up with a plaster or a mixture of resin and fibrous glass, the latter being sometimes preferred because of its lighter weight.

No matter which of the two molds is utilized, it must have numerous tiny holes through which the air can be exhausted to draw a suction of the softened plastic sheet. They may be drilled in both the plaster of the metal type or, in the case of the latter, protruding pins may be inserted in the master cast and then pulled out after the work of spraying and backing up the shell has been completed.

In preparation for the forming operation the sheet of plastic, cut to proper size, is placed over the mold and a clamping ring is lowered and secured to prevent any leakage of air into the space between the sheet and the mold. An electric element, capable of supplying uniform heat up to 700° F. throughout a large area, is next pulled into position over the sheet, usually within 1½ or 2 inches of it. When the plastic has softened sufficiently (it takes from seven to thirteen seconds per 1/100 inch of thickness, depending upon the kind of material used), vacuum is applied and the sheet is forced into the mold depressions by atmospheric pressure acting on it. After a short period to allow for cooling, the clamping ring is removed and the formed plastic stripped from the mold.

## BIG SNOW MELTING SYSTEM

Edson E. deCastro, *Heating, Piping and Air Conditioning*, v. 26, n. 5, May 1954, pp. 130-132.

A number of articles have been written about the Boston Central Artery, and some of them have given brief descriptions of the snow melting system now being installed in the ramps of that elevated highway.

The superstructure of the elevated portion of the artery is a steel framed viaduct with reinforced concrete deck — except for the lower ends of the ramps, which are on earth fill between retaining walls. It is these earth filled lower ends of the ramps in the downtown area, where central steam service is available, that are to be heated for snow removal in order to provide sure acceleration areas on "up" ramps and safe braking areas on "down" ramps.

Snow melting is being installed only in the earth filled portions of the ramps.

The system is conventional in that a warm anti-freeze solution is circulated through pipe grids in the ramp pavement. It was designed to melt approximately 1 in. per hr. of snow. However, the solution heaters have twice this capacity in order to reduce the time for warming up the roadway slabs and to provide sufficient overload capacity.

A greater rate of snow melting was considered but the larger quantity of steam required was not available. The ability of the utility company to supply steam had to be considered, particularly because the use factor of snow melting systems is quite low and the demand rate quite high. Large snow melting loads only become practical when the utility company has a large connected heating load. Most snowfalls occur in the 20 to 30 deg. temperature range, whereas the greatest space heating load is at zero or lower. A surplus of steam for snow melting is therefore usually available at the time when most needed.

Pipe design for snow melting on the ramps presented several problems. The two most pressing were the necessity for balancing the solution flow through the piping, and the problem of air removal. A ramp must slope and it may be curved entirely or only in part. This curvature results in the highway being banked and complicates the problem of air removal. The above-mentioned design problems limit the possible configuration of the snow melting piping considerably.

Sinuous coils cannot be easily used because of the problem of venting the air from each separate hairpin loop when one side of the roadway is higher than the other. A further limiting consideration is added when access boxes for balancing valves cannot be placed in the roadway due to high roadway loading, continuous traffic and a covering of blacktop over the concrete.

Due to the limitation on access boxes, the piping systems in the ramps must be self-balancing. Pipe grids with opposite inlets and outlets meet this requirement, and, therefore, the piping in the ramps consist of a series of grids. Since the grids are at right angles to the roadway, the grid headers butt each other, forming continuous headers running the length of the slab. Baffles are placed in the headers at regular intervals to direct the flow across the ramps and form a series of grids.

Entrapped air is vented up each ramp to a point of elimination through a ⅜ in. vent hole drilled through the top of each baffle. Air passes readily through the holes, and only about 4 per cent of solution bypasses the grids since the pressure head between any two adjacent grids is small. Another advantage of the series of grids arrangement of the piping is that it facilitates construction. The grids—consisting of ten 1 in. pipes on 12 in. centers, welded into 2 in. headers—can be shop fabricated and joined together in the field. Field welding is thus greatly reduced and construction made easier.

The wrought iron pipe grids rest on four parallel rows of supporting bars. These supporting bars are fastened to steel uprights. The supporting uprights are set to proper level before the pads are poured. The 1 in. pipes of the grids are then securely wired to the supporting bars.

The normal maximum length of concrete roadway slab is about 105 ft. The ramp slabs in the snow melting system vary from 60 to 110 ft. Each slab, therefore consists of from six to 11 grids in series, each ramp comprising one or two slabs as required. Loops are placed between the slabs to provide for expansion. Catch basins are located as close as possible to the lower end of the heated portion of each ramp in order to remove all water from melted snow and prevent puddles that might later freeze on the unheated part of the roadway.

All of the piping connecting the ramps with their respective pump houses runs underground, with the exception of the return lines to the pump house near the North Station. These returns are overhead, concealed in the highway structural steel as much as possible. All of the steel solution piping slopes back to the pump houses for drainage. Pipes are run parallel, are grouped together, and are encased in vermiculite water resistant insulating concrete, which in turn is wrapped in a waterproof envelope.

There are five pump houses. Each takes care of from two to four ramps, there being a total of 14 heated ramps. The return pipe from each slab has a separate regulating cock and thermometer in the pump house, making it possible to properly proportion the quantity of solution being pumped to each slab.

Steam is supplied to the snow melting system at three locations by the Boston Edison Co. Service manholes are located near North Station, Fort Hill Square, and on Minot St. just off Nashua St. The North Station manhole furnishes steam to two pump houses, as does the manhole at Fort Hill Square.

Each pump house contains pumps, heat exchangers, an expansion tank and control equipment. The pumps are sized to circulate the required quantity of ethylene-glycol antifreeze solution through the grids. The solution heater is designed for twice the normal capacity calculated to raise the temperature of the antifreeze solution 30° F. The economizer is sized to extract the maximum possible heat from the condensate before discharging it to the sewer.

Snow melting equipment in the pump house can be automatically controlled after starting, but requires manual starting. Consideration was given to various schemes for starting snow melting equipment at the beginning of a snowfall, but it was decided that starting the system at the beginning of a snowfall was too late and, therefore, any such system would be inadequate. It takes 4 to 8 hours or more to warm up the slabs to snow melting temperatures. Therefore, either the system must be maintained during the winter months at the snow melting temperature (35° F.) or it must be started several hours before a predicted snowfall.

Two control systems are provided. One maintaining the slabs at 35° F. during periods of threatened snowfall. The other maintains the antifreeze solution leaving the heater at a set snow melting temperature as long as desired. Either system must be manually started by pushbutton control and the change from one control system to the other is also manual. An automatic bypass control is provided in order to prevent the returning solution from ever reaching the pumps at a temperature lower than 35 deg. which would possibly freeze the economizer. The solution from the heater tempers the solution returning from the ramps so that the temperature of the mixed solution entering the pumps will never be lower than 35 deg.

Initially, the temperature of the solution leaving the pump houses will be limited to 160° F. to eliminate any possibility of softening the blacktop where it rests on the concrete. Although there is no danger of reaching temperatures high enough to soften the blacktop while actual snow melting is in progress, there is a possibility that the temperature of the blacktop may become too high when drying off the roadway to prevent later freezing of the wet surface. Such freezing would be as great a skidding hazard as the original snowfall, and therefore, the ramps must be free from water before heating is discontinued.

## WE WANT TO BE OURSELVES

*The Financial Post*, v. XLVIII, n. 25, June 19, 1954, p. 6.

Canadians may have their faults but no observer who pretends to know anything of this country has ever accused them of narrow nationalism. We simply want to be Canadian.

Long ago we decided that we wished to develop an independent nation, to create within our own political framework, a Canadian social and cultural life and our own industrial and economic structure.

At the annual meeting of the Maclean-Hunter Publishing Co. last week, President Floyd S. Chalmers summed it up this way:

> "We want to know how other people live, we want to sing some of their songs, see some of their films, read some of their books and magazines, and buy some of their products. We want to be independent but not isolated; we want to form ideas from the world just as we share ideas with the world. But at the same time we do not want to live someone else's way of life; we want to be Canadians, living the Canadian way of life".

How can we accomplish that reasonable aim?

Mr. Chalmers stressed one major contribution, the development of a national periodical literature, literature that keeps Canadians informed of the achievements of their own people, "that inspires, informs and entertains in Canadian terms" and that does this in a national setting that "breaks down the excessive sectionalism that has been the bugbear of Canada's historical development".

Outsiders cannot build a strong and independent Canada. They can help and their help is welcome. But the major responsibility for building Canada must always rest on Canadians themselves.

## THE PUBLIC HEALTH SIGNIFICANCE OF ENVIRONMENTAL CONTROL BY ENGINEERING MEANS

John A. Logan, D.Sc., and Robert P. Burden, d.sc. *Bulletin of Hygiene*, v. 29, n. 3, March, 1954, pp. 221-229. Chadwick Public Lecture Presented on November 17, 1953, at the Royal Sanitary Institute, London, S.W. 1, England.

More than one hundred years have passed since Sir Edwin Chadwick presented his revolutionary Sanitary Report (The Sanitary Condition of the Labouring Classes) in 1842, and during this period there have been remarkable improvements, throughout the world, not only in sanitation and in public health but in the attitude of peoples and of governments to the necessity for these amenities. Owing in great part to Chadwick's stimulus and enthusiasm it is now possible to say that, throughout a considerable part of the world, the first objectives of public health have been attained.

It is suggested that, by employing the same basic principles evolved in developing the science of public health engineering, it should be possible for engineers to consider in a rational way the more fundamental problem of environmental control. This would involve a broad engineering analysis of environmental conditions, followed by measures designed not only to eliminate those factors which are harmful but to produce the conditions most favourable for health.

### The Population Problem

The present population of the world is estimated at more than 2,500,000,000 (UNO, 1952) and by the year 2031 it will probably reach 4,000,000,000. The population pattern is changing as a result of the increasing adoption of modern public health and medical practices. Infant and child mortality are decreasing, people are living longer, and the world's population, on the average, is becoming middle-aged. The increasing number of people and their increasing age (which means more adults and more family units) will require more food, more energy, more housing, more medical services, more educational facilities and more communications. All of this will place greater and greater demands on the world's physical resources which, in turn, means that these limited resources will have to be utilized more rationally in the best interests of mankind as a whole.

### Health and Housing

Although, in terms of both morbidity and mortality, the health of the world is improving, it is generally agreed that two-thirds of the people lack elementary medical and nursing facilities, basic sanitation, insect control and adequate maternal and child health programmes. This means that for approximately 1,500,000,000 people now living the need for such essentials as water distribution systems must be measured in millions of miles, for insecticide in millions of pounds, for doctors and nurses in millions, and for hospitals in tens of thousands.

Liberia, for example, has an average of one physician for every 63,000 inhabitants, one nurse for every 61,000 and one hospital bed to each 4,000 (Winslow, 1952). In Ethiopia (UNO 1952a) there is one trained physician for each 150,000 people and only 3,200 hospital beds to serve the country's 15,000,000 people. In Switzerland, on the other hand, there is a trained physician for every 700 inhabitants and there are 71,763 hospital beds for the population of 4,694,000. In Ethiopia alone, in order to bring the country up to Swiss standards, it would require more than 21,000 additional trained doctors and the construction of hospital facilities to house more than 225,000 hospital beds.

In the field of housing an even more unsatisfactory situation exists. The United Nations Tropical Housing Mission has estimated that more than 100,000,000 Asian families (and perhaps as many as 150,000,000) at present live in crowded, insanitary sub-standard quarters (ILO, 1953). The Department of Social Affairs of the United Nations has estimated (1952) that the total need for the world may mount to 180,000,000 family dwelling units.

### Water

It is apparent that the presence or absence of water, in many parts of the world, constitutes the difference between a thriving, prosperous community and an empty, barren desert. Irrigation in such countries as Egypt and India and specific projects such as the Gezira project in the Sudan are brilliant examples of the benefits of water use. But the potential advantages of adequate water supplies have barely been tapped, and even in such countries as England, which is normally assumed to have adequate rainfall, it has been estimated (Pirie, 1953) that large areas could benefit substantially by irrigation, with crop production of certain types increased by as much as 100 per cent.

From the point of view of hydro-electric power, it has been estimated by Simon (1951) that there is sufficient potentially available to take care of about one-third of the world's present consumption. So far, however, only about 10 per cent of this is being utilized. The remaining 90 per cent, will be more difficult and therefore more expensive to develop.

Water is considered by many scientists as the key to development. Economic supply in adequate quantities and of a satisfactory quality is undoubtedly one of the major problems facing mankind, and the development of the world's water economy will rapidly assume a greater and greater significance.

### Food and Energy

Although there has been a certain amount of guarded optimism regarding our ability to maintain world food production and the Food and Agricultural Organization has recently been quoted in The Times (September 14, 1953) as stating that: "World Food production has caught up with the growth in world population for the first time since before the war", it is evident that a great imbalance remains between supply and demand in most parts of the world. Most of the recent increases have taken place in a few countries such as Argentina, the United States, Canada and Australia, while many other areas such as the West Indies and India are still very short of their requirements. In

1950, for example, while the Canadian diet was estimated to consist of approximately 3,147 calories per caput per day, that of India was barely 1,600 (FAO, 1952). And, although the population of India increased by more than 60,000,000 from 1940 to 1952, grain production actually decreased (Forbes, 1952; see Figure III).

But the food problem is, in the final analysis, only a part of the larger problem of the world supply of energy, and from this angle the outlook is more hopeful provided that a rational approach is adopted. Energy, in the broad sense, is obtained from "recurring" sources such as plants ,animals, water power, fuel and wood, and from "irreplaceable" sources such as natural gas, petroleum and coal. It is evident that all energy, recurring and irreplaceable, is derived, or has been derived, from the sun.

An examination of the magnitude of the potential sources of energy available shows that solar energy (only a very small amount of which is used) is incomparably greater than all of the other sources of energy combined. For example it is estimated that in the United States, the energy striking the roof of an average house in one-half hour on a sunny summer day is enough to supply that house with heat, light and utilities for a whole year (MacNevin, 1953. An area of the size of Venezuela could, at present rates of consumption, supply the power requirements of the entire world. Atomic power, as yet impracticable but rapidly being developed, will greatly increase the potential of our irreplaceable resources, while the use of wind-power, tides, atmospheric electricity, the heat of the earth's interior and of tropical waters would also increase the amount of energy available.

### The Engineering Contribution

The rapid increase in world population and the universal demand for higher standards of living have been shown to be matters of urgent importance. With population increasing at a rate approaching 30,000,000 per year, the magnitude of this problem is apparent. While the problems created by the attempt to raise living standards are not so apparent, they are of the same magnitude.

Faced with this situation, more and more people are convinced that the fundamental solution is population control. Although this approach is a difficult one owing to the mass of religious, moral and social scruples which are associated with it, progress is being made, and it may not be too long before it will be possible to consider population control calmly, dispassionately and rationally.

But while population control becomes increasingly necessary in order to maintain the total number of people within the limits imposed by the capacity of the world to support them, there must, simultaneously, be a determined effort to increase the world's 'population capacity'.

Environmental and population control are, therefore, of equal importance. Population control, however, presents a great many social and cultural difficulties; the control and development of the environment, on the other hand, is already a soundly established practice.

In the actual application of engineering techniques, it is becoming axiomatic that they can be successful only if due consideration is given to all the agricultural, educational, social, economic and health aspects which are involved; unilateral development, based on any one of these disciplines, is doomed to failure from the beginning.

### Environmental Control by Engineering Means

Engineering, like medicine, is an applied science that has grown to include a wide range of specialties, all based on the correlation and adaptation of science to human needs. One of these special fields, sanitary or public health engineering, has been concerned with a particular human need, the control of disease.

A natural evolution in the development of sanitary engineering has been from a concentration on these aspects of environmental control which have a direct bearing on disease to a broader consideration of environmental control as it affects health, health being understood in its positive sense. This new concept may best be described as "environmental engineering". Although the basic principles of environmental sanitation remain, the restrictions imposed by the original limited concept of health have been broadened by the acceptance of the modern concept of health as including general, as well as physical, well-being.

The engineering problems involved in environmental control are universal in character, whether in highly developed areas such as the United Kingdom or the United States, or in such relatively underdeveloped areas as Nigeria or Nepal. While in the less developed areas the problems to be faced are of a more fundamental character and the environment is Nature herself, as economic development proceeds the problems encountered are more likely to involve those arising from by-products of man's misuse of Nature.

### Environmental Control Practice

#### *Water*

In considering the environment as a whole, water stands out as the major constituent which enters into almost every phase of man's life and activity. In particular, the shortage of water for domestic, agricultural and industrial use is one of the most serious technical problems of the present-day world, not only in the tropics and subtropics but in many parts of the temperate zones. The availability of adequate supplies of water would change the entire status of the Mediterranean area, of the arid zone of Australia, the South-western United States, Mexico and North Africa, and would raise living standards throughout the world. It has been said that the provision of water is the basic need which, if satisfied, would go a long way to assuring the acceptance and the maintenance of sanitation in those areas where it is now lacking.

#### *Climate*

Climatic factors include those such as wind, humidity, changes in temperature and the air itself. Our primary interest in these fields is concerned with providing man with protection from adverse climatic factors through housing and shelter, certain special problems in connection with clothing, the prevention of atmospheric pollution and, in some special cases, problems such as the fixation of atmospheric nitrogen.

In the field of housing, for example, it has proved difficult to obtain a direct correlation between the standard of housing and disease. This has limited the interest of public health personnel in the housing field. Considered from the broader point of view of comfort and convenience, however, there is a much greater scope for effectiveness, and there is every reason to believe that the health team could make a much greater contribution to housing standards than has heretofore been possible.

#### *Sunlight*

Sunlight, as has previously been pointed out, is the ultimate source of the world's power, both recurring and irreplaceable. The earth daily receives from the sun a potential quantity of power far in excess of all other forms of power, and this offers possibly the greatest single challenge to mankind in the rational utilization of the world's resources. Here again, from an engineering point of view, it would be valuable to examine this environmental factor from the health concept. Cheap sources of power are fundamental to the utilization of sea water for irrigation purposes through either distillation or dialysis; economic power sources in the tropics might prove to be the major technological advantage needed by these areas to put them on a competitive basis with the rest of the world as far as economic development is concerned.

#### *Biological Factors*

The living environment (excluding man) has been of concern essentially because of weeds, rodents, disease-carrying insects, and the cultivation of domestic crops and animals. Here again a variety of professional groups have of necessity developed to handle the many problems involved in this complicated field; again, however, the virtues of examining this problem from the environmental point of view are obvious. This would involve such problems as insect and rodent control, diseases of plants and animals, and the destruction of extraneous vegetation. The production of food in sea water, possibly in combination with waste disposal, is another major problem.

### Conclusion

The events of recent years give promise that man has within his grasp the scientific technique necessary to revolutionize the scientific control of the environment throughout the world. The work of medical pioneers such as Manson, Ross, Smith, and Gorgas has laid the groundwork for the present status of insect control; the brilliant work of British engineers on the Nile and in India complemented by the success in the United States of the Bureau of Reclamation, provides an inspiring example of man's ability to control floods and to turn destructive flood water to the useful purpose of irrigation. The outstanding work of the Colonial Service in such widespread areas as Mayala, Uganda and the Gold Coast is an impressive example of achievement in such fields as reforestation, education, agriculture and health; the more recent examples of planning and development in the Americas by the Tennessee Valley Authority and the Office of Inter-American Affairs are also noteworthy. Modern developments—combine to provide us with a previously undreamed of wealth of knowledge to tackle the problems with which we are faced.

# FROM MONTH TO MONTH

**Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers**

## Overseas Reception

It has become a custom over the last eight years for the Institute to hold a reception for its members in the United Kingdom whenever the president or a senior officer is in London on Institute business.

It began in 1946 when the then president, J. B. Hayes of Halifax, was attending the Conference of Commonwealth Institutions. In 1950 James A. Vance of Woodstock was there on his return from the next conference held in Johannesburg. He was then vice-president and president elect. The reception was held at the Institution of Civil Engineers. In 1952 L. F. Grant of Kingston, a past president and field secretary of the Institute, was there in his capacity as chairman of the Engineers Council for Professional Development. This time the reception was at the premises of the Institution of Electrical Engineers.

In 1954 the Commonwealth Conference was back in London, and D. M. Stephens of Winnipeg, president of the Institute, held the reception at the headquarters of the Civils. In all, about one hundred and forty guests attended. In the receiving line with the president were Mrs. Stephens, Past-President and Honorary Member, Dr. C. J. MacKenzie, the general secretary and Mrs. Wright.

As well as members of the Institute, there were many officers of British engineering organizations. Also several Athlone fellows turned out to meet their president.

The buildings of the British engineering institutions are suited excellently to social events of this kind. They have several halls and auditoriums from which to choose, and catering facilities are readily made available either by the institution's staff or by outside caterers. The Engineering Institute is fortunate indeed to have such excellent facilities available to it.

The record of attendance is not complete, but here is the list of those who accepted the president's invitation:

Dr. P. Dunsheath, Prof. Fred Webster, C. A. Abbott, E. H. Allen, R. E. Burridge, Capt. Jack Adams, R. B. Grimsdick, Brig. Bonn, S. R. Banks, A. O. Barrie, G. L. Bodwell, C. R. Boehm, F. W. Bruce, Sheldon Cherry, W. B. Dodd, John Duby, W. E. Erlebach, D. C. Floyer, D. H. Franklin, Peter Currie, M. G. Ionides, B. H. Colquhoun, C. R. Cruttwell; E. H. Harrison; G. F. Lloyd, A. S. Lowe, Capt. Guy Lefebvre, C. B. R. McDonald, Hugh MacKenzie, J. F. MacLean, J. E. D. McCord, Dr. F. G. Malloch, R. W. Marsh, G. A. Williams, T. R. Wingate, R. H. Hales, Col. A. J. Kerry, Capt. H. L. King, R. W. Foxlee, C. H. Oakes, H. H. Poulton, A. U. Schiach, P. Simpson, F. W. Slingerland, F. G. Tanton, Colin McCallum, Major W. A. McDill, G. Monkman, H. C.

**A part of the group attending the E.I.C. London reception.**

## Cover Picture

The cover picture shows eight of the twelve penstocks for the Sir Adam Beck-Niagara Generating Station No. 2, at Niagara. Each penstock will be 19 feet in diameter, 492 feet long and will weigh some 500 tons. They descend the cliff on a 60 degree angle. There are two papers on the Niagara hydro-electric developments in this issue.

*Ontario Hydro Photograph*

**Receiving overseas guests, (left to right) President D. M. Stephens and Mrs. Stephens; General Secretary L. Austin Wright and Mrs. Wright; Honorary Member C. J. Mackenzie and Mrs. Mackenzie.**

Morris, R. N. Morrison, Robert Mortimer, G. L. Phillips, W. J. De Coursey, Miss A. M. Vidal-Hall; D. H. Waller, D. T. Wright, David Watson; Dr. C. J. Mackenzie.

Commonwealth Conference delegates: W. P. Shepherd-Barron, A. S. Quartermaine, V. A. M. Robertson, Alexander McDonald, A. Bannister, Dr. R. W. Bailey, A. C. Hartley, Brian Robbins, Mr. Platt, Mr. Bispham, H. Bishop, J. Eccles, Col. B. H. Leeson, W. K. Brasher, and F. Jervis Smith, of Britain; C. W. Candy, C. H. D. Harper, of Australia; Major-General H. Williams, Prof. M. S. Thacker, India; R. S. Maunder, P. R. Angus, New Zealand; T. W. Longridge, Rhodesia; C. W. J. A. Sandrock, L. T. Campbell Pitt, Prof. G. R. Bozzoli, A. J. Adams, of South Africa.

## Engineers International Conference

A conference unique in engineering history took place in Brussels on June 11 and 12.

It brought together delegates from three international conferences who between them represented 75 per cent of all engineers in the world outside of the iron curtain.

The three conferences cover most of the engineering world outside the communist circle. They are the Europe and United States Engineers Conference known as "Eusec". The Conference of Engineering Institutions of the British Commonwealth, and the Pan American Engineers Conference known as "Upadi."

The object of this special conference was to consider the objectives of the three conferences in order to determine how they might be worked out together to better advantage, and to develop joint policies and activities by which the three organizations might become of increasing value in the national and the international fields.

The host for the occasion was the Royal Belgian Society of Engineers and Industrialists, and excellent hosts they proved to be. The business conferences were held in the society's offices, the Hotel Ravenstein — one of Belgium's most ancient palaces. This building is famous for many things, but from the British point of view, one of the most interesting is that Anne of Cleaves, one of Henry VIII's wives, was born there.

The social program included a visit to Brussels University, a reception by the Bourgomaster and Aldermen of Brussels in the world famous Brussels Town Hall. A tour of the Congo Museum at Tervueren, terminating with a formal dinner at the Galerie Louise.

The business accomplished by the conference will be reported on later, after approval of the Council of the Institute.

**Brussels Conference. Around this table sit delegates from engineering organizations in Great Britain, Canada, South Africa, Australia, New Zealand, India, United States, South America, Belgium, Denmark, Sweden, Austria, Finland, Italy, The Netherlands, France and Switzerland. The photo was taken in the Board Room of the Royal Belgian Society of Engineers and Industrialists. They represent three international engineering organizations, i.e. the Commonwealth Conference of Engineering Institutions, The European and United States Council (EUSEC), and The Pan American Conference of Engineering Organizations (UPADI).**

## The "Abstracts" Return

In the November, 1938 issue of *The Engineering Journal* a new feature was introduced under the heading of "Abstracts of Current Literature".

Articles in the leading technical journals of various countries were abstracted and published continuously until the end of 1943. At that time the restrictions on the use of paper by the War Time Prices and Trade Board necessitated a reduction in the size of the publication. As a result, the Publication Committee were obliged to reduce or delete certain features and the "Abstracts" section has been absent since that time.

For the past year or more it has been recognized that the publication of abstracts should again serve a useful purpose in providing the member-readers with a broader and more diverse range of technical literature. To this end, the Publication Committee authorized early this year, the preparation of a selected list of abstract material in order that publication of this feature could be resumed as soon as considerations of time and space would permit.

This time has now arrived and once again with this issue, "Abstracts of Current Literature" will be found regularly immediately following the technical papers section.

## National Industrial Design Competition

The National Industrial Design Council will again give awards to designs of merit in Canadian manufactured products in 1955. The judges for the awards, which will be presented next February have been selected and preliminary judging of entries will take place each month by a reviewing committee at the Design Centre, Ottawa. Serving on the main jury will be: Jean M. Raymond, vice-chairman National Industrial Design Council, Montreal; J. D. Ferguson, president, Canadian Manufacturers' Association, Rock Island, Que.; John Bland, director, School of Architecture, McGill University, Montreal; Mark Ely, president, Canadian Retail Federation, Toronto; Mrs. John Butterfield, chairman of the Consumer Research Section, Canadian Association of Consumers, Toronto.

Regulations remain unchanged and emphasis continues to be placed on pleasing appearance, functional efficiency, good value and suitability to Canadian needs. Only those designs which have been produced and marketed since July 1, 1953, may be entered. Further information can be obtained from the N.I.D.C. Office, 80 Elgin Street, Ottawa.

Last year 95 awards in as many different categories of production ranging from lighting fixtures and furniture to kitchen stoves and toys were given to 72 Canadian manufacturers. An illustrated booklet describing all the Design Awards has recently been published and is available to interested consumers and retailers on application to the Design Centre, Ottawa.

Many of the products selected in 1954 will be included in the official Canadian display participating in the Triennale exhibition in Milan this early autumn. This will be the first time Canada has entered this great international exhibition devoted exclusively to good design in industrial products. Canada's display has been prepared by the Canadian Government Exhibition Commission in co-operation with the National Industrial Design Council.

## "Clarkson College Convocation"

The American Society of Mechanical Engineers and The Engineering Institute of Canada have accepted an invitation of the Clarkson College of Technology to hold a convocation on "Trends in Mechanical Engineering Education." The program for this event is given on the opposite page.

We in Canada are indeed fortunate to have this opportunity of participating in such a gathering and it exemplifies once again the benefits arising from the close cooperation between the American Society of Mechanical Engineers and the Engineering Institute of Canada.

Because of the limited accommodation, attendance must be by invitation only and it is sincerely regretted that a meeting of such widespread interest must be restricted in this way. However every effort will be made to report fully on the findings and recommendations of the convocation in *The Engineering Journal* for the benefit of our members who are unable to take part.

PLUMMER MEDAL PRESENTATION

The recent annual dinner dance of the Sarnia Branch provided the opportunity to present to J. S. Moloney the Plummer Medal of the Institute. E.I.C. vice-president G. R. Henderson (left) made the presentation. The meeting is reported in "Branch News".

# ASME-EIC INVITATION CONVOCATION

## TRENDS IN MECHANICAL ENGINEERING EDUCATION

## CLARKSON COLLEGE OF TECHNOLOGY, POTSDAM, N.Y.

*October 6-7-8, 1954*

**FIRST SESSION—Can Present Mechanical Engineering Curricula be Improved?**

*Moderator:* Thomas D. Jolly, Vice-President, Aluminum Company of America, Pittsburgh

*Speakers:*

R. J. Askin, Vice President, Abitibi Power & Paper Co. Ltd., Toronto
E. G. Bailey, Chairman of the Board, Bailey Meter Company
E. A. Allcut, Professor of Mechanical Engineering, Faculty of Applied Science and Engineering, University of Toronto
C. Richard Soderberg, Dean of Engineering, Massachusetts Institute of Technology

**SECOND SESSION—Panel Discussion**—Messrs. Askin, Bailey, Allcut, and Soderberg

*Discussion Leaders:*

Henri Gaudefroy, Dean of Engineering, Ecole Polytechnique, Montreal.
George B. Thom, Chairman, Department of Mechanical Engineering, Newark College of Engineering, Newark, N.J.
H. N. Meixner, Engineering Dept., E. I. du Pont de Nemours & Co., Inc.
D. C. R. Miller, Director and General Manager, Dow Corning Silicones, Ltd., Toronto

**BANQUET**

*Presiding:* William G. Van Note, President, Clarkson College of Technology

*Addresses:*

Donald M. Stephens, President, EIC; President, Winnipeg Electric Company, Winnipeg; Chairman, Manitoba Hydro-electric Power Board
Lewis K. Sillcox, President, ASME; Honorary Vice-Chairman of the Board, New York Air Brake Company.

**THIRD SESSION—Dangers of Overspecialization in the Curriculum**

*Moderator:* A. G. Christie, Professor Emeritus of Mechanical Engineering, Johns Hopkins University, Baltimore

*Speakers:*

D. L. Mordell, Professor and Chairman, Department of Mechanical Engineering, McGill University, Montreal.
R. S. Sproule, Manager, Hydraulic Dept., Dominion Engineering Works Ltd., Montreal
Jess H. Davis, President, Stevens Institute of Technology, Hoboken, N.J.
Karl B. McEachron, Jr., General Electric Company, Erie, Pa.

**ACADEMIC CONVOCATION**

*Presiding:* William G. Van Note, President, Clarkson College of Technology

*Address:*

Ralph S. Damon, Chairman of the Board of Trustees, Clarkson College of Technology; President, Trans-World Airlines, Inc.

**DINNER**

*Presiding:* W. A. MacIntosh, Principal and Vice-Chancellor, Queen's University, Kingston
*Address:* "Post-Graduate Education in Engineering"
D. L. Thompson, Dean, Faculty of Graduate Study and Research, McGill University, Montreal

# First a Subway, Now an Expressway

The Municipality of Metropolitan Toronto, which came into existence only this year, has wasted no time in tackling its pressing problems. One of the more important of these is the relief of traffic congestion in the central part of the city. While Toronto's new subway, opened last March, will no doubt improve conditions a good deal, it will not affect some sources of congestion. More relief is needed, which it is proposed to afford by building an expressway along the lake front from the Queen Elizabeth Way in the west to Coxwell Avenue at the Woodbine Racetrack in the east, a distance of about nine and a half miles.

A report on this project was submitted to the Municipality's Co-ordinating Committee on April 26 last by Margison, Babcock & Co., consulting engineers, of Toronto; Associated with them were DeLeuw, Cather & Co., consulting engineers, of Chicago, and Norman D. Wilson, M.E.I.C., consulting engineer, also of Toronto. From this report we have prepared the summary which follows.

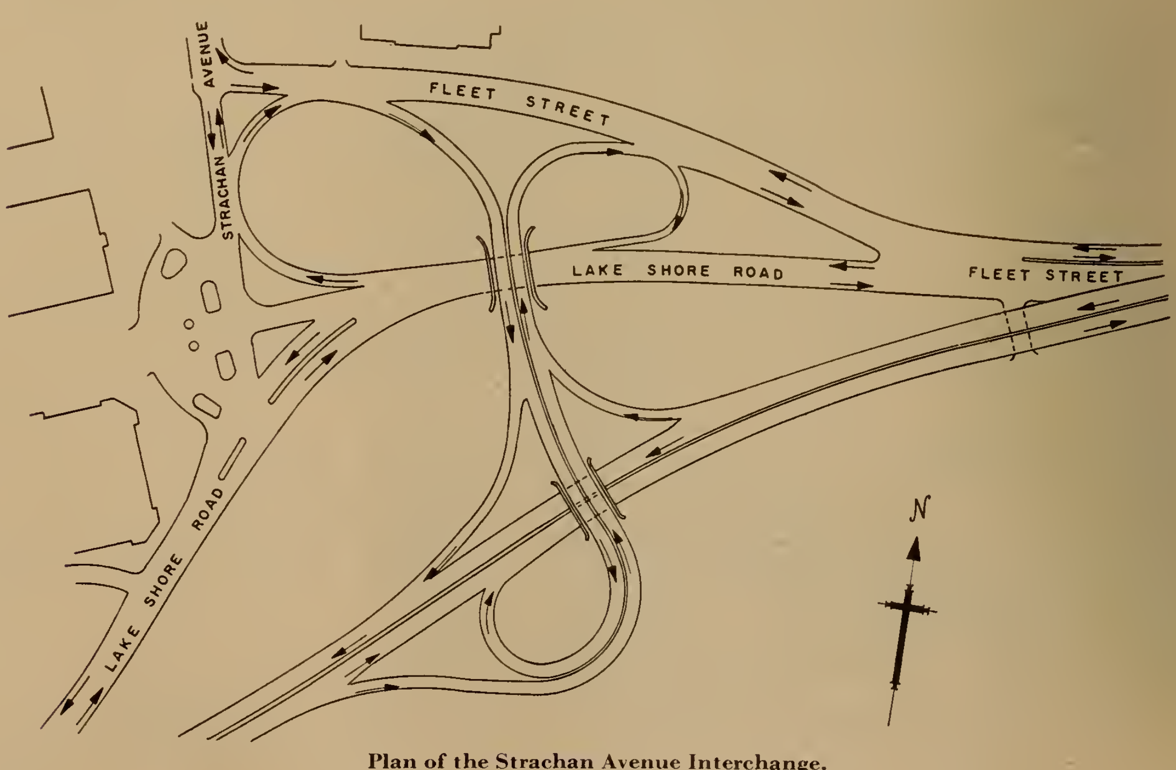
The idea of a throughway along the lakeshore is not new. As long ago as 1841 the Esplanade Plan provided for something of the sort as part of a lakeside park, but this scheme was upset by the appropriation of half the area concerned for a railway right of way. Following its creation in 1912, the Harbour Commission has tried to carry out its improvements with a throughway in mind. Actually, there is a major road development along the lake, which was planned with all the foresight possible at the time it was built and as far as available funds permitted, but it is woefully inadequate.

Predicted future traffic requirements, based on today's conditions, indicate that a total ultimate daily flow of 100,000 vehicles should be provided for and that this will require six traffic lanes, three in each direction with a separation strip between them. Attention was given to a non-separated, five-lane artery, which would be lower in cost, using the center lane for traffic one way in the morning and the other way at night. However, because of increased accident hazard, complications at inter-connections and for other good reasons, this scheme was abandoned.

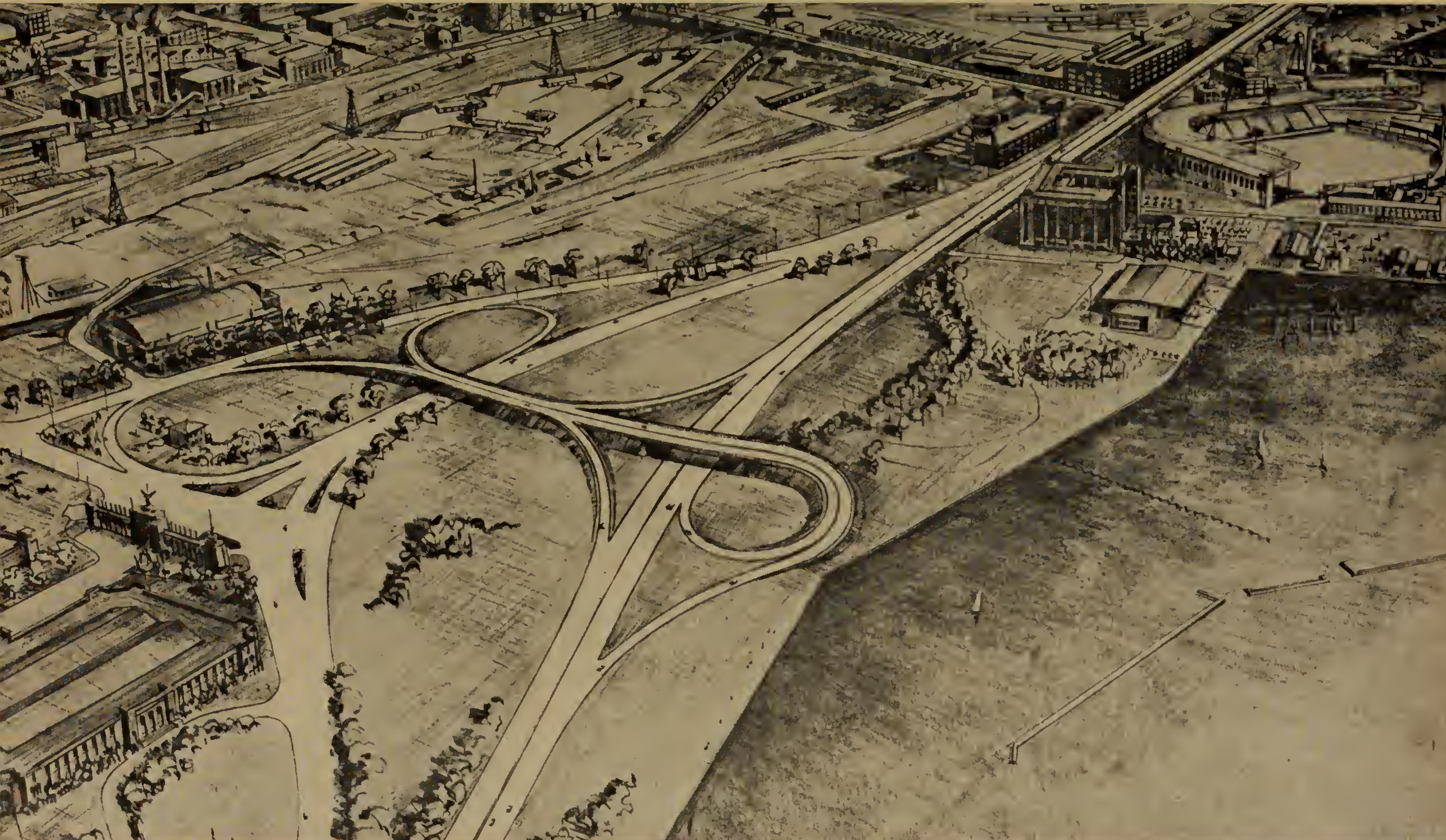
The expressway will be at grade where conditions allow, but from Bathurst Street to the Don River crossing it will be on a viaduct. Through the Sunnyside area and through Exhibition Park, it will closely follow the present Lake Shore Boulevard at grade, but elevated on fill at the Humber River, at Riverside Drive and at Jameson Avenue to accommodate interchange underpasses; there will be another interchange at Strachan Avenue. For further relief in this area, Queen Street will be extended from Roncesvalles Avenue westward across the Humber to the Queensway; the cost of this extension is included in the estimates for the expressway. Pedestrian overpasses for access to Sunnyside and Exhibition Parks will be provided. Through the latter the expressway will be located on fill between the existing seawall and breakwater and a new breakwater will be built.

The viaduct section will be over Fleet Street from Bathurst Street to Yonge Street and again from Parliament Street to Cherry Street; in the intervening section Fleet Street will be split into eastbound and westbound strips with the expressway between them, with parking facilities under the viaduct. From Cherry Street to the Don River the viaduct will be over private property. Thirteen ramp connections will be provided to the viaduct.

After crossing the Don, the expressway will continue on fill to




Plan of the Strachan Avenue Interchange.



The Strachan Avenue Interchange — from the air.

Logan Avenue and Morse Street, where there will be ramps. There will also be an interchange at the Don Roadway. Underpasses will be provided in this section for through streets.

East of Morse Street the route willl be at grade, with underpasses for Leslie Street and for the Keating Street extension. Like Fleet Street, Keating Street will be split into eastbound and westbound strips and the expressway located between them. At Coxwell Avenue a turn to the north will be made and the expressway will end. A diagonal connection across the Woodbine racetrack property to the Kingston Road is also planned, but this will interfere with the track itself and will probably not be built for some years to come.

Only enough detailed designing was done to afford a basis for reasonably accurate estimating, but the standards chosen are high and in line with those which have proved satisfactory for expressways already built elsewhere.

Eastbound and westbound lanes will be separated by a ten-foot median strip where the expressway is at grade, on fill or in cut and by a four-foot strip on the viaduct and on bridges. Traffic lanes will be twelve feet wide and there will be ten-foot surfaced shoulders, except on structures, where three-foot six-inch walks and railings will replace them. Guard rails will be used on all fills over six feet high. All curbs of the median strips and the outside curbs on structures will be non-mountable; at grade, on fills or in cuts outside curbs at the shoulders will be mountable.

Ramps are designed for single-lane passing or two-lane passing as estimated traffic volume may dictate, and have acceleration and deceleration lanes long and wide enough to allow safe entry and exit. Design speeds are 50 m.p.h. for the expressway and 30 m.p.h. for interchange ramps. There will be no traffic lights on the expressway.

Other details of design are:

| | |
|---|---|
| Maximum grades: | |
| On expressway . . . | 3 per cent |
| On ramps, . . . . . | 6 per cent |
| Minimum grades: | |
| At grade, on fill or in cut . . . . . . | 0.50 per cent |
| On structures, . . . | 0.35 per cent |
| Maximum curvature . | 6°30′ |
| Minimum radius of curvature without superelevation, . . . . . . . . | 4,000 ft. (1°26′) |
| Minimum length of horizontal curves . . . . | 500 ft. |
| Minimum sight distance, | 500 ft. |
| Maximum superelevation . . . . . . . | 1 in. per ft. |
| Minimum clearances: | |
| Over roadways . . | 15 ft. 0 in. |
| Over railways . . . | 22 ft. 6 in. |

At today's prices it is estimated that the cost of the expressway will be:

| | |
|---|---|
| Construction, . . . . . . | $32,758,000 |
| Right of way, . . . . . . | 6,852,000 |
| Relocation of roads, . . . | 1,796,000 |
| Alteration of utilities, . . . | 857,000 |
| Maintenance of traffic; engineering, park rehabilitation; central area parking; contingencies . . . . . | 7,541,000 |
| | $49,804,000 |

This report is a printed volume of letter size and 24 pages and includes 21 plates, most of them folding. We reproduce a plan of the Strachan Avenue interchange and the artist's conception of what it will look like when completed.

And the report is a credit to its authors. If and when its recommendations are implemented the east- or west-bound traveller by automobile, and commercial vehicles, will be able to pass through Toronto without interference from or interference with local traffic, and, of course, the expressway will bring many parts of metropolitan Toronto closer together in point of time.

# Columbia River Power

For forty-three years the International Joint Commission has been dealing with problems arising along the boundary between Canada and the United States. Most of them have had to do with boundary waters—the Chicago Sanitary District diversion from Lake Michigan, the use of water at Niagara Falls and the levels of Lake Ontario and of the Lake of the Woods—but there have been other problems, too, such as atmospheric pollution in Washington from the smelters at Trail, B.C.

The Commission's record is outstanding. Questions referred to it have at first sight often seemed almost insoluble, but thanks to the good sense and skill of the two sections of the Commission, Canadian and United States, and to the spirit of give and take shown by the disputants in the cases, solutions have been arrived at, which, if not entirely satisfactory to everybody, were at least the best under the circumstances and were accepted as such.

One of the most important matters now before the Commission has to do with power development on the Columbia river, much of the watershed of which is in Canada. Present developments on the river in the United States use flow originating in Canada under the hitherto accepted concept that the origin of flow is of little consequence; the concentration of head at any point confers the right to develop power at that point without upstream interference as regards flow.

The Columbia river watershed has a total power potential of about 34 million kilowatts. Some 60 per cent can be derived from heads and flows, including flows from storage, in the United States, about 20 per cent from heads and flows entirely in Canada and the other 20 per cent represents extra energy which can be developed in the United States from regulated flows from storage in Canada. The crux of the problem lies in this last one-fifth.

United States interests propose to build a power dam at Libby, Mont., which would raise the level of the river at the boundary by 150 feet and would flood it back into Canada for 42 miles. There would be about a million horse-power available at this site and the storage would add about 6 billion kilowatt-hours to the annual output of plants below it, some on the West Kootenay in Canada, but most on the Columbia in the United States.

This storage scheme involves international co-operation for its functioning and there are questions of compensation for flooding agricultural, forest and mineral lands and for the relocation of railways, roads and telegraph and telephone lines. Many buildings would have to be removed or replaced and cemeteries perhaps re-established. All these damages can be assessed and can be paid for in money.

The more difficult question is compensation for heads at downstream sites created by this storage in Canada and the regulated flow made possible by this same storage. The downstream interests wish to settle only in money; the upstream interests will not permit flooding and storage except for a proper share of the power produced by them. And here the matter stands.

To Canadians the position of the upstream interests seems just and equitable. Our Pacific coast area could, no doubt, use any money compensation to good advantage, but it needs, or will shortly need, additional power and money payments would not be too useful in that respect. We should not sell out for a mess of pottage.

In a speech delivered in New York on October 16, 1953, before the Engineers' Council for Professional Development, General A. G. L. McNaughton, chairman of the Canadian section of the International Joint Commission, said:

"I must forecast that this problem will not only trouble the International Joint Commission, but that it will also trouble many other people, until the situation clears and the lines of equity appear and are accepted. Meanwhile, it will be well to remember the vastness of the issues which are being determined in the Columbia basin and the vital consequences which the decisions will have on the future of industrial development and its placement, whether in Canada or in the United States. It will be well also not to forget Article II of the Treaty of 1909 and the physical fact that natural topographical advantages for the storage of water are assets just as real as are minerals from the mines and the products of the fields and forests. Actually, storage for water is far more precious than the most precious of mines, for the reason that the flow of water will go on forever, whereas minerals are a wasting asset, used up in being put to use.

It is most important that those concerned with power development on the Columbia, both in Canada and in the United States, should fully understand the conditions and the facts which I have mentioned, because the Treaty of 1909 is a binding agreement between our two countries and it is not to be expected that either country will give up its rights thereunder. I hope that the public of both countries may be fully informed, because public misinformation is the fundamental cause of misconception, and this breeds misunderstanding."

# C.E.A. Meets at Murray Bay

The Canadian Electrical Association's sixty-fourth annual convention was held at the Manoir Richelieu, Murray Bay, Quebec, on June 24, 25, and 26, 1954. More than 500 delegates from utilities, and manufacturing and engineering organizations from all parts of Canada were in attendance. A. M. Howard of Calgary Power was elected president for the ensuing year, with J. G. Dale of Canadian Utilities as vice-president for the Western Zone. V. A. Ainsworth of the Newfoundland Light and Power Co., and J. A. Page of Southern Canada Power were chosen as vice-presidents for the Eastern Zone.

### President's Address

President C. I. Bacon, in his welcoming address to delegates, pointed out that with requirements doubling every twelve years Canada will in another quarter century have used up all her natural hydraulic resources. This meant power must be secured from other sources, steam, diesel or atomic reactors.

Conventional fuel costs, he observed, will rise considerably over the next few decades. Without some competitive fuel coming in there will be no brake on the rise in fuel prices. Atomic energy supplies such a brake.

It was going to take courage, enthusiasm and some cold, hard cash to see this problem through, he said. Within five and ten years considerable power would be produced from atomic reactors. Just as coal consumption per produced kilowatt had been lowered from fifty pounds at first, to the present 7/10 of a pound, similar progress would be made in developing power from atomic reactors.

Calling attention to the growing foreign competition threatening to undersell Canadian products today, and undermining our high plateau of prices, Mr. Bacon warned that we must somehow get down from this high plateau, to face realities and still maintain as high a living standard as possible. More hours must be worked for the same or less money if our industries are not to be priced out of the market. Little had been done since the end of the war, he said, in reducing the cost of government. Some reduction could be made which would start a reaction towards achieving a stable economy.

### Power Costs to Rise Appreciably

"Canada's competitive position in the supply of electric power in industries will remain strong, though power costs are sure to rise appreciably in coming years." This was the opinion expressed by J. A. Fuller, president of the Shawinigan Water and Power Company. The cost of electric power was a basic element, whether small or great, he said, in the cost of all industrial production today.

Where power cost is a vital consideration, such as in the production of aluminum, Canada's position will remain excellent because of the undeveloped hydro-electric potential which, though remote, is often close to ore deposits or located at tidewater with easy access to raw materials and ocean transport.

In Pacific northwest states needs of secondary industries and domestic consumers would put prices out of reach of industries to which power costs are all-important, he explained. Vast resources of power for such industries exist in Quebec, the Yukon, British Columbia and Labrador. In time these would be developed, since at the moment there was no other source of electric energy at comparable cost.

In a second type of industry, that in which power cost is significant but may be outweighed by other items such as transportation cost, Canada's position is not so strong, Mr. Fuller continued. "I therefore believe we are less likely than in the past to see new plants in this type of industry locate in Canada, at least where they look elsewhere for markets for their products," he said.

In a third class of industry, where power is a relatively minor element of cost, such as in automotive, implements, electrical apparatus, textiles, clothing and petroleum products, Canada's position will remain good because our power prices will long remain lower on the average than those, for instance, in the United States.

Annual cost of hydro power in an investor-owned plant was 65 per cent for carrying charges and only 35 per cent for operating expenses and depreciation, he stated. Carrying charges had increased rapidly in recent years. With thermal plants 35 per cent of the cost was for carrying charges and the balance, half of which was fuel cost, went for operation and depreciation. The cost of energy from the modern thermal plant close to its source of fuel approached closely the cost of energy from a hydro plant more than 100 miles from load centres.

"Thermal plants will undoubtedly occupy an increasingly important position in Canada," Mr. Fuller predicted, "because of the lessened advantage of hydro production, but also because of new sources of energy in Canada, particularly oil and gas, with the possibility that atomic fuel will someday become competitive."

### The Demand for Power

The vigorous programs being carried out to meet Canada's power demands over the next decade were outlined in a symposium on "The Demand for Power", by leading utility engineers and executives. Speaking for British Columbia, T. Ingledow, vice-president of British Columbia Electric, cited several good hydro sites still undeveloped close to population centres, such as the Cheakamus river with 200,000 horsepower within 50 miles of Vancouver, and the Fraser with 3 million horsepower of potential power within 250 miles. In the Pacific northwest the U.S. was looking to Canada for help with water storage. Such storage rights could be traded for power in perpetuity. British Columbia's total potential capable of development was 10 million horsepower, he said, to which could be added another 5 million horsepower from the Yukon river by diversion through British Columbia.

### Prairie Provinces

The situation in the Prairie Provinces was described by W. D. Fallis, general manager, Manitoba Power Commission. Power requirements for Alberta to 1964 indicated a steady increase to an anticipated installation of 840,000 kilowatts. This would mean an increase of 528,000 kilowatts or 169 per cent over installed capacity in 1953.

Saskatchewan, he said, lacked economical water power resources. Its main resource of thermal fuel, low grade lignite coal, was located in the extreme southeast corner of the province. But the current search for oil and gas may change the picture quite rapidly. Demand, he predicted, would increase nearly threefold in the next ten years to approach a total of 440,000 kilowatts, up 300,000 kilowatts from today.

Rapid growth of demand in Manitoba would soon have used up all the resources of the Winnipeg river, said Mr. Fallis. The province is now planning a considerable increase in steam generated power as the next most economical step prior to developing northern rivers which are at a disadvantage due to their distance from load centres. From a 1943 peak demand of 435,000 kilowatts, a 109 per cent increase to 910,000 kilowatts is expected by 1964.

### Central Provinces

"In Ontario, St. Lawrence power is the last remaining major hydro site in Southern Ontario, and power from it would be required by December 1958," stated Dr. R. L. Hearn, general manager and chief engineer of Ontario Hydro. With this development completed, additional power will be needed by 1961 if a reasonable reserve is to be kept. Under study are additional sites in Northern Ontario and additional fuel electric plants using coal, oil or gas, and nuclear power plants, he said.

"Quebec will require 8,750,000 horsepower by 1960. Completion of the Bersimis project will just about meet this demand," stated Dr. Huet Massue, of Shawinigan Power Company. Per capita production of energy in Quebec is already 50 per cent higher than in any nation in the world, due mainly to particular requirements of the pulp and paper industry and the smelting and refining of aluminum.

### Maritime Provinces

J. L. Feeney, chief engineer, New Brunswick Electric Power Commission, referred to the widely held impression that his province lacked power resources. "Certainly we have no Shipshaws or Niagaras," he declared, "but we have substantial amounts of potential hydro energy and coal fields which jointly provide reliable power at a reasonable price."

He referred to a recently competed study of the Saint John River which showed a grand total of potential from six sites of 536,000 kilowatts. The Commission's present installed capacity is 107,500 kilowatts, while for 1960 the estimated peak will be 140,000 kilowatts. To meet this demand the partial development of a 68,000-kilowatt site at Beechwood is contemplated.

W. G. Macdonald, chief engineer of Nova Scotia Light and Power Company, said his province would depend on steam, gas turbine or diesel for new electric resources. Atomic power may be expected to follow. Some 117,000 kilowatts additional capacity would be required over the next ten years.

Listing presently developed power resources in Newfoundland and Labrador, both public and privately operated, totalling some 285,000 horsepower, Eric Hinton, of Bowaters Newfoundland Pulp and Paper Mills Ltd., estimated a load growth of 15 million kilowatt hours per year in the Avalon peninsula. Paper mills and surrounding areas would require an additional 30,000 kilowatts in the next decade. Rural electrification would be an important factor in the future power requirements, he stated.

### Light's Diamond Jubilee

"This year the electrical industry, through Light's Diamond Jubilee, are honouring the memory of a man whose achievements made the industry possible," said Walter H. Sammis, president of Ohio Edison Company and immediate past-president of the Edison Electric Institute. "Thomas Alva Edison's invention of the light bulb started a chain reaction that has had a profound impact on the social and economic life of the world."

"Electricity is truly the servant of the people," said Mr. Sammis; "it is a bright, cheerful and instantly responsive servant, tireless, able, multi-skilled, does not watch the clock, asks no time off, never complains about too many little monotonous jobs, nor balks at herculean tasks. Unlike other servants, it asks for very little pay."

Production of electricity in Canada, he stated, had multiplied 3.6 times in the last 25 years and installed capacity of central electric stations about three times. The residential use of electricity is still the largest component of the power load and is growing rapidly.

As an example he pointed out that 25 years ago there were nineteen types of home appliances on the market; today the list adds up to 54 and is still on the increase. "I venture to predict," he added, "that achievements which today appear to us very advanced, may seem quite archaic to our successors, and perhaps in a shorter time."

Recalling some of the developments of the early "nineties" in the electrical industry in Montreal, C. A. Morrison, vice-president of Canadian General Electric, told delegates that 'Edison's key invention broadened the horizons of the industrial revolution almost infinitely. It was the 'time fuse' that released new industries, basic changes in the ways of getting the world's work done, and fundamental adjustments in our lives and human comforts."

**The Investor and the Utility Industry**

E. R. Alexander, vice-president and treasurer, Sun Life Assurance Co. of Canada, told members that the institutional investor, who today provides the bulk of the capital for public utility financing, assessed the value of utility securities under six headings: economic conception, technical requirements, engineering soundness, public relations, financial structure and quality of management. "A good mark in five out of six," he said, "is not enough to pass."

The electric business was one of what economists call "increasing returns." Increasing use cuts unit cost. Since the war, however, inflation with its rising prices and costs had outrun the effects of increasing volume and technological progress. "There is no defence against a rubber dollar except a rate structure with some elastic in it," he warned.

In Canada there is no solid basis for rate regulation. There is considerable legislation and a long background of regulating activity. However, both these can be changed, and the fundamental constitutional guarantee of property rights that in the U.S. limits an intransigent regulatory commission is completely lacking. Thus the investor can rely only on the record in assessing the likelihood that a utility will be forced to exist on a starvation diet.

Disappearance of the gold standard had obliterated the old automatic restraint on excessive expansion, continued Mr. Alexander. Politicians have not been slow to realize how powerful a weapon is placed in their hands. Everyone likes full employment, production and purchasing power. To the party interested in continuing in office this means we should have perpetual over employment and boom conditions. "This," he pointed out, "is why we have had, until recently no perceptible business let-down for fifteen years, but the cost includes a 54 cent dollar in terms of 1939. Responsibility for this disturbing situation lies largely in the principal national capitals."

There are two things we can do about it. We can arrange our investment portfolios to provide an incomplete measure of protection against a depreciating dollar. Secondly, we can preach, and within limits, practice sound finance.

"I am convinced," he concluded, "that we would be better off with an economic structure into which a $4\frac{1}{2}\%$ interest rate for high grade corporation bonds fitted better than a $3\frac{1}{2}$ per cent rate. The effect of this slightly higher rate of return on the customer's bill is a negligible contribution for him to make in return for a monetary policy conducive to stability in the value of the currency."

**Rate Policies for the Future**

"Today in Canada and the United States certain provincial and most State governments have commissions with the right to regulate utility rates within their boundaries. In the States where operations cross State lines rates, financing and accounting also fall under the jurisdiction of the Federal Power Commission", stated Robert S. Quig of Ebasco Services Inc., in an address on "Rate Policies for Adequate Public Service."

In 1922, in its famous Bluefield opinion, the U.S. Supreme Court said: "A public utility is entitled to such rates as will permit it to earn a return on the value of the property . . . equal to that generally being made in the same general part of the country in other business undertakings . . . but it has no constitutional right to profits such as are realized . . . in highly profitable enterprises or speculative ventures. The return should be reasonably sufficient to assure confidence in the utility's financial soundness, and . . . adequate . . . to maintain and support its credit . ."

"Under existing regulatory standards," said Mr. Quig, "you may have a legal right to a fair return. No method of regulation, however, guarantees that fair return, and it is up to your operators to earn that return. Thus no rate or price can be set and left alone."

Rates require careful planning and watchful administration to see that they are reasonable and adequate. The whole industry and our customers are today beneficiaries of what yesterday was classed as a revolutionary or untried venture. This kind of risk taking in rate making must continue, he said, if we are to develop to the utmost our abilities and our markets.

The customer expecting adequate service must be informed regarding the importance of adequate rates, and rate policies must be geared to future system planning and revenue requirements, continued Mr. Quig. Regulation must recognize that the best service is not necessarily the cheapest service. Adequate pricing of utility service requires more than the cost accounting approach.

The customer's interest is closely tied to the investor's interest. An adequate return must recognize more than the mere cost of capital. Regulatory commissions must be informed of changing economic facts. In the words of Mr. Justice Frankfurter: " . . . the process of rate making is essentially empiric. The stuff of the process is fluid and changing . . . the resultant of factors which must be valued as well as weighted."

Looking ahead, there is a big job to be done, the speaker concluded. Future rate policies must consider that peak load requirements will double in ten years; that management, materials and money will be needed in ever increasing amounts; that maximum responsibility will be placed on management to provide the service so necessary to our way of life; employees will have to be better educated, and customers better informed as to the value of the service; and regulators will have to review and revise those regulatory standards and interpretations that will be detrimental to a broader concept of adequate public service.

# *Thirty-five Years Ago*

## Comment on the *JOURNAL* of August 1919

Every editor wishes he had that kind of foresight which would permit him to select for publication not only those articles which are of current interest, but also those which will be of more or less permanent value. The former is easy, the latter more difficult, for editors are no better prophets than the rest of us. In 1919, however, the editor of the *Journal* had two topics which forced themselves upon him; one was the effort of engineers to improve their professional status through legislation, a matter which presumably could be settled sometime fairly definitely, and the other was engineers' salaries, which bade fair to be a subject for continuing discussion.

That part of the August, 1919, *Journal* which was given over to the discussion of Institute affairs shows just how important these two matters were then. First, let us see how the struggle for better working conditions for engineers in the Civil Service was progressing. It was disappointing to learn that the Civil Service bill, to the drafting of which the Institute has contributed so much, failed to get to the floor of the House and so would be held over until its following session. But at least the bill was introduced.

This bill was noteworthy for the wide powers it gave the Civil Service Commission. Among other things, under it the Commission would be able to reclassify federal employees from time to time without special legislation in each case. Thus it would in future be much easier than formerly to adjust duties and salaries in keeping with the changes which were sure to take place as Canada grew.

The classification itself was prepared by Arthur Young & Co., of Chicago. We wonder if the retention of this firm caused as much unfavourable comment then as it probably would now. It is quite possible that there was not then any Canadian firm competent to make such a classification, in which case the Government could be excused for going abroad for help.

"Information as to the duties of an office was obtained by means of questionnaires . . . (Then) a tentative classification was adopted for each position . . . ; departmental lines were eliminated . . . (and) the first schedule was drawn . . ." The principles underlying the schedule of salaries were that:

1. Rates of pay should be the same for the same work;
2. They should be relatively right for different classes;
3. They should be fair to the employee and also to the taxpayer;
4. Each salary should provide a minimum and a maximum;
5. Salaries should not be based on the depreciated dollar of 1919;
6. In many cases, a war bonus should be paid in addition to salary.

There was a good deal of criticism of individual items of the schedule, though it was hailed as a great improvement over existing conditions. "Technologists . . . (will) begin their careers at widely differing rates of pay, according to the subjects in which they have graduated . . . There are undoubtedly many changes which should be made . . . (but this is) a great step in advance, and if carefully revised in the light of more detailed information and intelligently applied to the personnel; it should greatly improve the status of engineers . . ."

The *Journal* offered a quasi-apology for not reporting the results of the letter ballot of members on the proposed model licensing act; the scrutineers had not been able to complete their work in time for publication. In the meantime, individual members and the branches were giving the act a good going over. In a long letter, C. C. Kirby defended and explained the act; it will be remembered that he wrote in July along the same lines. Another correspondent objected principally to the use of the term "professional"; he preferred "registered." "Professional engineer is undignified and foolish, for all persons who earn a livelihood by any particular vocation or trade are professionals, such as professional hair-cutters, professional prize-fighters, professional golfers, etc." Among the branches, Sault Ste. Marie added its support to the model act by passing an appropriate resolution.

But at this time most of the branches seemed to have other things on their minds; many of them, of course, had already endorsed the model act. Saint John and Montreal heartily supported the Government's proposal to set up a National Research Institute. Saint John's committee on the remuneration of engineers was circulating questionnaires among the branch members, asking for salary data. A special committee of the Ottawa Branch, which had been "lobbying" for the Civil Service bill — in a perfectly legitimate way, of course — was preparing to become even more active when the bill should reach the debate stage in the House.

The account of Council's July meeting showed nothing but the routine admission and promotion of members.

Not the longest, but perhaps the most interesting, paper in this *Journal* was F. A. Bowman's "Effects of the Halifax Explosion on the Telephone Plant and Service." The explosion occurred at 9.05 a.m., December 6, 1917, when the S.S. *Mont Blanc*, laden with 5,000 tons of explosives, blew up in Halifax harbour. The results to the city were disastrous, as everyone whose memory goes back that far will recall. Telephone service at that time was already disorganized, because of a blizzard of wet snow and rain which had hit the province four days earlier; the explosion put the finishing touch to an unhappy situation, not made any happier by another blizzard on December 7.

At first, telephone service was completely crippled, but the Lorne exchange got back into partial operation four hours after the disaster, though one of its walls had to be shored up and falling plaster and trim were still menaces. Windows and doors were blown out in the St. Paul exchange, but the equipment was not seriously damaged. Pretty much the same things happened to the Harbour exchange. Outside plant was thoroughly wrecked; one and a half miles of aerial cable, 19 miles of twin rubber-covered wire, 16 miles of bare wire and both submarine cables across the harbour to Dartmouth were destroyed. Most long-distance service was cut off.

The first job was to get the operators back to work. Many lived or had relatives in the devastated area, so had to leave for a time at least. ". . . To their eternal credit be it said, the great majority came back as soon as they could, many of them with very sad hearts . . . Everyone . . . who knew anything about operating was called to the boards . . . Two operators were killed . . ."

In addition to restoring regular service, extra service had to be given to the railways, to the Red Cross and to various relief agencies, 135 of them in the end. By the end of the next day, a toll line to Saint John was set up by a roundabout route and a little later on, one to Boston, over which the Associated Press sent out the first complete story of the disaster. One good cable was made out of the undamaged parts of the two to Dartmouth, and another, fortunately on hand, was laid, too. Material was rushed to Halifax from the stores of suppliers and from other telephone companies and outside line was restored as soon as possible.

"Then came the reaction. Nobly as the (operators) had stuck to work in the crisis, they sooner or later had to think of themselves . . . Some broke down and resigned . . . Some . . . came from the country . . . and went . . . home . . . The same difficulty was met among the men . . . Military service took away a large percentage, whose places had to be filled by . . . inexperienced boys."

It is hard to imagine what conditions must have been like. Mr. Bowman did not soft pedal the company's troubles, neither did he exaggerate them, but one may read between the lines of his paper and infer that he put his best foot forward. It is doubtful if the *Journal* has ever published anything of more human interest.

Mr. V. I. Smart in "The Operation of Railways as an Engineering Problem" takes 12 pages, with numerous illustrations and numerical examples to prove his thesis, that more engineers in railway operating departments were needed. He seems to make a pretty good case and ends his paper by saying, "Is it not fair to conclude that the services of (the) engineer in the transportation department would be a decided advantage to all concerned, and that methods of increasing the loading of cars and engines, the saving of lost time on the road, the prevention of capital expenditures before they are strictly necessary, and the general increase in efficiency in means and methods, would result?"

We have heard a good deal about our natural resources lately, but the subject is not a new one. "The Resources of Western Canada", by Dr. R. C. Wallis, Commissioner for Northern Manitoba, was as optimistic as anything written in this year of grace of 1954 by Canada's biggest booster, who, by the way, was probably someone from south of the border; Americans seem to be more lyrical about our resources than we are ourselves. "Much of the reward that Ontario already enjoys will be the portion of (Manitoba) . . . Saskatchewan is *par excellence* the agricultural province . . . In Alberta there is a greater variety of wealth; . . . notwithstanding the comparative non-success of the . . . search for oil . . . there is yet a future for Alberta as an oil country . . . British Columbia came into being as a mineral country . . . but (it) does not now depend on its mineral wealth alone . . ." Who could have done better than Dr. Wallis?

## News of Other Societies

The 1954 triennial reunion of the **Engineering Alumni of the University of Toronto** is to be held in Toronto on October 29, 30, and 31, at the Royal York Hotel.

The 1954 gathering will be the largest ever and arrangements have been going on for some time so that the 3-day event will be an outstanding success. The program will include an industrial tour, class luncheons, business meetings, stag dinner and evening, dinner party and dance. Saturday afternoon football game (Varsity and McGill), and special entertainment for the ladies.

Every University of Toronto Engineering Alumni member will receive complete details with an advance registration card, toward the end of the summer.

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A recent review of the history of the **Institute of Administration** (1549 Burnside Place, Montreal) reported its progress and its activities since the work of a small group of Montrealers interested in management and administration brought about the first general meeting of the Institute in January 1939. Prof. J. A. Coote was the first chairman; T. M. Moran, vice-chairman; C. H. Fraser, secretary-treasurer. The group was limited to 30.

Members took their duties seriously and many worthwhile papers resulted; four volumes of papers were published, beginning in 1947. The Institute was instrumental in the establishment of an extension course in management and administration at McGill University. This course was carried on for five years, with a total registration of several hundred, and with Professor Coote teaching. Some of its graduates are active in the work of the Institute.

Those who have served as chairman of the Institute are: C. A. Peachey, J. H. R. Robertson, H. A. Wilson, S. W. Fairweather, George Henderson, J. A. Calder, Huet Massue, D. L. Adams, J. E. Dion, J. G. Campbell.

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In recent months, members of the **Institute of Marine Engineers** have been meeting in Toronto with a view to forming a Great Lakes Section.

The Institute is a world-wide organization, originating in England in 1889. Membership is comprised of all those who are connected with marine engineering in any way, and the aim of the Institute is to advance the profession of marine engineering in all its fields and phases.

Information about the new Section can be obtained from T. M. Pallas, 165 Lakeshore Blvd., Toronto, Ont.

A series of major events developing the theme of the "The Engineer's Place in Our World" will be conducted in 1955 to mark the 75th anniversary of the **American Society of Mechanical Engineers** (29 West 39th Street, New York 18, N.Y.).

Dr. Jess H. Davis, president, Stevens Institute of Technology, who is chairman of ASME's 75th Anniversary Committee, has announced that the areas of inquiry will concern "the engineer and his relationship with the world in which he lives and works: not just the mechanical engineer—and not just his contributions to his fellow man—but all engineers, and the entire pattern of relationships between engineers and the rest of the world."

The anniversary date of the founding of ASME will be observed on February 16, with a commemorative ceremony in the offices of the McGraw Hill Publishing Company, a panel discussion at the Engineering Societies Building, on the theme, "The Engineer and His Communications", and a banquet featuring a major address on communications.

The second special meeting on April 7 on the campus of Stevens Tech., Hoboken, N.J., will consider "The Engineer and the World of Education". This gathering will commemorate the first organization meeting of ASME, also held at Stevens, at which Professor Thurston was elected first president of the Society.

A meeting in Baltimore, Md., April 18-21, will centre around a discussion of "The Engineer and the World of Government". Another in Boston, Mass., June 20-23, will have two panels treating of "The Engineer and the World of Science". The fifth national anniversary meeting will take place in Chicago, Ill., November 13-18, and will be devoted to discussion of "The Engineer and the World of Commerce and Industry".

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There will be a Summer Institute of Nuclear Physics in Engineering Education at Northwestern University, Evanston, Ill., September 7-11, 1954. Open to physics and engineering educators, and with attendance limited to 150 persons, the conference is sponsored by the American Society for Engineering Education, the American Institute of Physics, the National Science Foundation, and Columbia and Northwestern Universities. For information write to Professor Robert L. Young, Technological Institute, Northwestern University, Evanston, Illinois.

The eighth National Chemical Exposition to be held in the Chicago Coliseum, October 12 to 15, 1954, will be sponsored by the Chicago Section of the **American Chemical Society** (86 East Randolph Street, Chicago 1, Ill.).

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The Corrosion Congress of 1954 will be carried out by the Working Party on Corrosion, in Frankfurt (Main) on November 11 and 12, 1954. This congress will also form the annual general meeting of DECHEMA (**German Chemical Apparatus and Equipment Association**, Frankfurt (Main) W.13, Postfach, Rheingauualle 25). The Working Party on Corrosion which held its last meeting as an international body in 1943, and is resuming activity for this congress, is formed of representatives of the leading German scientific and technical societies.

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The third Salon de la Chimie et des Matières Plastiques will be held at the Parc des Expositions, Porte de Versailles, Paris, from December 3 to 12, 1954. Four complementary exhibitions, will be devoted to laboratory equipment, chemical products, chemical engineering, plastics industry.

# Elections and Transfers

At the meeting of Council held in Montreal, on Friday, July 30, 1954, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

*Members.*

R. C. Adams, *Cornwall*
W. S. Allen, *Montreal*
L. P. Blaser, *Toronto*
C. P. Bradley, *Sarnia*
H. W. H. Casperd, *Toronto*
B. Cooper, *Vancouver*
A. B. Danard, *Montreal*
P. C. Garsonnin, *Montreal*
G. Glinski, *Ottawa*
J. Gyulveszi, *Tillsonburg*
B. C. Halley, *London, Eng.*
H. C. Hood, *Montreal*
G. L. Houghton, *Montreal*
C. M. J. W. Kohler, *Toronto*
M. J. Kruzynski, *Montreal*
F. J. Langer, *Montreal*
J. C. E. Lowcock, *Toronto*
R. Macrae, *Toronto*
R. J. Marriott, *Ottawa*
R. D. Mawhood, *Sherbrooke*
I. W. McCaig, *Niagara Falls*
J. P. McLaughlan, *Corner Brook*
W. E. Mercer, *Fort William*
S. J. Menich, *Kitchener*
D. G. Miller, *Ottawa*
J. S. Moloney, *Sarnia*
F. Petricek, *Clarke City*
E. I. Rubinsky, *Ottawa*
P. D. Smith, *Toronto*
R. C. Smythe, *Montreal*
R. L. Snitch, *Coniston*
E. G. Taylor, *Toronto*
J. A. Whelihan, *Lethbridge*
F. G. York, *Ottawa*

*Juniors.*

R. J. Arnold, *Calgary*
D. S. Bate, *Sarnia*
P. Beyeler, *Grand'Mere*
J. F. G. Bockstael, *St. Boniface*
R. Burns, *Toronto*
W. D. Croft, *Shawinigan Falls*
R. P. Crawford, *Sudbury*
A. Darragh, *London*
M. J. J. Dembinski, *Montreal*
H. J. Edens, *Toronto*
M. C. Edwards, *Toronto*
L. J. O. Holmes, *Sheffield, Eng.*
J. L. Hope, *Niagara*
F. E. Jones, *Sarnia*
J. A. Kane, *Montreal*
G. T. Keys, *Kingston*
R. W. Luchtenstein, *Goose Bay*
H. D. McPhee, *Glace Bay*
G. E. McIntyre, *Pickering*
W. G. Miller, *Amherst*
E. W. Petzold, *Toronto*
G. F. Pharo, *Kenogami*
D. R. Rae, *Montreal*
R. C. Roll, *Montreal*
J. N. Schilizzi, *Shawinigan Falls*
H. W. R. Smith, *Labrador*
O. Spijkerman, *Amherst*
W. Taciuk, *Brandon*
C. J. T. Van Leeuwen, *Montreal*

*Affiliates.*

L. A. Cox, *Montreal*
L. G. Ogilvie, *Montreal*
T. M. Parr, *Toronto*

*Transferred from the class of Junior to that of Member.*

A. E. Beazely, *Calgary*
H. B. Brock, *Montreal*
E. O. Butts, *Port Hope*
K. L. F. Coupland, *Ottawa*
H. K. Craibbe, *Hamilton*
M. M. Davis, *Toronto*
M. J. J. Dayton, *Vancouver*
H. Dederer, *Winnipeg*
C. M. Douglas, *Vancouver*
H. G. Dutz, *Edmonton*
J. R. Gregory, *St. Catharines*
G. Grenier, *Montreal*
F. C. Hamata, *Calgary*
J. R. Hazle, *Shawinigan Falls*
R. L. Hicks, *Toronto*
H. J. Hoseason, *Toronto*
Y. Kato, *Montreal*
C. H. Killoran, *Niagara Falls*
Y. H. O. Lee, *Niagara Falls*
J. A. Legris, *Toronto*
R. J. Leigh, *Toronto*
J. A. McKinnon, *Vancouver*
M. J. Nimmo, *Vancouver*
I. Orloff, *Kingston*
A. V. Overend, *Toronto*
H. H. L. Pratley, *Montreal*
R. G. Ryan, *Montreal*
A. W. Skene, *Sarnia*
S. Stoller, *Los Angeles*
P. J. L. Troalen, *Montreal*
E. C. M. Tuff, *Toronto*
D. L. Turner, *Malton*

The following Students were admitted:

*University of British Columbia*

T. R. Bagot, G. E. B. Nixon
L. M. Harper, W. D. Rion
J. Huva, E. W. Scratchley
R. J. Kania, W. H. Taylor

*University of Alberta*

H. T. Andersen, R. M. Morison
S. G. Howard

*University of Toronto*

R. G. Aishford, H. W. Cunningham
W. G. Banner, C. C. Henderson
P. B. Buchan, K. L. Murphy
D. A. Buchanan, D. C. Patel

*McGill University*

P. E. Bieler, N. Dodis
P. H. Butler, E. L. C. Miller
J. Dlouhy, D. C. Patel

*Queen's University*

R. F. Doughty, S. M. Jones
J. H. Ferguson, G. H. Walker

*Nova Scotia Technical College*

D. P. Andrews, L. D. Martell

*Mount Allison University*

J. L. Cutcliffe, W. R. Lowther
D. F. L. Hamilton, H. C. J. Webb

*University of Manitoba*

L. D. Arthurs

*University of New Brunswick*

J. H. White

*University of Detroit*

E. Halas

**Applications through Associations:**

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

ALBERTA

*Members.*

L. G. Alexander, E. L. M. Ryll
M. L. Coulson, H. S. Sparrow
G. Ross, P. D. J. Vinkenborg

*Junior.*

D. Bing-Wo, W. C. Sellehs

*Junior to Member.*

R. B. Butler, B. C. Van Hees
K. S. Smith

*Student to Junior.*

A. R. Towell

SASKATCHEWAN

*Members.*

A. C. Anderson, F. G. McBean
F. W. Bigsby, D. W. Organ
P. S. Friesen, D. C. Rotherham
W. H. Griffin, C. R. Usher
E. D. Johnson, Z. Wolski

*Junior.*

D. W. van Es

*Student.*

C. L. Slegel

*Junior to Member.*

E. W. G. Bodrug, J. T. J. Raleigh
J. A. Bryan, J. S. Sugiyama
J. M. Crook, B. L. Walsh

NOVA SCOTIA

*Members.*

R. L. Alexander, R. E. Wallar
W. L. Griffin

*Junior to Member.*

R. C. Bezanson, G. H. Love
A. A. Bruce, W. T. Windeler
J. J. Kinley

NEW BRUNSWICK

*Member.*

W. E. Jarratt

*Junior to Member.*

A. L. Bond, A. E. McDevitt
F. V. Maddox

# The ASME Boiler Code

## Interpretations

The Boiler Code Committee meets monthly to consider "Cases" where users have found difficulty in interpreting the Code. These pass through the following procedure (1) Inquiries are submitted by letter to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.; (2) Copies are distributed to Committee members for study; (3) At the next Committee meeting interpretations are formulated to be submitted to the ASME Board on Codes and Standards, authorized by the Council of the Society to pass upon them; (4) They are submitted to the Board for action; (5) Those which are approved are sent to the inquirers and are published in Mechanical Engineering.

The following Case Interpretations were formulated at the Committee meeting June 11, 1954.

### Case No. 1119-2
(Reopened)
Special Ruling

***Inquiry:*** May austenitic chromium-nickel alloy steels which are stabilized with columbium plus tantalum be used under Code rules which are applicable to the use of stainless steel Types 309Cb, 316Cb and 347?

***Reply:*** It is the opinion of the Committee that austenitic chromium-nickel alloy steels which are stabilized with columbium plus tantalum instead of columbium only may be used under the Code rules which are applicable to the use of Types 309 Cb, 316Cb and 347, with the following restrictions.

(1) Material — The material shall conform to an approved specification and grade covering Types 309, 316 or 347 modified by additions of columbium, except that the requirements for columbium contents shall be modified as follows:

Columbium — determination not required.

Columbium plus tantalum — 1.25 per cent max., 8 x the carbon content min.

(2) These steels, stabilized with columbium alone, may be used with a minimum columbium content of 8 x the carbon content.

(3) Working stresses shall be the same as those listed for the standard grades stabilized with columbium alone.

### Case No. 1122-3
(Reopened)
Special Ruling

***Inquiry:*** May the extra low carbon grades of the austenitic stainless steels Types 304, 316, and 317 be used under the applicable Code rules pertaining to the regular grades of austenitic stainless steels?

***Reply:*** It is the opinion of the Committee that the extra low carbon grades of Types 304, 316, and 317 may be used for construction under the Code rules applying to the regular grades of Types 304, 316, and 317 with the following modifications:

(1) The material shall conform to the requirements of an approved specification which covers the same grade with regular carbon content, except that:

(a) The carbon content shall be limited to 0.03 per cent max.

(b) The mechanical properties shall be as follows:

Tensile strength......70,000 psi min
Yield strength........25,000 psi min
Elongation in 2 in. — as required by specification.

(c) The stress values in tension (see table below) are to be used for vessels under internal pressure.

(2) The extra low carbon grades of austennitic steels Types 304, 316, and 317 may be used for the construction of vessels under external pressure under the Code rules applying to the regular grades of Types 304, 316, and 317.

(a) The material shall conform to paragraphs (1)(a) and (b) above.

(b) The required thickness of shells and heads, and the required moment of inertia for stiffening rings, shall be determined from the chart in Fig. UHA-28.3 for Type 304L, and from the chart in Fig. UHA-28.4 for Types 316L and 317L.

### Case No. 1134-1
(Reopened)
Special Ruling

***Inquiry:*** May seamless steel pipe or tubing conforming to the following chemical analysis (including check analysis) and having minimum specified tensile strength, yield strength and elongation shown below be used in the construction of special integrally forged unfired pressure vessels?

| | Per cent |
|---|---|
| Carbon.............. | 0.25–0.50 |
| Manganese.......... | 0.35–0.90 |
| Phosphorus.......... | 0.05 max. |
| Sulphur.............. | 0.05 max. |
| Silicon.............. | 0.15–0.40 |
| Chromium........... | 0.74–1.16 |
| Molybdenum........ | 0.12–0.25 |

| | | |
|---|---|---|
| Minimum Specified Tensil-Strength..... | 120,000 psi. | 100,000 psi. |
| Minimum Specified Elongation in 2″..... | 18% | 22% |
| Minimum Specified Yield Strength...... | 74,000 psi. | 70,000 psi. |

***Reply:*** It is the opinion of the committee that these materials may be used for the construction of seamless vessels to operate at temperatures between minus 20°F and 150°F and at a maximum stress value of one fourth of the minimum specified tensile strength and that the vessels may be stamped with the code symbol provided the following requirements are complied with:

(1) The material is made by the open hearth or electric furnace process.

(2) There are no stress raisers such as openings, welded attachments, or stampings on the shell portion.

(3) The maximum inside diameter of the shell is 24 in. and the maximum volume of the vessel is 5 cu. ft.

(4) The integral heads are hot formed, concave to the pressure, and so shaped and thickened as to provide details of design and construction of the center opening which will be as safe as those provided by the rules of the Code. The center openings shall not exceed 50% of the outside diameter of the vessel or 3 inch pipe size. Other openings in the head shall not exceed ¾″ pipe size and shall be placed at a point where the calculated stress, without holes, is not more than one-half the maximum allowable stress value.

(5) No welding is utilized.

(6) After all forming operations, vessels are heated to a temperature above the upper critical temperature, but in no case exceeding 1700°F., quenched in oil and then tempered at not less than 1100°F. for one hour per inch of thickness but in no case less than one hour.

(7) (a) For batch furnace treatment, one tensile specimen is tested from a ring of material heat treated with each furnace batch or from one of the vessels constituting the batch. If the batch exceeds 200, one tensile specimen shall be tested from each lot of 200 or less.

(b) For continuous furnace treatment, one tensile specimen is tested from a ring of the material heat treated with each lot of 200 or less. In no case may one tensile specimen represent more than four hours furnace production.

(c) Rings for tensile specimens or vessels from which tensile specimens are cut are from one of the melting furnace heats of steel in the vessel being treated and each melting furnace heat of steel is represented by at least one test.

(d) Recording temperature devices are used and records are made available to the inspector.

(8) The material of the vessel is not subject to corrosion on the interior or exterior.

(9) The vessels comply with all other requirements of Section VIII, 1950 Edition, including requirements for pressure relief devices.

**Item 1(c) Case No. 1122-3**

| Alloy Material (L) | Spec. Min. Tensile | −20 to 100 | 200 | 300 | 400 | 500 | 600 | 650 | 700 | 750 | 800 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Type 304 (T.S.)*........... | 70,000 | 17,500 | 17,000 | 16,000 | 15,000 | 14,000 | 13,000 | 12,500 | 12,000 | 11,500 | 11,000 |
| Type 304 (Y.S.)............ | 70,000 | 17,500 | 17,000 | 13,400 | 11,000 | 9,700 | 9,000 | 8,750 | 8,500 | 8,300 | 8,100 |
| Type 316 (T.S.)*........... | 70,000 | 17,500 | 17,500 | 15,800 | 14,750 | 14,000 | 13,600 | 13,450 | 13,250 | 13,000 | 12,700 |
| Type 316 (Y.S.)............ | 70,000 | 17,500 | 17,500 | 14,500 | 12,000 | 11,000 | 10,150 | 9,800 | 9,450 | 9,100 | 8,800 |
| Type 317 (T.S.)*........... | 70,000 | 17,500 | 17,500 | 15,800 | 14,750 | 14,000 | 13,600 | 13,450 | 13,250 | 13,000 | 12,700 |
| Type 317 (Y.S.)............ | 70,000 | 17,500 | 17,500 | 14,500 | 12,000 | 11,000 | 10,150 | 9,800 | 9,450 | 9,100 | 8,800 |

*At temperatures from 200°F. through 800°F. these stress values meet all of the criteria specified for establishing stress values except that they exceed 62½ per cent but do not exceed 90 per cent of the yield strength at temperature. They may be used where slightly greater deformation is permissible.

Typical sections of special seamless vessels are shown on a sketch available from the Committee.

### Case No. 1167-1
(Reopened)
Special Ruling

Add the following paragraph as a last paragraph to the Reply.

A further consideration of available data indicates that a stress value of 11,700 psi. is satisfactory for operation at temperatures up to and including 250°F.

### Case No. 1174-1
(Reopened)
Special Ruling

*Inquiry:* Will unfired pressure vessels fabricated by fusion welding under the applicable rules of Section VIII, 1952 Edition, meet the intent of the Code if the base material is an aluminum-magnesium-chromium alloy having the following composition (Alloy GR40A Specification SB-178):

| | |
|---|---|
| Magnesium, per cent | 3.1 to 3.9 |
| Chromium, per cent | 0.15 to 0.35 |
| Copper, max., per cent | 0.10 |
| Manganese, max., per cent | 0.10 |
| Zinc, max., per cent | 0.20 |
| Iron plus silicon, max., per cent | 0.45 |
| Other, each, max., per cent | 0.05 |
| Other, total, max., per cent | 0.15 |
| Aluminum | remainder |

*Reply:* It is the opinion of the Committee that the aluminum-magnesium-chromium alloy described in the Inquiry may be used for the construction of unfired pressure vessels according to the applicable rules of Section VIII, 1952 Edition, subject to the following conditions:

(1) The mechanical properties of the material are not less than the following:

| Condition | Tensile Strength psi. | Yield Strength psi. (0.2 per cent off-set) | Elongation in 2 in., per cent |
|---|---|---|---|
| Annealed | 30,000 | 11,000 | 18 |
| H112 | 30,000 | 11,000 | 8 |
| H32 | 36,000 | 26,000 | 8 |
| H34 | 39,000 | 29,000 | 6 |

(2) Sheet and plate further meet the applicable requirements of Specification SB-178.

(3) Rod, bar, and shapes further meet the applicable requirements of Specification SB-273.

(4) Pipe and tube further meet the applicable requirements of Specification SB-274.

(5) Fabrication is by fusion welding using filler metal complying in composition with the base material.

(6) The welding requirements and applicable paragraphs of Section IX, 1953 Edition, apply except that the tensile strength of the reduced-section tensile specimens shall be not less than 30,000 psi.

(7) The following maximum allowable stress values are used in applying the design rules where reference is made to Table UNF-23:

**Item 7. Case No. 1174-1**

| Condition | Metal Temperature not Exceeding, Deg. F. 100 | 150 | 200 | 250 | 300 | 350 | 400 |
|---|---|---|---|---|---|---|---|
| Annealed and H112 | 7,350 | 7,350 | 7,350 | 7,000 | 6,400 | 5,650 | 4,900 |
| H32 | 9,000 | 8,950 | 8,850 | 8,250 | 7,400 | 6,500 | 5,600 |
| H34 | 9,750 | 9,700 | 9,500 | 8,800 | 7,900 | 6,900 | 5,900 |

(8) For welded joints, the allowable stress values for annealed material are used.

(9) In view of the fact that this alloy does not undergo a marked drop in impact resistance at low temperatures, no additional requirements are specified for temperatures down to −325°F. (See Par. UNF-65).

(10) The joint efficiency factors, inspection, and testing comply with the applicable paragraphs of Section VIII, 1952 Edition.

(11) Thermal stress-relieving is not mandatory.

(12) Bolting materials conform to an aluminum alloy listed in Table UNF-23 or of one of the grades of austenitic steel of Specification SA-193. These bolting materials shall not be welded. The allowable stress values in Table UNF-23 or UHA-23 shall apply.

(13) In addition to the material described herein, any of the aluminum alloy materials for which allowable stress values for welded construction are given in Table UNF-23 may be used for appurtenances and other attachments. These parts and their connections shall be designed in accordance with the lower of the stress values in Par. (7) above and the applicable values in Table UNF-23. The welding process for these connections shall be qualified in accordance with the applicable rules of Section IX, 1953 Edition, except that the strength of the reduced-section tensile specimen shall be not less than the lower of the specified tensile strength of the two materials in the annealed temper.

(14) Cylindrical and spherical shells for external pressure and formed heads convex to pressure shall be designed by the rules of Pars. UG-28 and UG-33, respectively using Fig. UNF-28.13.

### Case No. 1188
Special Ruling

*Inquiry:* Is it permissible in welded construction conforming to the requirements of Section VIII to use plates, pipe, tubes, and forgings which meet the following chemical and physical requirements:

| | |
|---|---|
| Carbon, max., per cent | 0.07 |
| Manganese, per cent | 2.00 |
| Phosphorus, max., per cent | 0.035 |
| Sulphur, max., per cent | 0.035 |
| Silicon, max., per cent | 1.00 |
| Chromium, per cent | 19.00 - 21.00 |
| Nickel, per cent | 24.00 - 30.00 |
| Molybdenum, per cent | 2.00 - 3.00 |
| Copper, per cent | 3.00 - 4.00 |
| Columbium plus Tantalum, min., per cent | 8 x C |
| max., per cent | 1.00 |
| Tensile Strength, min. psi. | 75,000 |
| Yield Strength, min. psi. | 30,000 |
| Elongation, min. in 2″ per cent | 30 |

*Reply:* It is the opinion of the Committee that the materials specified in the inquiry may be used in the construction of welded pressure vessels under the rules of Section VIII provided the following additional requirements are complied with:

(1) The various product-forms shall meet all the requirements of the following specifications except that the chemical and physical requirements shall be those specified in the inquiry.

*SA-240*—Corrosion-Resisting Chromium and Chromium-Nickel Steel Plate, Sheet, and Strip for Fusion-Welded Unfired Pressure Vessels.

*SA-312*—Seamless and Welded Austenitic Stainless Steel Pipe.

*SA-249*—Welded Austenitic Stainless Steel Boiler, Super-Heater, Heat Exchanger and Condenser Tubes.

*SA-182*—Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

(2) The maximum allowable stress-values shall be those given in Table I.

**Table I: Case No. 1188 Maximum Allowable Stress Values in Pounds per Square Inch**

| For Metal Temperatures not Exceeding, Degrees F. 100 | 200 | 300 | 400 | 500 | 600 | 650 | 700 | 750 | 800 |
|---|---|---|---|---|---|---|---|---|---|
| 18,750 | 18,750 | 17,900 | 17,500 | 17,200 | 17,100 | 17,050 | 17,000 | 16,900 | 16,750 |

(3) The special design, fabrication and inspection requirements given in Part UHA for Type 304 austenitic stainless steel shall apply to this material.

(4) The material shall be subject to the same requirements in Section IX as for Type 304 austenitic stainless steel.

(5) The thickness of material used shall not exceed 1½″. A separate welding procedure qualification shall be made for each thickness from each heat of material that exceeds ¾″ in thickness.

(6) All longitudinal and circumferential joints shall be of the double-welded butt type or its equivalent.

(7) All butt-welded main joints shall be fully radiographed when the thickness at the welded joint exceeds ⅜″.

(8) All welds used throughout the vessel shall be examined by the fluid-penetrant method.

(9) For qualifying the welding procedure the material shall be included under P-number 8 of Table Q-11.1 and A-Number 8 of Table Q-11.3 of Section IX.

*Cautionary Note:* By publishing these specifications, the American Society of Mechanical Engineers disclaims responsibility for infringement of any letters patent by the user of such specifications; and such publication is not to be construed as a representation that the specifications may be used or applied without the permission of the owner of any patent involved therein or as a recommendation of any patented material which may be covered by the specifications.

### Case No. 1189
Special Ruling

*Inquiry:* Will flanged connections be considered to comply with Pars. H-31 and H-88 if they are designed with diameter and bolting according to Tables A-5 to A-8* and with other dimensions calculated according to the rules in Appendix II of Section VIII?

*Reply:* It is the opinion of the Committee that steel flanged connections designed with diameter and bolting according to Tables A-5 to A-8 and with other dimensions calculated according to the rules of Appendix II, Section VIII will comply with the intent of the Heating Boiler Code.

*Appendix to Section I.

# NEWS OF THE ASSOCIATIONS & CORPORATION

**Information received through co-operation with the provincial organizations**

## Nova Scotia

### Thanks

The privilege of having this means of conveying news to the membership is very much appreciated. Sincere thanks is hereby extended to the E.I.C. officials and editorial staff of the Journal.

The Nova Scotia representatives to the Dominion Council would like to take this opportunity of expressing thanks for the many courtesies received during the sessions of the Council. It also seems fitting at this time to acknowledge the fact that the Ontario Association of Professional Engineers made many valuable contributions to the success of the Council sessions, and after working hours they were perfect hosts.

### Salary Schedules

Those who have a keen interest in salary schedules must have been pleased to read the Ontario and Quebec news items in the June issue of the Journal. It is difficult to explain in a few words the tremendous amount of work accomplished by the Ontario Association and the Corporation of Quebec. The Nova Scotia Association is grateful to both engineering groups for making the results of their efforts available. The members will soon receive the new salary schedule.

### New Members

The following, having complied with all necessary requirements, were approved for registration as Professional Engineers of Nova Scotia at a recent meeting of the Council of the Association.

Robert Lewis Alexander, Assistant Chief Engineer, Canada Electric Co., Ltd., Amherst, N.S.

Robert Charles Bezanson, Construction Engineer, Seaboard Power Corporation, Sydney, N.S.

Wilfred Lester Giffin, Civil Engineer, Fundy Construction Co., Ltd., Halifax, N.S.

John James Kinley, Jr., Vice-President and Managing Director, Lunenburg Foundry & Engineering Limited, Lunenburg, N.S.

George Harry Love, Sales Engineer, Construction Equipment Co., Ltd., Halifax, N.S.

Francis Patrick Martin, Engineering Assistant, Maritime Telegraph and Telephone Co., Ltd., Halifax, N.S.

Walter O. Sorby, District Sales Manager, Canadian Westinghouse Co., Ltd., Halifax, N.S.

Robert Edwin Wallar, Chemical Engineer, Imperial Oil Refinery, Dartmouth, N.S.

## Quebec

### Saguenay Region

### Annual Report of Activities

The past year has seen the organization and subsequent existence of the Saguenay Region of the Corporation of Professional Engineers of Quebec. Commencing last fall as Region 6 of the C.P.E.Q. with 147 members, the Saguenay Region is ending its first season with 164 members who have had the opportunity of participating much more actively than formerly in engineering and Corporation affairs. Regional policy and aims as set forth in a circular letter to all members some months ago have come a substantial way along the road to realization, as is apparent from the description of the season's activities. The cornerstone of both our policy and our activities has been close co-operation with the Saguenay Branch of the Engineering Institute of Canada. It must be pointed out that the large measure of liaison and co-operation which was freely given by the Saguenay Branch E.I.C. and its executive have been fundamental to the success of the past season of the Region.

After some months of exploration and planning of local C.P.E.Q. activity and E.I.C.-C.P.E.Q. relations, the Saguenay Region was formally initiated. Its first

**The General Committee; Maritime Professional Meeting. Left to right: Front Row: O. K. Smith, secretary; J. E. Clarke, president, Association of Professional Engineers of N.S.; R. N. Fournier, general chairman; M. L. Baker, general vice-chairman; back row: G. W. Frey, chairman, publicity committee; J. D. Kline, representative of the Association; A. E. Flynn, chairman, speakers committee; J. R. Kaye, chairman, finance committee; Missing from the photo: W. V. Lodge, chairman, registration committee; A. J. E. Smith, chairman, entertainment committee; G. F. Bennett, O. N. Mann, representatives of the Halifax Branch, E.I.C., G. J. Currie, representative of the Association; Mrs. J. R. Kaye, Ladies Committee.**

and presently retiring executive was elected at a general meeting held at Arvida last October 8th. This meeting was attended by the president, vice-president, general secretary, and two councillors of the Corporation. There followed a period of active organizational activity in which the executive explored, defined and finally circulated branch policies and intentions, selected and set up committees, gathered records, set up its communications, and generally got its bearings. A great deal of assistance was given by the headquarters of the Corporation, an example of which is the fact that both the vice-president and general secretary paid the Region a second visit during the season in March and May respectively. Three meetings of the executive were held and a number of Saguenay Branch E.I.C. executive meetings were attended. The specific activities of the Region during the past season may best be described by considering those of the various committees.

The regional representative, Laurent Simard, has been exceedingly active, having attended a number of meetings of the Council of the Corporation, and the Annual General Meeting, and having in addition served as an active member of the Corporation's sub-committee on the question of Regional Branches, and he will report shortly on the activities of Council during the past season.

### *E.I.C.-C.P.E.Q. Relations*

The standing committee on E.I.C.-C.P.E.Q. relations was composed of the full executives of the Saguenay Branch E.I.C. and the Saguenay Region C.P.E.Q. Their object was to study and promote the eventual integration of the various Canadian engineering bodies, and for a short range objective to effectively accomplish such unity locally. They authorized the joint endorsement and circulation of the Smith "Plan for Unity" which was published in Ontario last December. Accordingly, this was jointly sent all across Canada to all councillors and officials of the E.I.C. and to all the provincial professional engineering groups. A large number of replies were received and all indicated support of this movement. It is hoped that our support gave additional impetus to it; certainly interest in it has been widespread. At the present time this plan is being widely studied.

### *Papers and Meetings*

The papers and meetings, and entertainment committees under J. E. Dyck and J. G. Jefferies collaborated with the local branches of the E.I.C. and C.I.C. in arranging the following activities in which the Region participated: two general meetings, five technical meetings, four open meetings, four student guidance meetings, one debate and study groups.

Publicity in both French and English was given in various newspapers to these activities.

### *Regional Constitution*

The committee on a regional constitution under the chairmanship of J. A. Pollock has spent considerable effort in the preparation of a framework of policies and by-laws under which branches could operate within the Corporation. This framework was recently submitted to the Corporation sub-committee on Regional Branches upon whose request it was prepared.

### *Membership*

The membership committee consisting of H. H. Lockwood, chairman, Lloyd Laventure and J. H. McCulloch conducted an active membership campaign in which about 75 non-member engineers were written and interviewed. A file on prospective members was established. Through their efforts, the Region gained 16 new members during the season. In connection with membership, it is of interest to note that the Region has established a policy of inviting to its meetings, those engineers who would like to join the Corporation but are barred from so doing by the citizenship clause in the Quebec Engineers' Act. Locally, these number seven at present.

In conclusion, it is hoped that the foundations of successful future regional activity has been laid, and that participation in the affairs of the Corporation through regional branches will continue to increase.

The retiring executive wish to thank the Region members for their confidence and help, the executive and members of the Saguenay Branch E.I.C. for their help and confidence, and headquarters of the Corporation for their support.

Submitted on behalf of the executive of the Saguenay Region of the Corporation of Professional Engineers of Quebec.

P. SCHOPFLOCHER,
*Secretary-Treasurer.*

### Young Engineers' Committees

For the last year and a half the younger members of the Corporation living in Montreal have been given an opportunity to meet periodically to discuss freely among themselves professional problems of particular interest to them.

An average of three general meetings a year have been held during which many topics have been aired: should there be a class of engineers in training within the Corporation; should young engineers sign plans and specifications they prepare; relations with architects, etc.

The formation of this group came about in 1952 when an important number of members voiced strong opposition against the opinion that a serious shortage of engineers existed.

Following his election to council, Dr. T. A. Monti organized a provisional committee to investigate the conditions under which a young engineers' group could exist. A constitution was drafted and a permanent Committee of the Young Engineer was elected and subsequently appointed by council. This committee directs the operations of the young engineers' group and acts as its mouthpiece.

At the general meetings called by the committee young members are forthright in expressing their ideas as to how the profession should be governed. Most of the time the president and some members of council attend. They gather the feeling of the group and quite often give in return illuminating comments on the policies of the Corporation.

Recently council suggested that a young engineers' committee should also be instituted in Quebec City. A very enthusiastic preliminary meeting has been held and the decision was taken by the young members present to establish such a committee on perhaps a different basis from that of Montreal. An investigating committee is now at work.

Each generation of young engineers has exhibited the same impetus and imaginative power. Athwart such a torrent the committee should prove to be a valuable water-wheel.

## Manitoba

### Golf Tournament

The first half of the Association of Professional Engineers annual Golf Tournament was held at the Pine Ridge Golf course. The weather and the attendance were excellent. At the dinner afterwards the presentation of the awards was made by J. Sill, chairman of the golf committee. The prize winners were as follows: low net, H. Burns; high net, George Tough; low gross, T. Gauvin; hidden hole prizes, J. Sill, H. Willms, and H. Yeomens. The remaining half of the golf tournament will be held in September with the Sullivan Cup as the coveted prize. A larger attendance is anticipated.

### A Plan for Unity

J. H. Smith, past president of the Ontario Association of Professional Engineers was guest speaker at a meeting arranged by the management committee of the Engineering Institute of Canada, Winnipeg Branch, and held at the Canadian General Electric Company plant in Winnipeg. Mr. Smith who is vice president and general manager, wholesale division, for C.G.E. discussed his plan for a unified engineering body in Canada under one leadership. A lively discussion on the pros and cons of his plan was then held and some of the members taking part in this discussion were: D. M. Stephens, president of the E.I.C., N. Bubbis, and C. V. Antenbring.

C. D. Osterland, district manager of the Canadian General Electric Company in Winnipeg was a genial host and on behalf of the C.G.E. provided the guests with an interesting tour of the plant as well as a very fine dinner.

### Official Plant Opening

The Pioneer Electric Company, manufacturers of transformers, held the official opening ceremonies for its new plant in Fort Garry, Manitoba, on June 17, 1954. The opening address and laying of the corner stone was done by the Premier of Manitoba, the Honorable D. L. Campbell. Following his address the Premier was presented with a miniature trowel by the president of the board of directors of the company, A. K. McKenzie. The Honorable R. D. Turner, Minister of Industry and Commerce, after a short address, pulled the switch which officially set the plant in operation. An interesting speech was made by E. V. Caton, retired chief engineer of the Winnipeg Electric Company, after which a plaque was unveiled, commemorating the delivery to the Pioneer Electric Plant of the equipment originally used at Pinawa, the first hydro-electric power development on the Winnipeg River.

### Appointments and Transfers

**V. S. Buckler** has recently accepted the post of chief electrical engineer with the firm of Green Blankstein Russell and Associates, architects and engineers. Mr. Buckler was formerly chief electrical inspector for the city of Winnipeg. He is succeeded in that position by Mr. J. S. Hicks, P. Eng., formerly with the Manitoba Telephone System.

**C. S. Landon,** secretary of the Association of Professional Engineers of Manitoba was named a commissioner of the Greater Winnipeg Sanitary District.

**W. I. Shuttleworth** has joined the firm of Green Blankstein Russell and Associates, architects and engineers. His duties involve the field inspection of all company building projects. He formerly served in the same capacity for the firm of Moody and Moore, architects.

# Ontario

### Engineering Science at Western Ontario

The Board of Governors of the University of Western Ontario, London, has announced the establishment of a department of engineering science on 1st July, 1954, and the appointment of L. Stuart Lauchland, as professor and head of the department.

A two-year course in engineering will be offered, with first-year instruction only in the 1954-1955 session and both first-year and second-year instruction in the 1955-56 and succeeding sessions. The course will be designed so that students who complete the program successfully may continue their engineering studies at other Canadian universities.

Professor Lauchland has been a member of the staff of the University of Toronto since 1937 and has been an associate professor of electrical engineering since 1951.

With overseas service during World War II, Lieut. Col. Lauchland has been in command of the University of Toronto C.O.T.C. for the past few years.

### Heads Division

H. S. Scott has resigned from the staff of McMaster University, Hamilton, and is Director of the Resources Survey Division of The Photographic Survey Corp. Ltd., Toronto.

His responsibilities, as head of this division, entails the direction of geological, forestry, soils and land use surveys in many parts of the world.

### Deputy Commissioner

Frank E. Wellwood, has recently been appointed deputy commissioner of buildings for the City of Toronto.

A graduate in civil engineering from the University of Toronto, Mr. Wellwood has been with the Engineering Department of the City of Toronto for a number of years. Latterly he has held the position of chief engineer, Department of Buildings.

### Contract Manager

Russell E. Upper has been named to the position of contract manager of the Standard Iron and Steel Works Ltd., of Toronto. Graduating in civil engineering from the University of Toronto in 1945. Mr. Upper has followed his profession in the structural field. Laterly he was associated with Wallace Carruthers & Associates Ltd., of Toronto.

# Saskatchewan

### E. D. Wilson Is Promoted

E. D. Wilson has been appointed management assistant in Imperial Oil's western producing division and a member of the division management committee, it was announced recently in Regina.

Formerly assistant manager of Imperial's Regina exploration district, Mr. Wilson graduated from the University of Alberta in 1939 with a degree in mining engineering. On graduation he joined the Royalite Oil Company.

In 1946 he joined Imperial's producing department in a production and petroleum engineering capacity. In 1948 he became division petroleum engineer, and in 1950 he was transferred to the producing department in Toronto.

Mr. Wilson joined the Saskatchewan Association in January of 1953 by transfer from the Ontario Association.

### Halifax Command for Col. C. G. Kirby

Lt.-Col. C. G. Kirby, M.B.E., assistant director of electrical and mechanical engineering (vehicle section) at army headquarters, Ottawa, will command the Royal Canadian Electrical and Mechanical Engineers at headquarters, eastern command, Halifax, army headquarters announced recently.

Col. Kirby was born at Fertile, Sask., and educated at the University of Saskatchewan, where he received his mechanical engineering degree. He enlisted in the Royal Canadian Engineers in 1939 and proceeded overseas in June, 1940 as a Lieutenant. He served in the United Kingdom, Italy and Northwest Europe and returned to Canada in June, 1945. Since the war he has served in various RCEME appointments before going to army headquarters in 1950.

Col. Kirby joined the Saskatchewan Association in June, 1949.

### E. C. B. Macnabb Appointed

E. C. B. Macnabb, formerly C.P.R. district engineer at Moose Jaw has been appointed superintendent at Saskatoon. He succeeds A. E. Hartley who retired July 1.

Mr. Macnabb served the railroad at Revelstoke, has been a road master at Yorkton and for 7 years was division engineer at Moose Jaw. He worked as a chainman and labourer at Nipawin, Debden, Meadow Lake and Shellbrook.

Mr. Macnabb is a 1937 graduate of McGill University in civil engineering. He joined the Saskatchewan Association in October, 1950 and was elected a member of the Council in February, 1954.

# British Columbia

### Engineers in the News

**A. R. D. Robertson** and **R. H. Forsberg** have accepted positions with the engineering services division of the B.C. Forest Service. They were formerly with the B.C. International Engineering Company.

**C. W. Leek** and **R. W. Hole** have recently been elected vice-president and director, respectively, of the National Association of Master Plumbers and Heating Contractors of Canada.

**F. R. Jones** has accepted the position of mine superintendent for the MacIntyre Development of National Lead Company in Tahawus, New York. Mr. Jones was formerly chief engineer with the Canadian Exploration Co. Limited at Salmo, B.C.

**D. A. Saunders** has recently been transferred to the position of manager of the Cowichan Sawmill Division of the B.C. Forest Products at Youbou. He was formerly situated in Vancouver.

**F. D. Bolton** is now president of Electric Panel Manufacturing Limited, and **W. A. Williamson** is vice-president and general manager.

**W. Bruce Scott** has recently been appointed as construction superintendent for McCarter, Nairne and Partners, architects and engineers. Mr. Scott will be in charge of construction work on the new $10,000,000 post office in Vancouver.

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The following appointments in the Consolidated Mining and Smelting Company of Canada Limited have recently been announced by R. D. Perry, general manager:

**S. M. Rothman,** ore buyer and assistant superintendent, Smelting Department

**J. F. Douglas,** supervisor of Budgetary Control.

**J. H. D. Hargrave,** Superintendent of Development, Metallurgical Division.

**J. D. Hartley,** Assistant Superintendent of Zinc Department.

**Lloyd Williams,** Superintendent of Development, Engineering Division.

**L. S. Piper,** Superintendent of Engineering Services.

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***The Maritime Professional Meeting***

of The Engineering Institute and the Associations of Professional Engineers of Nova Scotia, New Brunswick and Newfoundland.

***The Pines, Digby, N.S.*** September 8, 9, 10, 11, 1954.

**For details and reservations,**
**Write to: M. V. Lodge, M.E.I.C., P.Eng., P. O. Box 460, Halifax, N.S.**

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Lethbridge, Alta.

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# *Personals*

## News of the Personal Activities of Members of the Institute

**Air Vice Marshal A. L. James, C.B.E., C.D.,** M.E.I.C., will join on September 1 the board of the Bristol Aeroplane Company of Canada and that of its subsidiary. Bristol Aero Engines Limited. He will also become vice-president (engineering) of the latter company.

A.V.M. James joined the R.C.A.F. in 1924 and has held many senior appointments in the Air Force, including that of Air Officer Commanding Air Defence Command in which he was responsible for the past two years for the Canadian side of the planning and implementation of an arrangement by which the air defence systems of Canada and the United States will operate as a team in the event of an emergency.

He has been well known in aviation circles in England for many years, having flown at the Royal Aircraft Establishment at Farnborough in 1929. As the Air Member for the Technical Services at R.C.A.F. headquarters between 1946 and 1951, he became well acquainted with the British aircraft industry.

He is a graduate of McGill University and he also undertook post-graduate study in aeronautics at the Imperial College of Sciences and Technology in London.

**H. William Tate,** M.E.I.C., formerly assistant general manager of the Toronto Transit Commission, has been appointed executive vice-president of De Leuw, Cather & Company of Canada, Limited, which has been newly organized by De Leuw, Cather & Company of Chicago.

H. W. Tate, M.E.I.C.

After graduation in civil engineering from the University of Toronto, Mr. Tate spent some years in mining, railway and municipal engineering. He served overseas with the rank of major during the First World War, and joined the Toronto Transportation Commission in 1920.

He is a past-president of the Canadian Transit Association.

**Professor C. F. Morrison,** M.E.I.C., has been appointed head of the department of civil engineering at the University of Toronto.

Professor Morrison, who has served as professor of civil engineering and as a consulting engineer, graduated from the University of Saskatchewan and received his M.Sc. degree from McGill University. He taught in the departments of mathematics and civil engineering at the University of Alberta before coming to Toronto in 1928 as a lecturer.

Prof. C. F. Morrison, M.E.I.C.

Professor Morrison is co-author with dean emeritus C. R. Young of the textbook, "Structural Problems". He was chairman of the organizing committee of the first Canadian Conference on Prestressed Concrete held at the University of Toronto last January, and he is active in the Canadian Standards Association, having served on several of its committees. He is a past-chairman of the Toronto Branch of the Engineering Institute, and a past-councillor of the Institute representing the Toronto Branch.

Professor Morrison has been consultant to the Canadian Broadcasting Corporation on antenna structures, namely TV towers across Canada and the CBC International Service shortwave towers in Sackville, N.B. He has also been employed with the Dominion Bridge Company in Winnipeg and Toronto.

**Dr. Gordon Patterson,** M.E.I.C., has been appointed head of the department of aeronautical engineering at the University of Toronto. He is director of the university's Institute of Aerophysics at Downsview airport, and is a member of the aerodynamics panel at the United States Naval Ordnance Laboratory at White Oak, Mississippi.

Dr. Gordon Patterson, M.E.I.C.

A native of Edmonton, Dr. Patterson graduated from the University of Alberta in 1931, and undertook post-graduate work in the department of physics at the University of Toronto.

He spent four years as scientific officer in the aerodynamics department of the Royal Aircraft Establishment at Farnborough, England, and in 1939 was appointed by the Australian Government to set up an aerodynamics research laboratory at Melbourne. In 1945 he began a two-year period of post-doctoral study and research at the California Institute of Technology and at the Institute for Advanced Study at Princeton.

Dr. Patterson will continue to direct the Institute of Aerophysics.

**H. Little,** AFFIL.E.I.C., has been appointed president of R & M Bearings Canada Limited in Montreal. He was previously sales manager and vice-president of the company.

**F. A. Orange,** M.E.I.C., mechanical design engineer with the International Nickel Company, has been elected chairman of the Sudbury Branch of the Engineering Institute for the term 1954-55.

Mr. Orange was born in Salt Lake City, Utah. He received his early education in Sudbury and afterwards attended Queen's University, graduating with a B.Sc. degree in mechanical engineering in 1927.

After graduation he joined the engineering staff of the Carborundum Company in Niagara Falls, N.Y.

He entered the employ of the International Nickel Company in 1931 and has been associated with the mechanical and construction department since that time.

F. A. Orange, M.E.I.C.

Mr. Orange served from 1942 until 1947 as captain with the Royal Canadian Engineers, and latterly was occupied with research and development of engineering equipment at National Defence Headquarters in Ottawa.

Mr. Orange has been a member of the Engineering Institute since 1927, and became a charter member of the Sudbury Branch upon its formation in 1950. He is also a member of the Association of Professional Engineers of Ontario.

**Lt-Col. F. W. W. Doane,** HON.M.E.I.C., celebrated his ninety-first birthday this year, and a photograph taken on that occasion has been obtained for publication.

A Student Member at the time the Institute was founded in 1887, he was later a councillor and was awarded Honorary Membership in 1952. At that time his impressive engineering career in the Maritimes was reviewed in the *Journal*. He retired in 1924 after forty years' service as city engineer of Halifax, after which he entered into private practice. In 1931 he became associated as a consulting engineer with the firm Standard Paving Maritime Limited, of which his son, H. W. L. Doane, M.E.I.C., is now the manager.

It is of interest to note that another Honorary Member in the person of past-president A. J. Grant, also celebrated his ninety-first birthday this year by attending the recent annual meeting in Quebec, as noted in the meeting reports.

Lt-Col. F. W. W. Doane, M.E.I.C.

**E. A. Lawrence,** M.E.I.C., assistant city engineer for the City of Lethbridge, has been elected chairman of the Lethbridge Branch of the Institute for 1954-55.

Mr. Lawrence was born in Sydenham, London, England, and received his education in Alberta.

He joined the engineering staff of the irrigation branch of the Department of National Resources of the Canadian Pacific Railway in Lethbridge, Alta., in 1927 and became assistant engineer in 1945.

During World War II he served with the Royal Canadian Artillery from 1941 until 1945 when he was discharged with the rank of major.

He returned after the war to the Canadian Pacific Railway in Lethbridge, serving there as assistant engineer until October, 1945 when he joined the staff of the City of Lethbridge as assistant city engineer.

E. A. Lawrence, M.E.I.C.

Mr. Lawrence was secretary-treasurer of the Lethbridge Branch of the Institute from 1933 until 1941. He is a member of the Association of Professional Engineers of Alberta.

**W. E. Wakefield,** M.E.I.C., recently retired from the Forest Products Laboratories of the Department of Northern Affairs and National Resources after 28 years of service. He was head of the timber mechanics section.

Mr. Wakefield was born in England. He was trained as a mechanical engineer and materials inspector with the Midland Railway and at the Derby Technical College.

During the first war he served with the Royal Engineers in Palestine, after which he came to Canada where he was employed as a mechanical engineer with the City of Prince Albert.

He joined the Forest Products Laboratories as a test engineer in the timber mechanics section in 1926.

During the second war he was a member of the Subcommittee on Wooden Aircraft of the National Re-

W. E. Wakefield, M.E.I.C.

search Council. He was also a member of the associate Committee on Aeronautical Research, and the Joint Canadian-U.S. Mission to the United Kingdom to study wooden aircraft production methods.

In 1951 he represented Canada at the second meeting of the Food and Agricultural Organization mechanical wood technology panel, and at the third meeting of the F.A.O. mechanical wood technology panel in Paris.

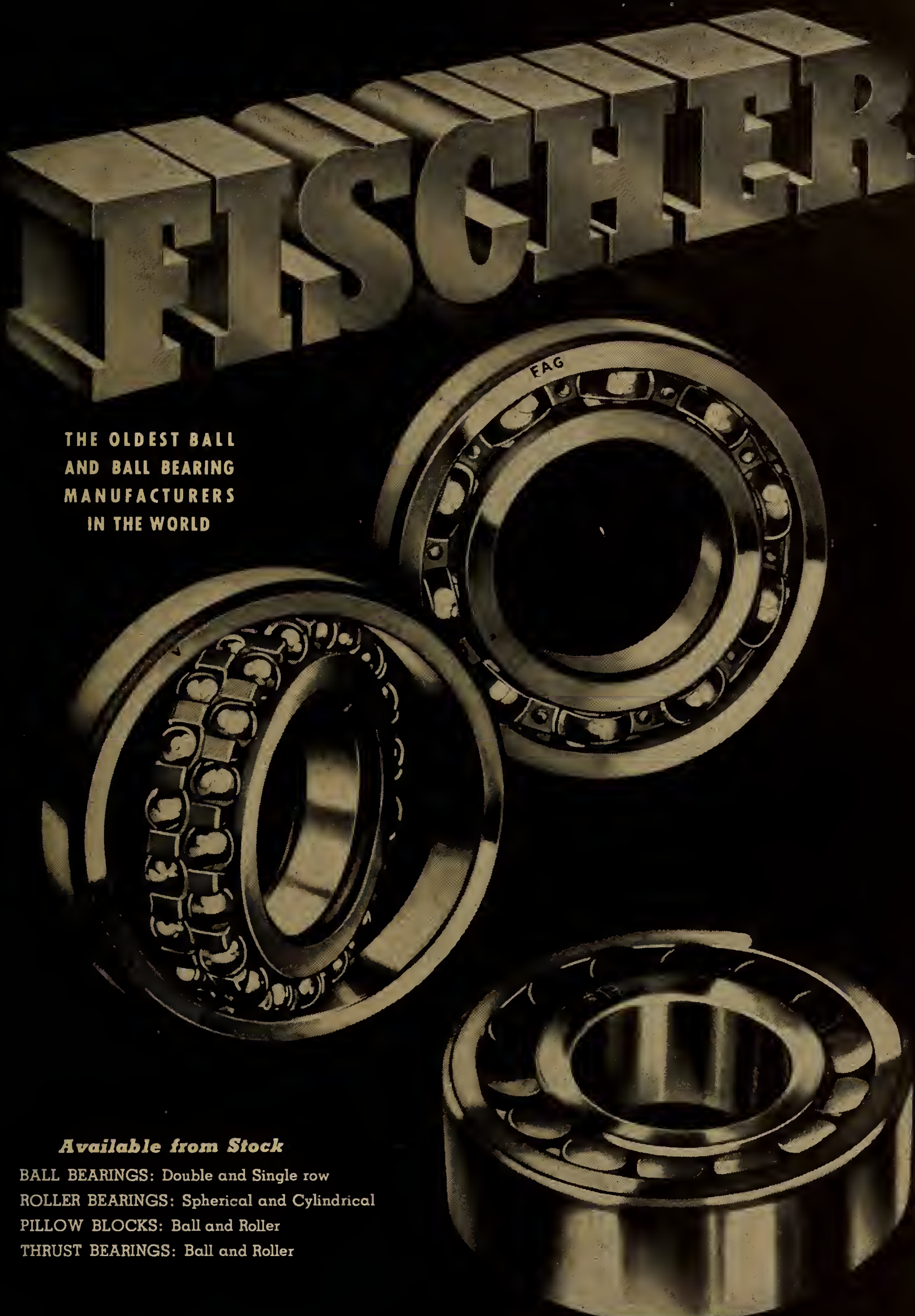
Mr. Wakefield was for a number of years a director of the Professional Institute of the Public Service of Canada. He made a noteworthy contribution as chairman of the technical committees which have prepared Canadian standards specifications for structural timbers, "Glue-Lam" construction, and cedar poles. He has also been active on a number of technical committees of the American Society for Testing Materials.

He is the author of a number of papers on subjects pertaining to the mechanical properties of wood and plywood.

Mr. Wakefield has been for the past two years a member of the Management Committee of the Ottawa Branch of the Engineering Institute.

**T. M. Moran,** M.E.I.C., is now a partner in the industrial and management engineering firm of Chas. W. Murray & Associates Ltd., He was vice-president of Stevenson & Kellogg Ltd., management engineers, for a number of years prior to which he had been associated with Dominion Rubber Co. Ltd. and Aluminum Co. of Canada Ltd.

Mr. Moran is a graduate of McGill University, class of 1923.


FISCHER
FAG

**John Stanley Waddington,** M.E.I.C., chief engineer of Phillips Electrical Company (1953) Ltd., has been elected chairman of the Brockville Branch of the Engineering Institute.

Mr. Waddington was born in Winnipeg. He received his B.Sc. degree in electrical engineering from the University of Manitoba in 1934, and the following year joined the Canadian Marconi Company in Montreal.

He entered the Phillips Electrical Works Ltd. in 1936 and was associated with the company's manufacturing department in Brockville and Montreal until 1938 when he was appointed technical secretary to the president in Montreal. In 1944 he entered the engineering department and three years later was named chief engineer. He received his present appointment of chief engineer of Phillips Electrical Company (1953) Ltd. in 1953.

Mr. Waddington is a member of the American Institute of Electrical Engineers, the Canadian Standards Association, the Canadian Electrical Manufacturers Association and the Association of Professional Engineers of Ontario. He has served on several technical committees of CSA and CEMA, and is at present acting chairman of the CSA Committee on Insulated Power Cable. He also served as a member of the Committee on the Canadian Electrical Code, Part I. Mr. Waddington is secretary-treasurer of the Brockville Public Library Board.

John S. Waddington, M.E.I.C.



**D. S. Simmons,** M.E.I.C., has been appointed general manager of the manufacturing department of Imperial Oil Ltd., succeeding G. L. Macpherson who was elected a director of the company at the annual meeting.

Mr. Simmons, a native of Sarnia and an engineering graduate of Queen's University, was assistant general manager of the department before his recent appointment.

**C. E. Hawke,** M.E.I.C., has been appointed general manager of Charles Warnock & Co. Ltd. of Montreal.

Prior to his new appointment, Mr. Hawke was chief engineer of the Warnock organization. He will carry on in the same capacity in addition to his new duties.

He is a graduate civil engineer of the University of Toronto, class of 1934.

**R. E. Tweeddale,** M.E.I.C., chief of the development division of the New Brunswick Electric Power Commission, has been elected chairman of the Fredericton Branch of the Engineering Institute.

Mr. Tweeddale was born in Arthurette, N.B. He received his early education at Plaster Rock High School and was granted his B.Sc. degree in electrical engineering by the University of New Brunswick in 1935.

After graduation he was employed as district highway engineer with the New Brunswick government. He joined the Royal Canadian Air Force in 1940 and served overseas as radar officer until his

R. E. Tweeddale, M.E.I.C.

discharge as a flight lieutenant at the end of the war.

He then joined the engineering department of the New Brunswick Electric Power Commission and was subsequently named manager of operations.

When the International Joint Commission was authorized to study the power potential of the Saint John River Basin in 1950, the development division was set up with Mr. Tweeddale as chief. The division is responsible for the Commission's system planning and the investigation of new power developments in New Brunswick. During the study of the Saint John River by the International Joint Commission, Mr. Tweeddale served on a number of committees of the engineering group and is now acting as liaison engineer for the New Brunswick Electric Power Commission and the Shawinigan Engineering Company which recently has been engaged to design the 135,000 hp. Beechwood hydro-electric development.

**Dr. J. J. Green,** M.E.I.C., of Ottawa, has been elected the first president of the Canadian Aeronautical Institute, a newly organized association of Canadian aeronautical engineers.

Dr. Green is scientific advisor to the chief of air staff and chief of Division B., of the Defence Research Board, Ottawa. He is a councillor of the Engineering Institute, a former chairman of the Ottawa Branch.

**C. M. Smyth,** M.E.I.C., has been appointed consulting engineer for Eastern Light and Power Company Limited in Sydney, N.S. Previous to his present appointment he was general superintendent of the company.

Mr. Smyth is a 1909 graduate of the London Polytechnic.

**G. A. Robb,** JR.E.I.C., of the New Brunswick International Paper Company, has been elected chairman of the Northern New Brunswick Branch of the Engineering Institute.

Mr. Robb was born in Edmonton, Alta. He received his early education there and afterwards attended McGill University where he graduated with a B.Eng. degree in mechanical engineering in 1948. As a student he spent three summers in the employ of The Shawinigan Water and Power Company.

After graduation he undertook the Canadian General Electric test course, and then served for a time with the Canadian Blower and Forge Company and its associate company, Canada Pumps Ltd.

**M. D. MacKenzie,** M.E.I.C., is now manager of the Regina Branch of the Associated Engineering Services Ltd.

He was previously city engineer in North Battleford, Sask.

Mr. MacKenzie graduated from the University of Saskatchewan in civil engineering in 1948.

**J. L. F. Gaboury,** M.E.I.C., is now in private practice as consulting engineer in Montreal, Que. He was previously associated as designing engineer with Lord and Company Limited in Montreal and with the St. Maurice River Valley Company in Three Rivers, Que.

Mr. Gaboury is a 1923 civil engineering graduate of the University of Toronto.

**Col. C. W. Jones,** M.E.I.C., who was appointed commanding officer of R.C.E. M.E. School at Barriefield Camp, Kingston, Ont., in June 1953, has been promoted recently to the rank of colonel and made commandant of the school. He served in the Canadian Army throughout the 1939-45 war in various capacities, both in Canada and overseas and was on the headquarters staff of the R.C.E. M.E. Corps at Ottawa before taking over command of the school.

**Raphael Belanger,** M.E.I.C., has been appointed vice-president of Deschamps & Belanger Ltd. in Valleyfield, Que. He was previously in private practice as construction engineer in Valleyfield, Que.

Mr. Belanger graduated in civil engineering from Ecole Polytechnique in 1923.

**G. R Minty,** M.E.I.C., has been appointed manager of the marketing research department of the major appliances division of Canadian General Electric Co. Ltd. in Montreal.

Mr. Minty was formerly product planner with Canadian General Electric Co. Ltd. in Montreal.

He is a graduate in mechanical engineering of the University of Saskatchewan, class of 1941.

**L. Williams,** M.E.I.C., has been named to the post of superintendent of development in the engineering division of The Consolidated Mining and Smelting Company.

Mr. Williams was born in Asbestos, Que. In 1932 he obtained his B.A.Sc. degree in electrical engineering from the University of British Columbia.

He made his start with the company in 1934 as a smoke tester. Between 1935 and 1940 he did research work in the instrument department and was then transferred to Calgary. He completed his service with the company's Alberta nitrogen department in Calgary as assistant general superintendent in 1947, when he was appointed superintendent of engineering trades at Trail.

He is president of the Trail branch of the Association of Professional Engineers of British Columbia and an active member of the Trail Chamber of Commerce.

**J. E. Cranswick,** M.E.I.C., has been appointed sales manager of the apparatus and supply division of the Canadian Westinghouse Supply Company with headquarters in Toronto. He was formerly sales manager of the Canadian Westinghouse Company's industrial products division.

Mr. Cranswick joined the Westinghouse organization in 1929 after graduating in electrical engineering from the University of Manitoba. After completing the company's apprentice course he was assigned to sales work in the Alberta district. In 1944, after considerable experience with both apparatus and consumer products, he was appointed branch manager in Edmonton. In 1951 he was named central region manager of apparatus sales, and the following year was appointed sales manager for the industrial products division.

J. E. Cranswick, M.E.I.C.

Mr. Cranswick is a past-chairman of the Edmonton Branch of the Institute, and served as councillor representing that Branch in 1949.

**R. L. Morrison,** M.E.I.C., is now chief engineer of maintenance and operation of the United Electric Coal Companies in Chicago, Ill.

He was previously manager of Blairmore Iron Works in Blairmore, Alta.

Mr. Morrison is a graduate of the University of British Columbia, class of 1929.

**D. E. Ellis,** M.E.I.C., has been appointed personnel manager of The Shawinigan Water and Power Company in Montreal. He has been assistant manager of the personnel department since 1949.

Mr. Ellis was born in Ottawa. He received his B.Sc. degree in electrical engineering from McGill University in 1931, and joined The Shawinigan Water and Power Company the same year. After spending three years in training at Victoriaville, Quebec City, Shawinigan Falls and Montreal, he was assigned to the company's commercial and distribution department at Three Rivers. He subsequently became assistant distribution engineer there, and in 1945 was transferred to the personnel department in Montreal as safety engineer.

David E. Ellis, M.E.I.C.

**Leon A. Duchastel,** M.E.I.C., has long appointed assistant manager of the personnel department of The Shawinigan Water and Power Company in Montreal. He has been general personnel supervisor for the past five years.

Mr. Duchastel is a native of Montreal. He received his engineering degree from Ecole Polytechnique and is now the president of that university's alumni society. He has been with the Shawinigan organization since 1927 and has been employed on some of the first plans for hydro-electric generating stations on the upper St. Maurice River. In 1935 he was transferred to the parent power company's commercial and distribution department in the power sales division, and in 1943 was made manager of that division. He moved to the personnel department as employment supervisor in 1946.

L. A. Duchastel, M.E.I.C.

Mr. Duchastel is a past-councillor of the Engineering Institute representing the Montreal Branch.

**D. B. Leightner,** M.E.I.C., has been appointed director of manufacturing and engineering of Reliance Electric & Engineering (Canada) Ltd. in Welland, Ont. He formerly held the position of chief engineer.

Mr. Leightner is a native of Jansen, Sask. Since his graduation from the University of Manitoba in electrical engineering, he has had twenty years of experience in the engineering field, the last eight of which have been with Reliance. He was appointed chief engineer of the company in 1950.

D. B. Leightner, M.E.I.C.

He is a member of the American Institute of Electrical Engineers and the Association of Professional Engineers of Ontario.

**W. B. White,** M.E.I.C., has been transferred by Canadian National Railways from Winnipeg, Man., to the research branch of the department of research and development in Montreal, Que.

Previous to his transfer, Mr. White was assistant engineer in Winnipeg.

He is a graduate in civil engineering from the University of Manitoba, class of 1937.

**C. P. Flemming,** M.E.I.C., has been appointed director of sales for Pre-Engineered Supplies Ltd. in Halifax, N.S.

He was formerly field engineer with McDonald Construction Co. Ltd. and Nova Scotia Construction Co. Ltd. in Halifax.

Mr. Flemming graduated in civil engineering from the Nova Scotia Technical College in 1937.

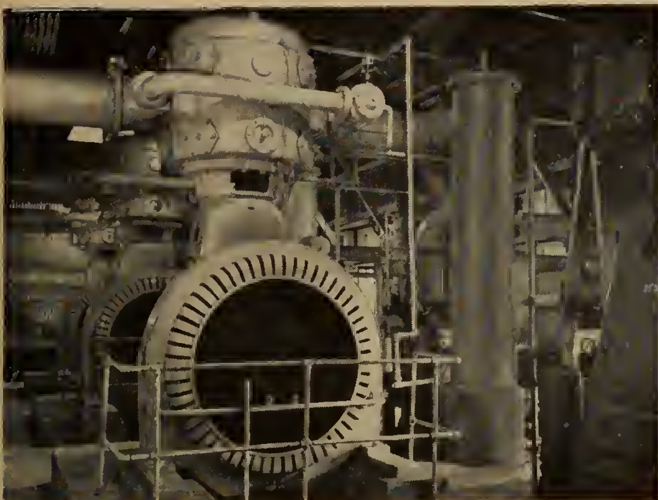
**C. W. Coote,** M.E.I.C., has been appointed assistant manager of British American Oil Co. Ltd. in Montreal.

Prior to this appointment Mr. Coote was refinery manager with The British American Oil Co. Ltd. in Calgary, Alta.

He is a graduate in chemical engineering of the University of Alberta, class of 1939.

**J. W. Morgan,** M.E.I.C., has been transferred as assistant manager of manufacturing with the British American Oil Co. Ltd. in Toronto, Ont. from Montreal, Que., where he was refinery manager.

Mr. Morgan is a graduate in chemical engineering of the University of Alberta, class of 1939.



Over 30,000 cubic feet of air per minute for drilling, and countless other jobs, was supplied by Ingersoll-Rand Compressors in batteries like this. Many of the twenty I-R XVH compressors were veterans of other Hydro projects, moved easily and economically to this location, and moved on the job to wherever required. Access shafts sunk along the tunnel line were serviced by four Canadian Ingersoll-Rand Mine Hoists. The muck hoists each handled loads of about 6,800 tons of broken rock per 24-hour day.

Wagon-mounted Drifter-drills on the canal section of the project. Similar drills cut an access road down the steep side of the Niagara Gorge to facilitate construction of the Generating Station.

*The photos on this page provide an indication of how some of the work was accomplished. The complete story of the project has been reprinted and copies can be obtained from*

**Canadian Ingersoll-Rand Company Limited**

620 CATHCART STREET, MONTREAL, QUEBEC

Ask for Form 174, "More Canadian Kilowatts at Niagara."

Huge Quarrymasters were used in drilling the 70 foot deep canal. This picture shows a drill at each side of the canal putting down line holes to obtain a solid vertical face.

Rail-mounted Jumbo, used for benching, carries 17 power-feed drifter type drills. The Jumbo is moved by air-powered "Tugger" hoists.

**G. R. Goring,** M.E.I.C., has joined the staff of the Steel Company of Canada Ltd. in Montreal.

He was formerly assistant division engineer with Consolidated Paper Corporation in Grand'Mere, Que.

Mr. Goring is a graduate in mechanical engineering of McGill University, class of 1939.

**J. D. McPherson,** M.E.I.C., has been appointed manager of the new Regina branch of Construction Equipment Co. Ltd. He was previously located in the company's Toronto office.

Mr. McPherson is a graduate in civil engineering of the University of Alberta, class of 1943.

**A. T. Girard,** M.E.I.C., is now assistant manager of the Carthage Machine Company in Carthage, N.Y.

He was formerly maintenance engineer with Brown Corporation in La Tuque, Que.

Mr. Girard is a graduate in mechanical engineering of the University of Toronto, class of 1943.

**G. A. Thompson,** M.E.I.C., has been appointed manager of Mattagami Construction Co. Ltd. in Kapuskasing, Ont.

He was formerly construction engineer with Spruce Falls Power & Paper Co. Ltd. in Kapuskasing, Ont.

Mr. Thompson received his B.A.Sc. degree from the University of Toronto in 1934.

**R. B. Wotherspoon,** M.E.I.C., formerly of the Aerocrete Construction Company Limited, has joined Imperial Chemical Industries of Canada Ltd. as senior engineer.

He is a 1935 graduate of the Royal Military College.

R. B. Wotherspoon, M.E.I.C.

**A. Nechi,** M.E.I.C., is on the engineering staff of Surveyor, Nenniger & Chenevert in Montreal, Que.

He was formerly design engineer of Cowans Engineering Co. Ltd. in Montreal, Que.

Mr. Nechi is a graduate in mechanical engineering of the University of Vienna, class of 1944.

**Dr. J. T. Hugill,** M.E.I.C., has joined the staff of Spaco Incorporated in New York.

Dr. Hugill received his B.Sc. and M.Sc. degrees from the University of Alberta in 1939 and 1940, respectively, and his Ph.D. in physical chemistry from McGill University in 1946.

He was formerly associated with the Liquid Air Company, in Paris, France.

**J. Boles,** M.E.I.C., is now manufacturing engineer in Plant No. 2 of Canadian Westinghouse Ltd. in Hamilton, Ont.

He was previously general manager of Johnson Turner Electric Repair and Engineering Company in Windsor, Ont.

Mr. Boles graduated in electrical engineering from Queen's University in 1940.

**J. G. Fitzpatrick,** M.E.I.C., is assistant general superintendent with Richard and B. A. Ryan Ltd. in Montreal.

Previous to this appointment he was Maritime manager with the company in Lancaster, N.B.

Mr. Fitzpatrick is a graduate of McGill University, class of 1944.

**H. M. Edwards,** M.E.I.C., is now on sabbatical leave from Queen's University where he has been a lecturer. During his leave of absence he will undertake postgraduate work in highway and traffic engineering at Purdue University. He will return to Queen's upon completion of this work.

Mr. Edwards is a civil engineering graduate of Queen's University, class of 1944.

**N. J. Weedmark,** M.E.I.C., is now associated with the Iindustrial Development Bank in Toronto, Ont.

He was previously assistant to the electrical superintendent of the International Nickel Company of Canada in Copper Cliff, Ont.

Mr. Weedmark graduated in electrical engineering from the University of Toronto in 1944.

**H. G. Farish,** M.E.I.C., is a project engineer with Bristol Aeroplane Engines (E) Ltd. in Montreal.

He was formerly mechanical engineer with the National Harbours Board in Montreal, Que.

Mr. Farish is a graduate in mechanical engineering of the University of London, class of 1947.

**R. F. Brooks,** M.E.I.C., has been appointed assistant superintendent of the system operating division of the Shawinigan Water and Power Company in Montreal.

He was previously assistant superintendent of Shawinigan Falls Power Developments in Shawinigan Falls, Que.

Mr. Brooks is an electrical engineering graduate of the University of New Brunswick, and joined the company as a graduate in training in 1949.

**A. I. Wotherspoon,** M.E.I.C., has been transferred from Sault Structural Steel Co. Ltd. in Sault Ste. Marie, Ont., to the Dominion Bridge Company Ltd. in Montreal.

Mr. Wotherspoon graduated in civil engineering from Glasgow University in 1949.

**M. A. Nelson,** M.E.I.C., has joined the Simpson Elevation Company in Calgary, Alta.

He was previously employed by Stock, Ramsay & Associates in Regina, Sask.

Mr. Nelson is a 1947 mechanical engineering graduate of the University of Saskatchewan.

**Ernest C. Brisco,** M.E.I.C., and **Herbert H. Todgham,** M.E.I.C., of Chatham, Ont, have changed the name of their firm from McCubbin, Brisco and Todgham to Brisco and Todgham, civil engineers and surveyors.

**M. D. Puziak,** M.E.I.C., has been appointed an associate of P. Winkiski & Associates, consulting engineers and land surveyors in Toronto, Ont.

He was previously employed by Catalytic Construction of Canada Ltd. in Sarnia, Ont.

Mr. Puziak graduated in civil engineering from the University of Lwow, Poland.

**D. Drake Oldreive,** M.E.I.C., is now design engineer with the works department of the Township of York in Toronto, Ont.

He was formerly field engineer with M. M. Dillon and Company in London, Ont.

Mr. Oldreive is a civil engineering graduate of the University of Toronto, class of 1943.

**M. F. Rodman,** M.E.I.C., who is associated with Canadian Overseas Projects Limited of Montreal, will serve for the next year with the Pakistan Industrial Development Corporation at Daud Khel, Mianwali District, in West Pakistan.

Mr. Rodman is a graduate in civil engineering of the University of Toronto, class of 1944.

**D. M. Venton,** M.E.I.C., formerly engineer of streets and sanitation for the City of Ottawa, has joined Nordic Truck and Equipment Ltd. of Weston, Ont., as sales representative in the municipal equipment division.

Mr. Venton is a graduate of civil engineering of the University of Toronto, class of 1945.

**D. K. Plummer,** M.E.I.C., former professor of electrical engineering at the University of New Brunswick, is now senior engineer with Sylvania Electric Products Inc. in Buffalo, N.Y.

Mr. Plummer is a graduate in electrical engineering of the University of New Brunswick, class of 1945.

**R. S. Lockeberg,** M.E.I.C., is now associated with B. W. Deane & Company of Montreal.

He was formerly with Canadian Ingersoll-Rand Co. Ltd. in Montreal.

Mr. Lockeberg is a graduate in mechanical engineering of Queen's University, class of 1947.

**J. E. Mallabone,** M.E.I.C., is employed as geologist with Anerada Petroleum Corporation in Calgary, Alta.

He was formerly field geologist with Imperial Oil Ltd. in Edmonton, Alta.

Mr. Mallabone graduated in geological engineering from the University of Alberta in 1948.

**Robert C. T. Stewart,** M.E.I.C., has joined Cameron Contracting Ltd. in Halifax, N.S.

He was previously associated with the Rankin Company Maritime Ltd. in Halifax, N.S.

Mr. Stewart is a graduate in civil engineering of McGill University, class of 1949.

**Frank C. O'Neill,** M.E.I.C., has entered partnership in the firm of Connor & O'Neill, engineering consultants in Halifax, N.S.

He was formerly associated with Industrial Engineering Co. Ltd. in Halifax, N.S.

Mr. O'Neill graduated in electrical engineering from the Nova Scotia Technical College in 1949.

**K. M. Mote,** M.E.I.C., of the British Cellophane Limited, Bridgewater, Somerset, England, is now in Mexico where he will be associated for the next year with Celorey, S.A., in Monterrey, Nuevo Leon.

Mr. Mote is a graduate of the Birmingham Central Technical College, class of 1949.

**J. L. Aikman,** M.E.I.C., formerly power engineer with Canadian Celanese Ltd. in Drummondville, Que., has joined Cyprus Mines Corporation in Skouriotissa, Nicosia, Cyprus, as assistant chief engineer.

Mr. Aikman received his B.Eng. degree from McGill University in 1950.

**J. H. MacDonald,** M.E.I.C., is structural engineer with Supercrete Ltd. in St. Boniface, Man.

He was formerly associated with Underwood, McLellan & Associates in Saskatoon, Sask.

Mr. MacDonald graduated in civil engineering from the University of Saskatchewan in 1950.

**Steve Hegion,** M.E.I.C., is now a consulting petroleum geologist in Regina, Sask.

He was previously associated with Well Analysis Ltd.

Mr. Hegion graduated in mining and geology from the University of Toronto in 1950.

**J. W. Davies,** M.E.I.C., formerly intermediate design engineer on the staff of the city engineer of Hamilton, Ont., is now associated with the Orillia Water, Light and Power Commission.

Mr. Davies is a 1950 graduate in civil engineering of Cardiff University.

**S. N. Bugaresti,** M.E.I.C., has joined the staff of the construction and maintenance department of the marketing division of Imperial Oil Limited in Regina, Sask.

He was previously associated with Western Dominion Coal Mines Ltd. in Taylorton, Sask.

Mr. Bugaresti graduated in mechanical engineering from the University of Saskatchewan in 1950.

**P. C. Kempe,** M.E.I.C., has been appointed plant engineer with Canadian Iron Foundries Ltd. in Hamilton, Ont.

Mr. Kempe graduated in mechanical engineering from Ballarat School of Mines in 1950.

**Aime Loranger,** AFFIL.E.I.C., is now associated with Defence Construction (1951) Ltd. on engineering inspection in Montreal.

He was previously service engineer with Accessories Machinery Ltd. in Montreal.

**S. E. Rutledge,** JR.E.I.C., formerly with Calgary Power Ltd. in Canmore, Alta., is now employed by Montreal Engineering Co. Ltd. in Montreal, Que.

Mr. Rutledge is a civil engineering graduate of the University of Alberta, class of 1946.

**Mario Tammaro,** JR.E.I.C., is now office supervisor of the engineering department of the Bell Telephone Company of Canada in Montreal, Que.

Mr. Tammaro graduated from McGill University in electrical engineering in 1947.

**B. T. Kerr,** JR.E.I.C., has been appointed president of Charles Warnock and Company, Limited in Montreal, Que.

He was formerly vice-president of Purdy & Henderson Co. Ltd. in Montreal.

Mr. Kerr is a graduate in civil engineering of Nova Scotia Technical College, class of 1947.

**Jean J. Lafleche,** JR.E.I.C., is now on the engineering staff of the City of Montreal.

He was previously associated with the Brossoit Refrigeration Co. Ltd. in Montreal, Que.

Mr. Lafleche is a civil engineering graduate of Ecole Polytechnique, class of 1947.

**R. G. Johnson,** JR.E.I.C., is president of Defence Construction (1951) Ltd. in Ottawa, Ont.

He was formerly associated with the Ford Motor Co. of Canada.

Mr. Johnson graduated in mechanical engineering from the University of Saskatchewan in 1948.

**C. W. Higgins,** JR.E.I.C., is now associated with Western Electric Co. Inc. as product engineer in Jersey City, N.J.

He was formerly sales service engineer with the Bailey Motor Company in Halifax, N.S.

Mr. Higgins graduated from the Nova Scotia Technical College in mechanical engineering in 1948.

**W. A. Thompson,** JR.E.I.C., is methods engineer with Northern Electric Co. Ltd. in Montreal.

He was previously with the Bell Telephone Co. of Canada in Montreal.

Mr. Thompson graduated from Queen's University in mechanical engineering in 1949.

**M. B. Paterson,** JR.E.I.C., has opened a private practice as a B.C. land surveyor in Vancouver, B.C.

He was previously associated with Underhill & Underhill, B.C. land surveyors in Vancouver.

Mr. Paterson graduated from the University of British Columbia in civil engineering in 1949.

**W. G. Greene,** JR.E.I.C., has been appointed supervisor of automotive equipment with the Bell Telephone Company in Montreal, Que.

Mr. Greene has been associated with the Bell Telephone Company since his graduation in electrical engineering from Queen's University in 1949.

**R. A. W. Bond,** JR.E.I.C., has joined the Canadian International Paper Company in Hawkesbury, Ont.

He was formerly associated with the Montreal Engineering Company at Chute des Georges, Que.

Mr. Bond is a graduate of London University, class of 1949.

**P. J. Newsom,** JR.E.I.C., is now design engineer with Abitibi Power & Paper Co. in Toronto, Ont.

He was formerly junior engineer with the St. Anne Paper Co. Ltd., an Abitibi subsidiary in Beaupre, Que.

Mr. Newsom is a 1949 mechanical engineering graduate of the University of Manitoba.

**J. S. Swietanski,** JR.E.I.C., has been transferred from McColl-Frontenac Oil Company Ltd. to the staff of the Trans-Northern Pipe Line Company in Toronto.

Mr. Swietanski is a graduate in mechanical engineering of McGill University, class of 1949.

**John C. Gilmore,** JR.E.I.C., formerly associated with the Gatineau Power Company in Ottawa, is now employed by the Public Utilities Commission in Port Arthur, Ont.

Mr. Gilmore graduated in electrical engineering from the University of Manitoba in 1949.

**Hedley G. Saville,** JR.E.I.C., is an electronic engineer with Radio Valve Co. of Canada Ltd.

He was formerly associated with Ferranti Electric Limited in Toronto.

Mr. Saville graduated in engineering physics from the University of Alberta in 1949.

**E. J. Penrose,** JR.E.I.C., has been appointed a management consultant with Bois, McCay and Associates in Montreal, Que.

He was previously warehouse supervisor with Dominion Tar & Chemical Co. in Montreal, Que.

Mr. Penrose graduated from McGill University in chemical engineering in 1949.

**G. L. Laycock,** JR.E.I.C., is now superintendent of the Okanagan and Similkameen division of West Kootenay Power and Light Company, Limited in Penticton, B.C.

He was previously associated with Consolidated Mining & Smelting Co. of Canada Ltd. in Trail, B.C.

Mr. Laycock is a graduate in electrical engineering of the University of Alberta, class of 1950.

**K. Colin Kent,** Jr.E.I.C., is a sales engineer with Bristol Company of Canada Limited in Montreal, Que.

Before joining the company he was associated with Johnson, Matthew & Mallory Ltd. in Montreal.

Mr. Kent graduated in electrical engineering from McGill University in 1950.

**Richard B. Parker,** Jr.E.I.C., is a research and development engineer with Canadian Celanese Ltd. in Drummondville, Que.

Mr. Parker is a graduate of the Nova Scotia Technical College in chemical engineering, class of 1950.

**F. C. Brown,** Jr.E.I.C., is assistant district municipal engineer with the Ontario Department of Highways in Kingston, Ont.

Mr. Brown is a civil engineering graduate of Queen's University, class of 1950.

**J. J. Leydon,** Jr.E.I.C., has been appointed superintendent of the Dominion Salt Company Ltd. plant at Unity, Sask.

Mr. Leydon was born in Cambridge, Mass., and received his early education in Halifax, after which he obtained his engineering diploma and B.Sc. degree from St. Mary's University in 1945. He received his B.E. degree in mechanical engineering from the Nova Scotia Technical College in 1950.

After graduating he was employed by Dominion Salt Company Ltd. at Amherst, N.S. as assistant plant superintendent, which position he held until his recent appointment.

For the past year Mr. Leydon has served as secretary-treasurer of the Amherst Branch of the Institute.

**J. J. Leydon, Jr.E.I.C.**

**P. A. Hardwick,** Jr.E.I.C., is now employed as Winnipeg branch manager by Taylor Instrument Companies of Canada Ltd.

Mr. Hardwick graduated in mechanical engineering from Nova Scotia Technical College in 1950.

**J. W. Drover,** Jr.E.I.C., has returned from Jamaica and is now associated with Saguenay Power Co. Ltd. in Isle Maligne, Que.

Mr. Drover graduated from McGill University in civil engineering in 1950.

**D. H. Rutherford,** Jr.E.I.C., has been transferred from Stone & Webster Canada Ltd. in Trail, B.C., to Stone & Webster Engineering Corporation in Roanoke Rapids, North Carolina.

Mr. Rutherford is a graduate in civil engineering of the University of Manitoba, class of 1950, and was employed for a time with the division of building research of the National Research Council in Ottawa.

**David B. Harper,** Jr.E.I.C., has been appointed senior assistant engineer with the Aluminum Company of Canada in Montreal.

He was formerly on the research staff of the mechanical engineering department of the Massachusetts Institute of Technology.

Mr. Harper is a mechanical engineering graduate of the University of British Columbia, class of 1950.

**Herman Erkku,** Jr.E.I.C., has returned to the Aluminum Company of Canada Ltd. in Arvida, Que., after post graduate study at Ecole Polytechnique.

Mr. Erkku graduated in civil engineering from Laval University in 1950.

**Raymond V. Quintal,** Jr.E.I.C., has joined the firm of Surveyer, Nenniger & Chenevert in Montreal.

Mr. Quintal graduated in civil engineering from Ecole Polytechnique in 1950.

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**E. L. Mercer,** Jr.E.I.C., is now employed by Laminated Structures Limited in Montreal.

He was formerly associated with Timber Structures of Canada Ltd. in Peterborough, Ont.

Mr. Mercer is a 1950 civil engineering graduate of the University of Toronto.

**M. A. Jackson,** Jr.E.I.C., has joined Maloney-Crawford Tank & Service Co. Ltd. in Edmonton, Alta.

Mr. Jackson is a 1950 graduate of the University of Alberta in petroleum engineering.

**G. E. Reid,** Jr.E.I.C., is control engineer with Canadian International Paper Co. Ltd. in Three Rivers, Que.

He was formerly control engineer with Anglo Newfoundland Development Co. Ltd., in Grandfalls, Nfld.

Mr. Reid is a 1950 graduate of the University of Toronto.

**K. S. Smith,** Jr.E.I.C., is associated with Poole Construction Ltd. in Edmonton, Alta.

Mr. Smith is a 1950 civil engineering graduate of the University of Manitoba.

**Ross Taylor,** Jr.E.I.C., is now a transformer design engineer with English Electric Co. of Canada Ltd. in St. Catharines, Ont.

Mr. Ross graduated in electrical engineering from McGill University in 1950.

**H. L. Snyder,** Jr.E.I.C., is assistant engineer with the City of Kingston, Ont.

He was formerly with the C. D Howe Co. in Chalk River, Ont.

Mr. Snyder graduated in civil engineering from McGill University in 1950.

**F. G. Holyroyd,** Jr.E.I.C., is design engineer with Foundation of Canada Engineering Corporation in Montreal.

He was previously field engineer with C. D. Howe Company in Montreal.

Mr. Holyroyd is a graduate of the University of Manchester, class of 1950.

**Martin McGregor,** Jr.E.I.C., is engaged in concrete design and detailing with Cowin & Company in Winnipeg, Man.

Mr. McGregor graduated in civil engineering from the University of Manitoba in 1951.

**J. B. Motta,** Jr.E.I.C., is now sales engineer with Canadian General Electric Co. Ltd. in Toronto, Ont.

Mr. Motta graduated in mechanical engineering from the University of Saskatchewan in 1951.

**W. R. Coles,** Jr.E.I.C., has transferred from the Aluminum Company of Canada Ltd. in Vancouver, to Demerara Bauxite Co. Ltd. in MacKenzie, British Guiana.

Mr. Coles graduated in civil engineering from McGill University in 1951.

**S. Olenik,** Jr.E.I.C., is now on the power plant engineering staff of Trans-Canada Air Lines in Winnipeg, Man.

He was formerly design engineer with A. V. Roe (Canada) Ltd. in Malton, Ont.

Mr. Olenik is a 1951 mechanical engineering graduate of the University of Manitoba.

**J. H. A. Lavallee,** Jr.E.I.C., is associated as plant engineer with the Bell Telephone Company of Canada in Montreal.

Mr. Lavallee is a 1951 civil engineering graduate of Ecole Polytechnique.

**R. D. Mignault,** Jr.E.I.C., is now employed by C. D. Howe Co. Ltd. in Montreal.

Mr. Mignault graduated in electrical engineering from McGill University in 1951.

**D. E. Quail,** Jr.E.I.C., has been transferred by Shell Oil Company of Canada, Ltd. from Vancouver, B.C., to Toronto, Ont.

Mr. Quail is a 1951 mechanical engineering graduate of the University of British Columbia.

**W. G. Gerry,** Jr.E.I.C., has joined Haddin, Davis and Brown in Calgary, Alta.

Having completed his studies toward his M.Sc. degree in civil engineering from the Colorado A. & M. College, he was employed for a time with Burn & McDonnell, consulting engineers.

Mr. Gerry graduated in mechanical engineering from the University of Toronto in 1951.

**John K. Cavers,** Jr.E.I.C., has recently joined F. D. Bolton Ltd. as sales engineer in Vancouver, B.C.

A mechanical engineering graduate of the University of British Columbia, class of 1951, Mr. Cavers was previously associated with Canadian General Electric and Bepco Canada Ltd. He will now be responsible for the sale of electrical apparatus including transformers, circuit breakers, and motors in the British Columbia area.

**John K. Cavers, Jr.E.I.C.**

**Robert Hunter Dunn,** Jr.E.I.C., is now associated with Dominion Tar & Chemical Ltd. in Toronto.

He was previously with the Fraser-Brace Engineering Company in Montreal.

Mr. Dunn is a graduate in civil engineering of McGill University, class of 1951.

**R. S. Taylor,** Jr.E.I.C., is employed as field engineer with Central Mortgage and Housing Corporation at the Comox airport in Cumberland, B.C.

Mr. Taylor is a graduate in civil engineering of the University of British Columbia, class of 1951.

**C. T. Taylor,** Jr.E.I.C., is special projects engineer for the City of Edmonton, Alta.

Mr. Taylor graduated from the University of Alberta in civil engineering in 1951.

**A. G. Westaway,** Jr.E.I.C., has been promoted to the position of plant engineer for Clayburn Co. Ltd. in Abbotsford, B.C.

Before his promotion he was assistant plant engineer.

Mr. Westaway is a 1951 mechanical engineering graduate of the University of British Columbia.

**W. T. Haggert,** Jr.E.I.C., has been named president of Engineering Associates (Western) Ltd. in Vancouver, B.C.

Prior to joining the company, Mr. Haggert was associated with International Engineering Co. Ltd. in Vancouver.

He is a graduate of the University of British Columbia in electrical engineering, class of 1951.

**Howard A. Bradley,** S.E.I.C., has joined Cartier Construction Ltd. at Labrieville, Que.

He was formerly junior office engineer with Stone & Webster Engineering in Toronto, Ont.

Mr. Bradley is a 1949 graduate in civil engineering of the University of Toronto.

**James F. Longley,** S.E.I.C., has joined the staff of the department of civil engineering of Queen's University as a lecturer.

He was previously associated with Canadian International Paper Company in Temiskaming, Que.

Mr. Longley is a 1953 graduate in civil engineering of Queen's University.

**John R. Jenkins,** S.E.I.C., has been transferred by the Petroleum and Natural Gas Conservation Board to Calgary, Alta., as assistant gas engineer.

He was previously located in Lloydminster, B.C.

Mr. Jenkins is a 1953 chemical engineering graduate of the University of Alberta.

**Douglas Walker,** S.E.I.C., has joined the staff of the structural steel department of Dominion Structural Steel Ltd. in Toronto, Ont.

Mr. Walker graduated in 1953 from McGill University in civil engineering.

**James C. Gilley,** S.E.I.C., is now with Northern Construction Ltd. at Goldbridge, B.C.

He was previously with the Canadian Bechtel Company in Vancouver, B.C.

Mr. Gilley graduated from the University of British Columbia in civil engineering in 1953.

**Murray E. McRae,** S.E.I.C., is construction superintendent with Storm Construction Co. Ltd. in Toronto, Ont.

Mr. McRae graduated in civil engineering from McGill University in 1953.

## Win Overseas Fellowships

**Jean Paul Dick,** S.E.I.C., Laval University, **D. D. Jack,** S.E.I.C., University of British Columbia, and **P. K. Lauren,** S.E.I.C., and **J. B. Haworth,** S.E.I.C., of McGill University, sailed to England during August to start training under English Electric fellowships.

Graduates of this year's engineering classes, they are in a group of six students, who will train for two years in the various works of the Company in England, with the object of obtaining a knowledge of British engineering skills and equipment. They will return to Canada for employment in the Scarborough, Toronto and St. Catharines plants of John Inglis Co. Limited and English Electric Company of Canada Limited.

# Obituaries

*The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.*

**Charles Michael Morssen,** M.E.I.C., founder and former president of the Atlas Construction Company in Montreal, Que., died on May 13, 1954, at the Hotel Dieu Hospital after a brief illness.

Mr. Morssen was born in Jankowse, Austria, on January 6, 1872. He obtained his B.Sc. degree with honours from the government college at Lemberg, Austria in 1892 and four years later received his diploma in civil engineering from Ecole Nationale des Ponts and Chaussees in Paris.

Upon graduation he served as a lieutenant in the technical regiment of railroads and telegraphs of the Austrian Army, and a year later joined the government railroad as assistant engineer in Lemberg, during which time he was engaged in the construction of a line between Teresin and Skala. The following year he was appointed engineer in charge of construction of a 16-mile line between Kolomyjer and Hefanowka. He joined the Hennebique Construction Company as engineer and designer in Paris in 1900 and a year later he became engineer and general manager of the company's branch office in Lemberg. During this period he designed and built 50 bridges for the Austrian Government, as well as many water tanks, heavy foundations and factories.

Mr. Morssen came to the United States in 1906 and was employed for six months with the Underwriters Engineering Company in New York, during which time he designed a powerhouse for Seattle, a factory for Troy, N.Y., and a retaining wall for Hamilton, Ohio.

He then came to Canada to join the Hennebique Company in Montreal where he was engaged in the construction of the Southam Building.

In 1908 he opened his own contracting and engineering offices in Montreal under the firm name of Morssen & Company.

He subsequently founded the Atlas Construction Company in Montreal and served as the company's consulting engineer and president for more than 20 years. Mr. Morssen retired a few years ago.

Mr. Morssen was closely associated with the late Dean Ernest Brown of McGill University. Together they built the *Concretia,* the first self-propelled concrete ship launched on the American continent in November, 1917.

He was an Associate Member of the American Society of Civil Engineers and a governor of the Montreal General and Queen Elizabeth Hospitals.

A winner of the Gzowski Medal of the Engineering Institute, Mr. Morssen joined the Institute as an Associate Member in 1909 and transferred to Member in 1914. On January 1, 1947 he was granted Life Membership in the Institute.

**James Macgregor Forbes,** M.E.I.C., chairman of the Alberta Assessment Commission, died in hospital on May 21, 1954, after a lengthy illness.

Mr. Forbes was born in Callander, Scotland, on January 21, 1891. He attended the McLaren High School there and completed the Stirling High School technical course during which time he also served as apprentice for five years with Messrs. R. W. Christie & Davidson, civil engineers in Dunblane, Scotland.

He came to Canada in 1912 and joined the engineering staff of the Canadian Northern Railway as assistant to the division engineer. Two years later he was engaged on railway location work as leveller and draughtsman.

In 1917 he joined the provincial civil service as engineer in charge of drainage work at Holden, Daysland, Bawif and Hay Lake. He transferred to the Department of Highways in 1924 as a resident engineer on construction work and later became district engineer.

In 1946 Mr. Forbes became director of assessments, administrator of the Communal Property Act and chairman of the Alberta Assessment Commission. He held the two latter offices at the time of his death.

Mr. Forbes was a member of the Association of Professional Engineers of Alberta. He joined the Engineering Institute of Canada as an Associate Member in 1920, transferring to Member in 1940.

**Ronald Morrison McKinnon,** M.E.I.C., former commissioner of works for the City of Halifax, N.S., died on April 23, 1954.

Mr. McKinnon was born at Sydney River, Cape Breton, N.S. on May 22, 1885. He received his B.Sc. degree from Dalhousie University and the Nova Scotia Technical College in 1912.

After graduation he was appointed assistant city engineer for the City of Sydney, and four years later became acting city engineer, and subsequently, city engineer.

After serving with the City of Sydney for nearly 20 years, Mr. McKinnon went to Halifax, N.S. in 1930 to join the city works department. In 1940 he was appointed deputy commissioner of works, succeeding W. J. DeWolfe, and a year later, he was named commissioner of works, succeeding H. W. Johnston. It was under Mr. McKinnon's direction that the City took steps to assure itself of adequate reserve water supplies. The booster pump at Dutch Village Road was installed to increase water pressure from Chain, Long and Spruce Lakes, and Big Indian Lake was hooked up for reserve supply. In addition to holding the position of commissioner of works, Mr. McKinnon also served the City as building inspector for many years. He retired from the works department in 1951.

Mr. McKinnon joined the Engineering Institute of Canada as an Associate Member in 1921 and transfered to Member in 1940.

**Clifford Rutherford Kinnear,** M.E.I.C., former assistant engineer of way with the Toronto Transportation Commission, died on February 15, 1954.

Mr. Kinnear was born in Halifax, N.S., on January 26, 1882. He received his education at Kings Collegiate School in Windsor, N.S., and through the International Correspondence Schools.

Between 1902 and 1921 Mr. Kinnear was associated with the engineering departments of the Halifax Electric Tramways Company, the Pittsburgh Railways Company and the Montreal Tramways Company.

He joined the Toronto Street Railway Company as office engineer in 1921. In 1930 he was appointed assistant engineer of way, the position he held at the time of his retirement in 1949.

Mr. Kinnear joined the Engineering Institute of Canada as an Associate Member in 1921 and transferred to Member in 1936. He attained Life Membership in the Institute in January of this year.

**Casper Dull Meals,** M.E.I.C., chief engineer of the wire rope division of the Bethlehem Steel Company, died at his home in Williamsport, Pa., on April 27, 1954.

Mr. Meals was born in Harrisburg, Pa., on April 15, 1891. He received his technical high school education there and at the Drexel Institute in Philadelphia. He also had private tutoring in mathematics, mechanics, strength of materials, machine design and structural engineering for seven years.

In 1911 he joined John A. Roeblings & Sons as draughtsman in Trenton, N.J. Eight years later he was appointed assistant engineer.

In 1922 he became associated with Wilcox, Crittenden & Company in Middleton, Conn., and in 1923 entered the Bethlehem Steel Company as structural draughtsman in Bethlehem, Pa. He spent the following year as sales engineer with the American Cable Company, and in 1926 he was named assistant chief engineer of the company, becoming chief engineer in 1927.

Mr. Meals joined the New York Cordage & Cable Company as chief engineer and general manager in 1930, and within the same year became president and general manager of the Wire Rope Corporation of America in New Haven, Conn.

He came to Canada in 1931 as wire rope engineer with B. Greening Wire Company Limited in Hamilton, Ont. He remained in Hamilton for six years before returning to the United States as chief engineer of the wire rope division of the Bethlehem Steel Company in Williamsport. He continued in this position until the time of his death.

Mr. Meals joined the Engineering Institute as a Member in 1935.

**Henry Lewis Schermerhorn,** M.E.I.C., county engineer for Lennox and Addington, Ont., died on March 19, 1954.

Mr. Schermerhorn was born in Selby, Richmond Township, on May 2, 1895. He attended the Napanee Public School and the Napanee Collegiate. He served with the Royal Air Force during World War I and afterwards attended Queen's University.

Having worked during the summers as rodman with the Ontario Department of Highways, he joined the department on a permanent basis in 1921. He remained with the department for 16 years, becoming district engineer for municipal roads.

In 1937 he became roads engineer for the County of Lennox and Addington.

He enlisted in 1941 in the Canadian Army and was in the first class to graduate from the officers' training course at Brockville, Ont. He served with the Royal Canadian Engineers for three and a half years, and upon his discharge, returned to his duties as county engineer.

Mr. Schermerhorn was chairman of the building committee of the Napanee and District Community Centre. He was a member of the Association of Professional Engineers of Ontario.

He joined the Engineering Institute as an Associate Member in 1937 and transferred to Member in 1940.

**Francis W. Clark,** M.E.I.C., who retired recently from the generation department of the Hydro-Electric Power Commission of Ontario in Toronto, died in the Toronto Western Hospital on June 7, 1954.

Mr. Clark was born in St. Paul, Minn., on January 23, 1887. He received his early education at the Harbord Collegiate in Toronto, and graduated from the School of Practical Science (University of Toronto) in 1911.

Before entering the School of Practical Science, Mr. Clark served for a year as chainman and rodman on construction with the Canadian Pacific Railway. In 1909 and 1910 he was employed as chainman and instrumentman on the first transmission lines and substations of the Hydro-Electric Power Commission of Ontario.

In 1911 Mr. Clark served as assistant engineer with the International Waterways Commission.

He returned to the Hydro-Electric Power Commission in 1913 and was placed in charge of surveys of the Lake of the Woods and the Grand River for regulation and flood control purposes, respectively. In 1914 and during the ten ensuing years he was engaged on preliminary surveys and the construction of the Queenston development, and served as division engineer on construction for the river and canal sections. In 1924 he was employed on surveys and preliminary studies on the Ottawa River from Mattawa to Carrillon for power development purposes, and in 1927 he made reconnaissance surveys of the Mississagi and Montreal (Algoma) Rivers.

Mr. Clark was appointed resident engineer on the construction of Lac Seul conservation dam and first powerhouse at Ear Falls in 1928. This was the most northerly work undertaken by the Commission up to that time.

From 1930 until 1939 he was engaged in surveys of the Nipigon River from Pine Portage to Lake Nipigon, on general hydraulic work in the Toronto office, including small surveys on the Wahnapitae and English Rivers, on surveys of Madawaska River, particularly at Stewartville, Barrett Chute and Bark Lake, and on field investigations and the preparation of a report on the control of the Thames River.

In 1939 he undertook at the Toronto office general administrative work dealing mainly with negotiations and the preparation of agreements and leases with outside concerns. He continued with this work until his retirement in March, 1954, at which time he had completed more than 42 years of service in the Commission's hydraulic and development department.

Mr. Clark joined the Engineering Institute as a Member in 1940.

**Charles Gordon Hutton,** M.E.I.C., vice-president and general manager of Heaps Waterous Limited in New Westminster, B.C., was killed instantly as the result of the Trans-Canada Air Lines and Harvard trainer collision over Moose Jaw, Sask., on April 8, 1954.

Mr. Hutton was born in Burnaby, B.C., on December 24, 1910. He received his education at the Kingsway West Public School and the T. J. Trapp Technical School in New Westminster, and in 1928 became an apprentice machinist with Heaps Engineering Company Limited. He was promoted to the position of general machinist in 1932.

Mr. Hutton became draughtsman and estimator in 1934 and was named chief draughtsman of the company the following year. In 1940 he was appointed designer and chief engineer of the succeeding company, Heaps Engineering (1940) Limited.

In the years that followed, Mr. Hutton occupied the positions of production and sales engineer, executive assistant to the president, sales manager and chief engineer, and chief engineer and technical sales supervisor, vice-president and general manager of the firm.

**C. G. Hutton,** M.E.I.C.

Mr. Hutton was a member of the Association of Professional Engineers of British Columbia.

He joined the Engineering Institute of Canada as a Member in 1948.

**David Franklin Bond,** M.E.I.C., died as the result of an automobile accident near Chester, England, on May 11, 1954.

Mr. Bond was born in Regina, Sask., on November 3, 1923. He received his high school education in Calgary, Alta.

After serving with the Royal Canadian Air Force as a flying officer during the Second World War, he attended the University of Alberta where he graduated with a B.Sc. degree in electrical engineering in 1950.

He was employed by the Saskatchewan Power Corporation in Regina and last July obtained a bursary from English Electric Company Limited and proceeded overseas for special field work.

He was a member of the Association of Professional Engineers of Saskatchewan.

Mr. Bond joined the Engineering Institute of Canada as a Junior in 1952 and transferred to Member in 1953.

**Michael George Duval Hawkes,** S.E.I.C., sales and service engineer with Picker X-Ray of Canada Limited in Edmonton, Alta., died on February 16, 1954.

Mr. Hawkes was born at Greencourt, Alta., on November 11, 1918. He received his early education there and in 1939 joined the Canadian Army. He served overseas with the Second Division of the Canadian Corps of Signals and was awarded the Certificate of Merit by General Montgomery for outstanding service.

At the close of the war, Mr. Hawkes attended the University of Alberta. During the summer of 1948 he worked for the City of Edmonton in the engineering department, and during the summer of 1949 he was employed by the Department of Communications in Ottawa.

During the summer of 1950 he joined Picker X-Ray of Canada Limited as a sales and service engineer working out of Edmonton. While working for this company he contracted polio, and was an iron lung patient for many months.

The University of Alberta at its 1954 spring convocation honoured Mr. Hawkes posthumously with the B.Sc. degree in electrical engineering.

Mr. Hawkes joined the Engineering Institute of Canada as a Student Member in 1950.

# Employment Service

**THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.**

**NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.**

**REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.**

**INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.**

## SITUATIONS VACANT

### CHEMICAL

CHEMICAL ENGINEER required 1954 graduate with pulp and paper experience. Investigation of paper quality or production problems on both laboratory and mill scale, analysis of test data, development of test methods, etc. Working under the divisional chemist. File No. 4864-V.

GRADUATE CHEMICAL ENGINEER from Canadian University required by manufacturer of organic chemical products. Attractive opening in new project located in Ontario. Several years of practical experience in production and process development is required. File No. 4900-V.

CHEMICAL ENGINEER required to work in control department of paper mill located in Province of Quebec. Graduate from a Canadian or British University. Pulp and Paper experience desirable but other chemical engineering experience would be acceptable. File No. 4915-V.

### CIVIL

ASSISTANT CHIEF ENGINEER wanted for large construction company. Applicant must have thorough knowledge and experience in reinforced concrete design capable of estimating buildings, road construction and all branches of general construction work. Excellent salary to the right man. Good prospects for the future. Do not apply unless you are thoroughly experienced. File No. 4853-V.

CIVIL ENGINEER REQUIRED by the technical co-operation service department of Trade and Commerce, Ottawa, Canada, to serve in Burma. The union of Burma has plans for an expansive scheme in Hydro Electric development. The engineer should be Canadian and will act as special advisor to the chairman of the Burmese electricity supply board to review the designs and specifications and supervise general construction. Salary would be in the range of $14,000 to $17,000 per annum. Free furnished accommodations, cost of internal travel, free hospital and medical treatment. File No. 4857-V.

ENGINEER CIVIL PREFERABLY, wanted for young progressive construction company. Preferably one with experience in sewage and water supply as well as cement work as we are specializing more in this line of work. When replying, please state age, graduation and experience. File No. 4865-V.

QUALIFIED ENGINEER required as principal Ahsanullah Engineering College, Dacca, Pakistan. Candidate should possess a good honours degree in civil engineering from a recognized University. He must have enough of practical experience of actual execution of large projects, and their organization, and teaching and administrative experience in a recognized engineering institution. Candidate should preferably be 45 years of age or thereabouts. Further information apply file number 4878-V.

THE CITY OF MONCTON N.B. invites applications from engineers preferably with municipal experience, for service in the city engineers office. In reply please give details of experience, including any service with H.M. Forces and indicate salary required. File No. 4887-V.

GRADUATE CIVIL ENGINEER for company in Brazil as technical assistant for chief planning. Age around 40, with 5 years experience in: 1) preparing and completing preliminary and basic studies and layouts of hydro electric developments for consideration as to technical and economic feasibility; 2) analyzing and evaluating hydrological topographical and geological data with relation to power development studies; 3) determining survey work required. Position requires engineer of maturity and judgment with teaching experience and leadership ability. File No. 4888-V.

CONSTRUCTION DEPARTMENT OF prominent oil company with headquarters in Maritimes requires experienced man to supervise construction of bulk plant facilities and pipelines. Position has an excellent potential. Please write details. and if possible enclose photo. File No. 4889-V.

CIVIL ENGINEER required with experience in municipal engineering including the design and supervision of water supply and sewage road construction, subdivision design and related work. Permanent position and the salary would be commensurate to the qualifications and experience. Location Toronto. File No. 4909-V.

THE TOWN OF BRIDGEWATER, Nova Scotia, requires the services of an experienced civil engineer for regular municipal services. Reply stating age, municipal experience, and when available to File No. 4921-V.

SALES ENGINEER for promotion and sales in professional field. Background in structures and/or construction. Preferred age early thirties. Location Ontario. File No. 4922-V.

GRADUATE CIVIL ENGINEER with about 2 years experience required by major oil company. Duties include job inspection; service stations, bulk storage depots and marine terminals. Preferably bilingual but not necessary. Territory Quebec and Eastern Ontario. File No. 4932-V.

CIVIL GRADUATES. Recent graduates in Civil Engineering required by structural steel firm, Montreal. Men to be employed in Engineering Department. Experience in structural steel design of advantage but not necessary. Chances of advancement excellent. File No. 4938-V.

### ELECTRICAL

ELECTRICAL ENGINEER with several years experience required mainly with experience on production engineering of electronic equipment. Salary would be commensurate with the applicant's experience and qualifications. File No. 4862-V.

ELECTRONIC ENGINEERS required for attractive positions. Degree in electrical engineering or equivalent, 5 to 10 years general experience with 1 to 5 years specific radar experience. Supervisory ability, able to maintain liaison and work efficiently under pressure. Canadian citizenship or British nationality a requisite. Attractive employee benefits. File No. 4874-V.

SENIOR ELECTRONIC ENGINEER with degree in physics or electronics from a recognized university with at least five years experience in electronic circuit design. British subject preferred. Salary commensurate with ability. Send resume to File No. 4877-V.

ELECTRICAL ENGINEER (Electronics) required by major worldwide electronics organization. Present opening for a fully experienced electrical engineer to do project development work on monochrome T.V. The successful candidate must have a minimum of 3 years in T.V. receiver design and 10 years in electronics in general. Salary will be commensurate with ability. Reply in writing, stating details of age, experience, education and salary desired. All applications will be held in strictest confidence. File No. 4892-V.

JUNIOR ELECTRICAL ENGINEER — single, 25 to 30 years of age with 1-5 years experience in metering department of a large public utility or manufacturer. Location Rio de Janeiro, Brazil. File No. 4898-V.

GRADUATE ELECTRICAL ENGINEER wanted as demonstrator in the electrical engineering department, University of Toronto for the session 1954-55. Session commences on September 20, 1954 and extends seven months. File No. 4911-V.

ELECTRICAL SALES ENGINEER required by manufacturer of switchboards high and low tension, panelboards, busways and switches to cover

# Assistant Chief Engineer

**$10,000 per annum**

Harbours and Rivers Branch
Department of Public Works
Ottawa

Details and application forms at your nearest Office of the Civil Service Commission, Post Office and National Employment Office.

Quote No. 54-1258

CIVIL SERVICE OF CANADA

# Specialist on Weapon Analysis

SALARY — up to $7,900
Depending upon Qualifications

Department of National Defence
Ottawa

Preferably Graduation in Mechanical or Electrical Engineering

Details and application forms at your nearest Civil Service Commission Office and National Employment Office.

Quote No. 54-1205

CIVIL SERVICE OF CANADA

# Technical Assistant

to the

# Chief Cartographer

Department of Mines
and Technical Surveys
Ottawa

**$5,760 - $6,480**

Address all enquiries to the Civil Service Commission of Canada, Ottawa

Quote No. 54-1707

territory East of Province of Quebec and Maritimes. Bilingual preferred. Opportunity for the right man to become district sales manager. File No. 4918-V.

ELECTRICAL ENGINEER required to take charge of draughting and inspection of switchboards, panelboards, busways, switches, etc. Location Province of Quebec. Bilingual preferred. Opportunity for right man to become plant superintendent. Previous practical experience preferred. Permanent position, salary depending upon qualifications. File No. 4918-V.

ELECTRICAL ENGINEER required by paper mill located in the Province of Quebec. Well qualified engineer to act as assistant electrical superintendent. File No. 4925-V.

PROJECT ENGINEER to join a rapidly expanding company which is a leader in the electronics field and offers scope for advancement. Applicant should be graduate in Electrical Engineering with a minimum of 2 years experience in Television designing, and the development of television and radio receivers, a knowledge of production manufacturing and production processing desirable. Excellent working conditions and a complete programme of employee benefits. Salary is open for discussion. File No. 4927-V.

LARGE ALBERTA ELECTRICAL wholesale firm will, due to retirement, require an executive, qualified as an electrical engineer about 45 years of age. Must be a first rate administrator, now holding a very responsible position and able to manage a large portion of the company. A substantial investment in this company, will be made available to a top man with proper qualifications, personally and technically. File No. 4930-V.

# National Research Council Canada

requires at Ottawa

a

# Health and Safety Engineer

Under direction, to develop a program of safety consciousness throughout the laboratories of the Council.

The duties will include the investigation of potential accident and health hazards, accidents and fires, and the recommendation of safety measures.

Graduation in Engineering, Chemistry or Physics, from a university of recognized standing is required; must be physically fit, and have several years' experience in technical work; safety engineering experience desirable but not essential.

Initial salary will depend on qualifications.

Apply to the Employment Officer, National Research Council, Sussex Street, Ottawa 2, Ontario, giving full details of qualifications and experience.

PROCESS ENGINEER with about ten years manufacturing experience preferably in the electrical industry. He would report to the works manager and would be responsible for methods and cost reduction studies, plant layout work and the supervision of time study, tool room and maintenance departments. A knowledge of sheet metal work, plastic moulding, metal finishing, assembly operations, material handling, etc., is desirable. The salary would depend upon the applicant's qualifications. File No. 4931-V.

### MECHANICAL

CHIEF MECHANICAL ENGINEER, salary up to $7,200., required by Department of National Defence, Ottawa. Details and application forms at your nearest Civil Service Commission Office, National Employment Office and University Placement Office. Quote Competition No. 54-1204. File No. 4855-V.

MECHANICAL ENGINEER required as product designer. Recent graduate with Canadian background for training in spring and hydraulic components design, one year experience in production and general machine shop practices desirable. Location in Montreal. Write giving full particulars of training and experience. File No. 4884-V.

TOOL DESIGNER REQUIRED, mechanical engineering graduate or equivalent in actual experience. Should have approximately five years experience in design of cutting tools, light, sheet dies, forging dies, fixtures, jigs and gauges. Canadian background required. Location in Montreal. Write giving full details of training experience and state salary desired. File No. 4884-V.

MECHANICAL ENGINEER required in the lubrication department of prominent oil company with headquarters in Maritimes to be trained in doing lubri-

# National Parks Administrative Officers

**$4,260 - $4,860**

National Parks and Historic Sites
Department of Northern Affairs and National Resources
Ottawa

Details and application forms at your nearest Civil Service Commission Office, Post Office or National Employment Office.

**Quote No. 54-652**

CIVIL SERVICE OF CANADA

# OPERATIONS MANAGER

Long established and progressive pre-mixed concrete company in major Canadian City requires the services of a man who is capable of taking complete charge of operating its 5 modern concrete plants and 100 plus truck mixer fleet. Applicants must have had previous experience and successful record in a similar capacity. Give age, particulars of experience, references, state when available and salary requirements. All replies will be treated strictly confidential. File No. 4924-V.

# Mechanical Engineer

**$5,100 - $5,820**

Post Office Department
Montreal, P.Q.

Details and application forms at your nearest Civil Service Commission Office, Post Office or National Employment Office.

cation surveys and selling same. Position has an excellent potential. Please write details and if possible enclose photo. File No. 4889-V.

MECHANICAL ENGINEER required in Edmonton Alberta who has graduated from a recognized Canadian University, and who has about five (5) years experience in a chemical plant or refinery. He will deal mostly in equipment used in the manufacture of petrochemicals and synthetic fibres. Duties will consist of general engineering, which will include design, layout, estimating and some administration. Must be able to handle project work and general plant engineering problems. File No. 4891-V.

MECHANICAL ENGINEER required who has had practical experience in structural design. He will be required for commercial vehicle designing particularly. This is a good opportunity with a sound future. Location Ontario. File No 4893-V.

GRADUATE MECHANICAL ENGINEER required as assistant to engineering superintendent of large manufacturing company. Administrative qualities and thorough knowledge of modern maintenance control methods are required together with practical experience in the maintenance and installation of pumps, ventilation and steam and refrigeration systems. Age 30-35. File No. 4912-V.

MECHANICAL ENGINEER, $4,100.00-$5,820.00 for Post Office Department, Montreal, P.Q. Details and application forms at your nearest Civil Service Commission Office, Post Office or National Employment Office. File No. 4916-V.

PRODUCTION MINDED ENGINEER required as assistant production manager after suitable training period in paper converting firm about 60 miles from Montreal. A recent graduate, preferably but not necessarily, mechanical who is bilingual would best meet our requirements. Adequate recreational and housing facilities available. An outstanding opportunity for an engineer to acquire experience in production and apply his training to methods and management problems with excellent future prospects. File No. 4923-V.

MECHANICAL ENGINEER to act as Assistant to plant superintendent required by large bottling plant in Montreal. Recent graduate preferred with some plant experience. File No. 4929-V.

WANTED GRADUATE MECHANICAL ENGINEER with several years experience for work on design of steam power plants and industrial steam plants. South Eastern Ontario location. State full details, your letter will be treated in strictest confidence. Our Staff knows of this ad. File No. 4933-V.

### MISCELLANEOUS

YOUNG CIVIL OR MECHANICAL engineer required by a pulp and paper company in Quebec. Applicant should have a minimum of three years experience in engineering and maintenance preferably in the pulp and paper industry. Applicant should be fluent in either French or English and should be able to get along in both. Replies should outline qualifications, experience age and salary expected. File No. 4768-V.

THREE SALES ENGINEERS required by manufacturer of multiwall Kraft bags and related paper products. 1954 graduates to 3 years of experience. Training period in Montreal. Subsequent work in variety of locations. File No. 4777-V.

CIVIL AND/OR MECHANICAL engineer required by a firm of consulting engineers in Western Ontario. Preference given those with experience in municipal engineering and sewage treatment plant design, or commercial and industrial building design. This position can lead to an interest in the firm if qualifications are sufficient. All replies treated with strict confidence. Please provide complete outline of experience and background with first letter. File No. 4854-V.

RESEARCH PHYSICIST or engineer required by the Pulp and Paper Research Institute of Canada to take charge of a long-range project now being initiated on the fundamentals of mechanical pulping, i.e. the factors governing the mechanical separation of paper making fibres from wood. Necessary qualifications will include a post-graduate physics or engineering degree with emphasis on mechanics and mathematics; experience in planning, executing, and reporting research projects, and the ability to confer with mill staffs on the practical data pertinent to the problem. Salary will be commensurate with training and experience. File No. 4856-V.

ENGINEER REQUIRED by paper board converter organization manufacturing a wide variety of cardboard containers and special packaging. Duties include a considerable amount of machine design and in addition to investigate a preventative maintenance program to cover all production equipment. Applicant should be prepared to continue on as assistant engineer in the engineering department. Salary would be based on qualifications. The location will be London, Ontario. File No. 4858-V.

SENIOR TIME STUDY engineer required by a progressive plant in south Western Ontario. A production engineer 28 to 35 years of age to head their time study department. Applicants should state experience, age and salary expected. File No. 4871-V.

SALES ENGINEER wanted by established transformer manufacturer, for Montreal district. Bilingual preferred. State age, education, experience and salary required. File No. 4873-V.

FOUNDRY METALLURGIST required by large manufacturing concern in Montreal, operating steel cast iron and bronze foundries. Experience desirable but not essential. File No. 4876-V.

LECTURER REQUIRED in an expanding department. Subjects economic geology, geomorphology, stratigraphy, M.A. desirable. University year September 15 to May 15. Salary range $2500 to $3,000. File No. 4880-V.

ENGINEER REQUIRED by consulting firm located in Calgary, Alberta. Minimum 5 years experience in sales and foundations with some post graduate training. Applicant should state age, summary of experience and salary expected. File No. 4883-V.

GRADUATE CHEMICAL or mechanical engineer required with two to five years experience on industrial maintenance work. As project engineer duties include the maintenance of the buildings and equipment of the plant, including some design work in the nature of alterations and improvements. Location Province of Quebec. File No. 4885-V.

YOUNG ENGINEER either mechanical or electrical to assist in the design and manufacture of blueprinting and white printing. Location Ontario. File No. 4894-V.

TWO INSTRUCTORS required to divide the following subjects: tool design, manufacturing analysis, metrology, engineer drawing and strength of materials; applicants should have a genuine interest in teaching at the junior college level and have had some industrial experience. They should be Professional Engineers with either a degree or the Higher National Certificate. These positions lead to a permanent appointment in the Ontario Civil Service providing a three week annual vacation, adequate superannuation and sick leave benefits. File No. 4895-V.

CANADIAN SALES REPRESENTATIVE, preferably a professional engineer required with successful sales record to industrial organizations. Must have knowledge of materials handling, dust collection and fume disposal equipment. Work can be undertaken in conjunction with other activities if desired. Exclusive territory. File No. 4896-V.

STRESS ENGINEER graduate in mechanical or civil engineering, with two or three years experience in stress analysis of steel structures and machinery. Required by manufacturer in the Montreal area, opportunity for varied experience in the stress analysis of heavy machinery and structures. Salary commensurate with experience. File No. 4897-V.

A CIVIL OR MECHANICAL engineer preferably with knowledge of soil mechanics and some practical experience to work on the engineering aspects of snow and ice research, especially on field studies of ice and snow. A Physicist or Engineering Physicist with M.Sc. or Ph.D. degree to assist with the research programme. Positions are in connection with the completion of special laboratory facilities for snow and ice research in the new building, Research Centre, Ottawa. Salaries will depend on training and experience. The opening provides challenging opportunities in a new field of work. File No. 4899-V.

YOUNG ENGINEERS for industrial engineering training in the textile industry in Ontario. Besides technical ability work will require ability to sell ideas and to deal successfully with mill personnel. Replies should outline experience, age and salary expected. File No. 4901-V.

ELECTRICAL UTILITY has opening for two junior electrical engineers or engineering graduates in Halifax, N.S. The work will provide opportunities for advancement along both technical and administrative line. Applicants should have a university degree and not over three years post graduate experience. File No. 4904-V.





HEATING VENTILATION AND air conditioning specialists. Salaries up to $7,200 per annum. Department of Public Works. Transport and National Defence at Ottawa. Details and application forms at your nearest Civil Service Commission Office and National Employment Office. No. 54-1209. File No. 4905-V.

ELECTRICAL ENGINEERS (electronics and radar), salaries up to $6,840. per annum. Department of National Defence and Post Office Department, Ottawa. Details and application forms at your nearest Civil Service Commission Office. and National Employment Office. No. 54-1150. File No. 4906-V.

PROJECT ENGINEER, process-instrument engineer, and piping layout draughtsmen required by consulting firm located in Niagara Peninsula. Applicants must have considerable experience in refinery and chemical plant design and construction. Please write stating qualifications and full details to File No. 4910-V.

MECHANICAL OR ELECTRICAL ENGINEER with education equivalent to graduation in engineering and at least four and preferably six years of engineering experience. Must be registered professional engineer. Experience in plant maintenance and plant engineering is desirable, as well as experience in job installation supervision and in layout and design. Duties will consist of preparation of equipment layout for supermarkets and supermarket renovation and warehouse; plans for refrigeration, air conditioning, ventilation, plumbing, electrical, etc. for supermarkets, supervision of mechanical plans prepared by consultants and correlation of these plans with architectural plans; calling of tenders for mechanical trades; the preparation of maintenance work orders for field forces and minor amount of field supervision. File No. 4914-V.

PATENT OFFICER REQUIRED at Ottawa. The successful applicant will be required to undertake various duties dealing with patent applications in the electronic field. University graduation in engineering physics, electrical engineering or physics, with specialization in electronics is required. Pertinent experience desirable but not essential. Initial salary up to $4620.00 per annum depending on qualifications.

Apply by letter giving full details of education and experience. File No. 4917-V.

FIRE PROTECTION ENGINEER required for employment on a national basis in Canada preferably with headquarters at Ottawa, under direction of a group of regional and national forest industry associations to design and carry out fire research on all phases of the fire protection problem in Canada, to coordinate educational activities in fire protection and fire prevention, to generally conduct a public relations program on fire protection for the improvement of the standards of fire protection in all classes of properties and occupancies. Should have qualifications for membership in the Society of Fire Protection engineers. Should have experience in modern fire prevention theory and practice with some knowledge of the principle of fire insurance underwriting and fire loss adjustments; and should have ability to meet and address the public with authority on the above subjects. Salary commensurate with qualifications. Duties to commence as soon as satisfactory arrangements can be made. File No. 4919-V.

TECHNICAL MINING EDITOR required by Canadian Mining Journal Established 1879. Must hold mining engineering degree from recognized university and have had some practical operating experience in industry. Position offers excellent salary, prestige, and opportunities for travel. Please state qualifications, experience, references, earliest possible starting date. File No. 4920-V.

OPERATIONS MANAGER required by long established and progressive premixed concrete company in major Canadian City. Man who is capable of taking complete charge of operating its 5 modern concrete plants and 100 plus truck mixer fleet. Applicants must have had previous experience and successful record in a similar capacity. Give age, particulars of experience, references, state when available and salary requirements. All replies will be treated strictly confidential. File No. 4924-V.

THE SASKATCHEWAN RESEARCH COUNCIL requires an industrial engineer preferably with mechanical or chemical experience to assist in making industrial surveys, to prepare reports on process and developments, and to provide liaison between science and industry. Position available immediately. Salary will depend on academic attainments and experience. Apply with all particulars, recent photo and addresses of reference, to File No. 4926-V.

GRADUATE ENGINEER required to act under the supervision of the plant engineer by manufacturer of telephone dial switching equipment and associated apparatus such as telephone relays etc. The incumbent will be connected closely with the maintenance of equipment and the provision of general plant building service. One or two years general experience in this field would be of considerable assistance to the person selected. File No 4928-V.

## SITUATIONS WANTED

ELECTRICAL ENGINEER, B.Sc. (E.E.), Manitoba 1943, P.Eng. (Ont.), M.E.I.C., age 34, married, requires immediate employment. Six years with industrial motor control manufacturer, mainly application engineering including circuit design, plus general supervisory and manufacturing experience and liaison with sales, purchasing, production and inspection department. Eighteen months with National Research Council, Ottawa. Three years Cdn. Army (R.C. Signals) immediately after graduation. Desires responsible position with consultant or manufacturer. Will locate anywhere. File No. 1408-W.

MECHANICAL ENGINEER, M.E.I.C., with apprenticeship and university background available for responsible position, on reasonable notice, interested in representing manufacturers wishing to develop and service markets in Canada or abroad. Experience includes design, construction and maintenance in the pulp and paper industry, several years handling sales of power plant equipment Working knowledge of French and German. Free to travel. File No. 2642-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., interested in design or development work in I.C. engine, automotive or similar field or in instrumentation and control. Available on one month notice to present employer. File No. 3460-W.

MECHANICAL ENGINEER Jr.E.I.C., single, age 26, N.S.T.C., 1951. Seeking position with insurance underwriters or in some branch of sales. Experienced in building construction, design of manufactured gas installation and presently employed as fire survey engineer. File No. 3903-W.

CIVIL ENGINEER B.A. (Honours) maths. B.Sc. (Civil Eng.) M.Eng. (McGill University). About two years experience in field and design work (structural and hydraulic work) in Canada. Age 26. Married, one child. Citizen of India. Available from October 1954 for teaching engineering design work in India or Colombo Plan countries, or Indonesia. Keen, hard working, good references. File No. 4108-W.

MECHANICAL ENGINEER M.E.I.C., graduated, married, sound Canadian practice, twenty years experience includes: design, estimating in piping, heating, ventilation, air conditioning, refrigeration, plumbing, steam and power plant installations. Experience in manufacturing industry, foundry, boilers, pressure vessels, pumps, compressors, valves, shopwork, paper and pulp industry construction. Capable for administrations, organizing, supervision, sales. Desire a position of responsibility suitable to past experience with possibilities for advancement. Location in Montreal. Available on one month's notice. File No. 4211-W.

MECHANICAL ENGINEER, Jr.E.I.C., '51 McGill graduate, 29 years of age, single. Completed 2 years graduate student training course with Canadian Electrical manufacturer. Presently engaged as manufacturing engineer. Desires a position with opportunity to demonstrate his ability. Location—anywhere. File No. 4217-W.

MANAGEMENT ENGINEER, M.E.I.C., age 39, family. Queen's 1936, B.Sc. (Hon.) mechanical, P.Eng. (Ont.). Seventeen years industrial experience; eight years in aircraft, three years in bus and five years in miscellaneous sheet-metal manufacture; last year spent in light construction industry operating own business. Experience includes all phases of factory operation as well as top level general management assignments. Good record in organization work, labor relations and product development through all phases of design, tooling, material and production control, sales cost accounting and management control. Seeking management career opportunity, any location domestic or foreign with Southern Ontario preferred. Available on short notice. File No. 4219-W.

CONSTRUCTION ENGINEER, Jr.E.I.C., B.Eng. (Civil) McGill 1951, married. Considerable experience in design and field supervision of industrial and commercial projects, including steel, concrete and timber structures. Thoroughly familiar with office routine, estimating, writing specifications and preparing plans for tendering. Interested in position with progressive, growing firm of consultants or contractors. File No. 4273-W.

CIVIL ENGINEER, graduate Delft Technological University, Holland (specialization: hydraulics, dike building), age 28, 1½ years experience in reinforced concrete structure and surveying; interested in prestressed concrete. Presently employed as instrument man in Western Canada. Desires position with possibilities for advancement. Available on about one week notice anywhere in Canada. File No. 4318-W.

CHEMICAL ENGINEER with several years experience in control, operation and development in the field of metal finishing and protective coatings for appliances, chemical and food industry. Has had varied experience in finishing, design and maintenance of large factory equipment as well as small serial articles in aluminium, magnesium, steel and brass. Multicolor finishing on anodized aluminium. Formulation of cleaning, etching and phosphating solutions etc. Desires permanent position with opportunity for advancement. Will locate anywhere. File No. 4359-W.

CHEMICAL ENGINEER, 32, B.A.Sc. (Hon.), P.Eng., Jr.E.I.C., veteran, 1½ years process and quality control supervision. 2½ years process development in cellulose products, lacquers and solvent recovery, 3 years business experience, desires responsible position preferably in Southern Ontario, supervisory and/or technical. File No. 4391-W.

GRADUATE MECHANICAL ENGINEER, McGill 1950, with master of business administration degree, University of Michigan 1954, looking for a career with a progressive company. Three and a half years experience in industrial engineering and also summer work in several industries. Would want to start in production or industrial engineering work. File No. 4444-W.

GRADUATE MECHANICAL ENGINEER 1952, Jr.E.I.C., married, age 30, with varied maintenance experience on high pressure equipment in the chemical industry, electrical repair for a mining company and some industrial engineering experience. Desires employment on plant maintenance or field supervision of industrial equipment installation and alteration. Location preferably in Ontario. File No. 4453-W.

ELECTRICAL ENGINEER, Graduate 1949, power and machinery, Edinburgh, Scotland, M.E.I.C., Grad.I.E.E., Whitworth Prizeman, age 29, married, two children. 5 years electrical engineering apprenticeship, 3 years electrical draughting, 3 years electrical engineer. Experience on rural and urban distribution; construction, maintenance and operation; H.V. and M.V. lines, cables, substations and associated gear; estimating, profile surveying, pressure testing, fault location, etc. Also inspection, testing and maintenance of all types industrial electrical machinery and cabling in paper mills, quarries and other industry; i.e. generators, motors, switchgear, transformers, elevators, etc. Desires employment on either distribution work, plant maintenance or with consulting engineer, commencing beginning of September. File No. 4475-W.

SENIOR MECHANICAL ENGINEER B.Sc., P.Eng., M.E.I.C., age 41 years. Member A.S.M.E., A.S.H.V.E., A.S.R.E., over twenty years experience in air conditioning, heating and ventilating, piping, plumbing, refrigeration design and installation, waterworks and sewerage plant, workshops and plant layout, buildings, roads, and utilities and fully experienced in all mechanical and steam power plant boilers, pumps hot water systems, design, specifications installation, maintenance and planned maintenance desires an engineering appointment anywhere in Canada, U.S.A., or on overseas projects. Previous experience as resident engineer on very large projects overseas, on construction of varied type jobs on contract basis for government departments. Further particulars will gladly be forwarded to interested employers. File No. 4481-W.

ADMINISTRATOR, Professional Engineer in early forties, extensive manufacturing experience, large corporations; well qualified industrial relations including contract negotiations, arbitrations, proven record in safety, supervisory training, policy formation, cost budgetting, maintenance and stores control; sales and warehousing experience; seeks challenging position in small or medium company. File No. 4496-W.

CHEMICAL ENGINEER, Jr.E.I.C., 27, graduated from University of Toronto 1950. Four years experience in the protective coatings industry dealing with plastics, paints, varnishes, and waxes. Engaged in sales, supervisory and research capacities. Presently employed but seeking a more challenging position. Would consider other fields than protective coatings if sufficiently interesting. File No. 4505-W.

ELECTRICAL ENGINEER, Australian citizen, age 39, single. Associate Member of Institution of Engineers Australia and Member of Association of Professional Engineers Australia. Desires position with a supply authority whilst establishing professional status in Canada. Twenty years experience in Electrical industry, 14½ with supply authorities in Australia and 1¼ with consultants and construction engineers Great Britain. Experienced in design, construction, maintenance and operation of distribution works, substations and thermal station electrical installations. Experience up to 66KV. Field experience on 275 KV general line construction British Electrical Authority. File No. 4506-W.

CIVIL ENGINEER S.E.I.C., P.Engineer, located in Montreal desires evening work in draughting, design, etc. File No. 4507-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc., Manitoba 1950, married, 2 children. Age 30. Seeks position in electrical ultility or plant maintenance in industrial concern. 4 years in transformer design, production and test. Some sales. Western Canada preferred. File No. 4508-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng. (Ont.) B.A.Sc. 1948, M.A.Sc. 1951, U.B.C., age 28, married, one year on design of substation layout and control with a large public utility prior to receiving M.A.Sc. Completed industrial training and sales course with a large electrical manufacturing company. Experience in application and manufacture of low voltage air circuit breakers, power fuses and grounding resistors. Design of metal clad switchgear control circuits and layout of wiring diagrams. Also teaching experience. Desires position requiring initiative, organizing and supervisory ability with opportunity for advancement. File No. 4509-W.

ELECTRICAL ENGINEER, B.Sc. Queens 1951; power option; Jr.E.I.C., P.Eng., aged 26, married, one son, and am a veteran. Employed since graduation by large chemical company. Have had varied experience in mechanical design, plant start-up trouble shooting and in electrical maintenance. Some experience with pneumatic instrumentation. Good knowledge of electronics through signal corps and amateur radio. Have done electrical estimating on minor plant projects. Would like to further electrical training through position with construction company installing generation equipment, or with constructing engineer on design and layout of plant power distribution systems. Location no object. Will send transcript of education, details of work background and references on request. File No. 4510-W.

CIVIL ENGINEER, honours graduate, of Glasgow University, with two years of construction experience, desires position in design office or on construction. Single, willing to work anywhere in Canada. File No. 4514-W.

CIVIL ENGINEER, Manitoba 1952, Jr.E.I.C., age thirty, married, one child. Presently employed by oil company on work becoming more the province of petroleum engineer desires employment with consultant or contractor on heavy construction or municipal projects. Five summers experience in highway and drainage construction, bituminous and concrete paving as instrument man and resident engineer. Location immaterial. File No. 4518-W.

MECHANICAL ENGINEER seeks senior executive position in chemical or allied industry, or firm of consulting engineers. 12 years experience in the financial and engineering side of large scale plant expansions in the chemical industry. Excellent knowledge of the following processes; ammonia, methanol, urea, formaldehyde, chlorine, wood saccharification, alcohol distillations. 5 years experience in dyestuffs including complete design and erection of services and maintenance workshop. Superintendent planning engineer in charge of drawing office of 40 men, re-organization of engineering department of large concern. Excellent references, bilingual, graduate 1942, M.E.I.C. File No. 4519-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., with 3 years urban distribution experience and CGE test course in switch gear, motor generator, installation and transformers seeks post with utility, involving generation, transmission and distribution. Present salary in power transformer engineering sales $350 per month. File No. 4525-W.

EUROPEAN CIVIL ENGINEER would accept some part time work in structural designing. File No. 4526-W.

AGRICULTURAL ENGINEER, M.E.I.C., U. of S. 19[illegible] available December 1, 1954. 4 years teaching experience, 3 years research engineer for Sask. Research Council. Thoroughly acquainted with automotive and internal combustion equipment. Age 38, married. File No. 4527-W.

ELECTRO - MECHANICAL ENGINEER, P.Eng. (Ont.), membership several English Professional Institutions. 2 years post graduate course in servo-mechanisms and control equipment. Practical experience of electro-hydraulic mechanisms. Desides position in administrative capacity. Minimum salary $7,000 per year. File No. 4528-W.

STRUCTURAL ENGINEER, A.M.I., Struct. E., P.Eng., desires responsible position in the Hamilton area. Experienced in the competitive design of light and heavy industrial and commercial structures and road and rail bridges. Eight years and three years English and Canadian experience respectively. At present employed in Hamilton. File No. 4529-W.

CIVIL ENGINEER, graduate of U. of Latvia in Riga 1926. 18 years experience in railroad, road, reinforced concrete and structural steel constructions. Seeking position in any part of Canada. File No. 4530-W.

ELECTRICAL ENGINEER, graduated Norwegian University 1950, age 30, married. Experience: 2 years design and development of hydro-power station and lighting engineering, 1 year as a sales engineer. Available immediately, location anywhere. File No. 4531-W.

CIVIL ENGINEER (European), graduate Polish University College, London, Jr.E.I.C., age 41. Married. Seven years experience (including two years in Canada) in design, draughting and supervision of all sorts of engineering structures, buildings, industrial plants, bridges and earthworks. Will accept position in line with his experience. Location preferred Montreal or Southern Ontario. Available on reasonable notice. File No. 4532-W.

CIVIL ENGINEER, member E.I.C., A.C.I., graduate University of Pennsylvania, U.S.A., bilingual, married, 2 children, 18 years varied experience abroad and in Canada. Last 9 years specialized in design and supervision of reinforced concrete and steel structures of all types. Seeking permanent position where technical skill and experience would be of value. Available on reasonable notice. File No. 4533-W.

CIVIL ENGINEER, graduate of technical university of Norway, 1949, age 30, married, no children, 3 years experience in structural engineering and two in construction. Desires position in construction engineering. Free to travel, but would prefer to be in eastern provinces. File No. 4534-W.

CIVIL ENGINEER, B.Sc., U.B.C., 1951, Jr.B.C.P.E., Jr.E.I.C., age 25, 3 years heavy construction experience having responsible work in layout and construction supervision during the excavation and construction of an underground power house and power tunnels. Seeks position in design office or responsible field position where experience will be of value. Preferably in Montreal or vicinity. File No. 4539-W.

MECHANICAL AND INDUSTRIAL ENGINEER, graduate, 1937; M.E.I.C., P.Eng., A.S.M.E., age 45, married, now employed as plant manager, wishes to locate outside Quebec. Reason, plant closing. Seasoned senior engineer with vast mechanical experience in paper making, construction and the steel industries. Well qualified for the positions of plant manager, chief engineer, plant engineer, mechanical superintendent, etc. Seeks a position in a reliable company where application and effort will be rewarded with advancement, peace of mind, and permanency in order to establish a home. File No. 4540-W.

ELECTRICAL ENGINEER, B.E., M.E.I.C., 12 years of experience in responsible positions including operation and testing of AC and DC machinery, design and supervision of construction of transmission lines, overhead and underground distribution systems, and substations, also system planning, report writing, economic studies, budgeting, staff supervision, etc. Desires position with increasing responsibility. Excellent references. Available on suitable notice to present employer. File No. 4541-W.

CHEMICAL ENGINEER, 33, veteran, graduate with five years wide experience in mechanical, chemical and electrical engineering, presently employed by plant manufacturers in Scotland, available for employment in Canada in August, 1954. Desires responsible position in planning, plant or production engineering, or industrial research and development work. Resume and references on request, languages. locality no barrier. File No. 4542-W.

CIVIL ENGINEER, P.Eng., M.E.I.C., with extensive experience in design and detailing of R.C. structures. Seeks part time employment in Toronto area. File No. 4544-W.

MECHANICAL ENGINEER, Jr.E.I.C., Polytechnique, 1953, P.Eng., equivalent of 4 years in plumbing and heating business as an apprentice, service man, design, estimate, sales and surveillance of complete plumbing and heating system for a contractor in Eastern Townships. Seeks employment in similar work preferably in Eastern Townships or Montreal but would locate anywhere. Married, one child, 2½ years old, bilingual. File No. 4548-W.

CHEMICAL ENGINEER, M.A. (Hons. Engineering), Cambridge University, England; A. F. Inst. of Petroleum, 28, married, recently arrived from England. Four years service wtih Royal Engineers as survey officer in the Middle East. Three and a half years supervisory experience in control, development, and maintenance of various types of petroleum refinery plants. Desire responsible position any where in Canada. File No. 4551-W.

CHEMICAL ENGINEER M.E.I.C., P.Eng., Toronto 1942, married, 12 years industrial experience in chemical plant project supervision, process equipment and piping design and fabrication. Seeks position with chemical company on new projects supervision or with process plant design engineering and construction company. File No. 4552-W.

ELECTRICAL ENGINEER, McGill 1953, S.E.I.C., presently employed, seeks position which calls for judgment, initiative and willingness to accept responsibility. Over two years varied experience (including summer work) in switchgear, rotating equipment, household appliances, sales, and drafting. Location Montreal. File No. 4553-W.

PROFESSIONAL ENGINEER, Jr.E.I.C., B.A., B.A.Sc., Athlone Fellow '52, age 27, bilingual. Post graduate studies in engineering production and management principles, Birmingham University, England. One year experience in construction, Canada; and one year experience with manufacturing concern. Seeks employment in the Montreal area preferably. Available for work at the beginning of September. File No. 4554-W.

ELECTRICAL AND MECHANICAL ENGINEER, B.A. (Eng.), A.M.I.E.E., British, aged 44, family; seeks administrative, sales or consulting engineering post, any location not involving prolonged separation from family. Twenty-two years technical sales of heavy electrical plant, generation with all types of prime mover, distribution, application. Newly arrived from five years in Brazil as technical chief, selling and supervising diesel and diesel alternator installations. File No. 4555-W.

GEOLOGIST, SOILS ENGINEER and Surveyor, M.E.I.C., P.Eng., age 41, 18 years experience in geological and geophysical exploration (oil, coal, chromum, tin, iron), glacier research, soil mechanics (foundations, airports, hydrology, laboratory), diamond drilling, terrestrial and aerial photogrammetry, photogeological interpretation. 8 years consultant in Europe. Very experienced alpinist. Seeking responsible position with occasional field work in Western Canada, preferably Calgary. Permanently employed. File No. 4556-W.

MECHANICAL ENGINEER, Jr. E.I.C., 1949 N.S.T.C., age 28, married with children, desires a responsible position with an energetic company. Experience in general mechanical design, standardization, cost reduction, shop supervision, personnel administration and manufacturing methods. Interested in manufacturing, sales or design. File No. 4557-W.

ELECTRICAL ENGINEER, Jr.E.I.C., N.S.T.C., 1952, age 23, single. Interested in all fields of electrical engineering activity and willing to take responsibility and apply himself. Presently in second year of graduate student training course with large and reliable Canadian manufacturer of electrical equipment. Experience includes one year in transmission and distribution departments of hydro-electric utility. Some accounting experience. Desires position in Canada and would give special consideration to Newfoundland as a location. File No. 4558-W.

MECHANICAL ENGINEER Jr.E.I.C., graduate N.S.T. College 1951. Experience includes 1 year research work and 2 years mechanical design. Interested in position in plant engineering maintenance or design. Preferably located in Montreal area. File No. 4559-W.

ELECTRICAL ENGINEER Jr.E.I.C., B.Sc. (Maths. and Chem.) Acadia University 1949, B.E. Nova Scotia Technical College 1952. Age 27, married. Experience: One year as engineer in distribution department of small electrical utility; presently taking Westinghouse Graduate Training Course. Desires position offering scope for learning and advancement with smaller company or utility. File No. 4560-W.

CONSTRUCTION ENGINEER B.Sc. (1943) M.E.I.C., A.M.I.C.E., A.M.I. Struct. E., 11 years experience. Seeks responsible position. Has held the following positions: General superintendent, assistant project engineer, estimator. Experienced on light and heavy construction excavation water mains, sewers, concrete, etc. Married, 33 years old, bilingual. File No. 4561-W.

MECHANICAL ENGINEER, M.Sc. Delft Institute of Technology (Netherlands) 1953, married, age 26. Experience: one year pre-graduate training with various industries, including pulp — and paper-mill, one year Canadian Westinghouse graduate training course. Desires position in mechanical field; manufacturing, development, plant engineering. References include present employer. Location preferably Ontario or Western Canada. Available on short notice. File No. 4562-W.

CIVIL ENGINEER, B.E. 1953 U. of S., Jr.E.I.C., seeks position in design and construction. Working at present with prominent Government engineering department. Interested in position with good possibilities for advancement. Willing to work hard. Single with car. Experience in surveys (all types), supervision of survey crews and construction crews, design in water and sewer lines, some concrete design. Was completely in charge of installation of many hydraulic structures. highway-type bridges, large culvert installations and a gravel contract. Has also had experience photo-elastic analysis, soils studies and river studies. Has taken night classes in photography, welding and carpentry. Interview can possibly be arranged. File No. 4563-W.

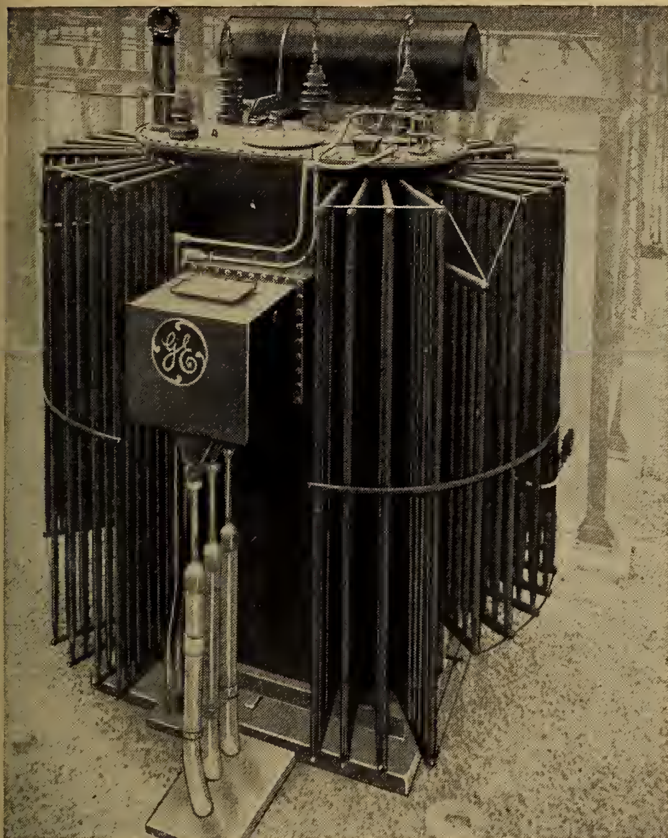
GRADUATE CIVIL ENGINEER, D.R.T.C. (Glasgow), A.R.T.C. (Glasgow), San. Eng. (Glasgow), age 31 years, single, bilingual, willing to travel, desires senior position with responsibility in municipal engineering, contracting, concrete or structural steel installations. Experience: one year research work, 3 years general municipal engineering, 4 years drainage and irrigation experience in Malaya including supervision of earth moving plant, reinforced concrete design, estimating, surveying, office routines design of irrigation schemes and structures, chief assistant on a $5,000,000 (Canadian) irrigation scheme. Experienced in jungle clearing and swamp drainage. Available September 1st. File No. 4565-W.

MECHANICAL AND INDUSTRIAL ENGINEER, P.Eng., M.E.I.C., A.M.I.Mech.E., Junior executive, 10 years experience of industrial plant specifications, layout, design and erection, also specialized machine design and plant maintenance. Interested in entering consulting field in Southern Ontario. File No. 4568-W.

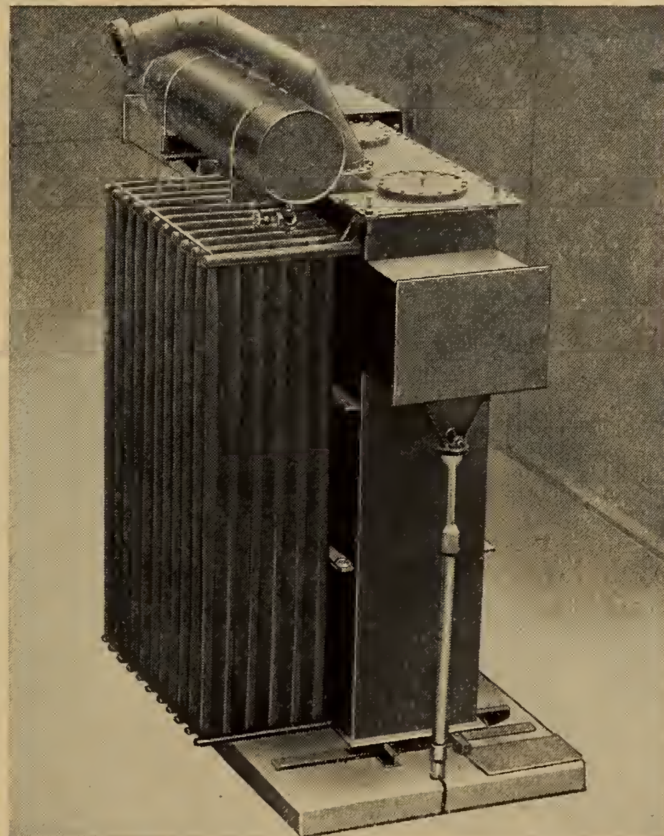
ELECTRICAL ENGINEER, B.A.Sc., M.E.I.C., P.Eng., age 40, married, three children, requires immediate employment preferably in consulting industrial or utiity. C.G.E. test course, four years production engineering, eight years apparatus sales engineering. File No. 4576-W.

**A well-engineered** blasting operation shattered this 34,500 cubic ard rock plug, allowing the new canal to cross over the existing ne. Eighteen tons of "Nitrone", a new C-I-L blasting agent, were sed in this successful operation.

**Six tons of "Nitrone"** shatter 12,000 cubic yard rock plug separa forebays. In the foreground, under the waters of the forebay, a curtain of compressed air bubbles is absorbing the shock of blast to protect the existing power house about 50 yards a



In B-A Oil Company's Refinery at Clarkson, Ont. — G-E 7500 KVA Power Transformer



Also in B-A Oil Company's Refinery at Clarkson, Ont. — G-E 750 KVA Power Transformer

# Now . . . delivery of G-E RM Power Transformers

# in only 8 weeks

Owing to greatly expanded plant facilities, you can now get speedier deliveries on G-E Standard Repetitive Manufacture Power Transformers – as follows:

> Transformers with standard RM Ratings of 250 to 2500 KVA can be shipped in 8 weeks . . . standard RM Ratings of over 2500 up to 10,000 KVA can be shipped in 16 weeks.

Speed of delivery is not the only advantage G-E RM Power Transformers offer. They embody all the refinements of design, high quality of materials and precise manufacturing methods which have made G-E Power Transformers outstanding. Their flexibility makes them widely adaptable to many situations where custom-built installations may at first seem inevitable.

G-E's Repetitive Manufacture of Power Transformers is based on standardized pre-engineered design. It permits quantity production and stock of parts common to several ratings. This improves the product and lowers the price—as much as 7½ percent. For further information, write Apparatus Division, Canadian General Electric Company Limited, 212 King Street West, Toronto, Ontario.

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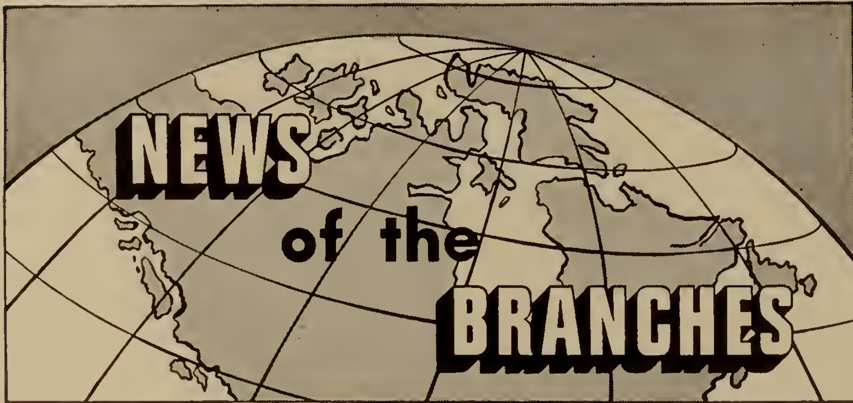



**Activities of the Forty-seven Branches of the Institute and abstracts of papers presented at their meetings**

## British Columbia

H. D. De Beck, Jr.E.I.C.,
*Secretary-Treasurer*

***Joint Meeting***

A general meeting was held at the Golf Club in Kamloops on April 9, 1954, with 29 members and guests present.

Refreshments were available and dinner was served. Following dinner, the business of the evening was introduced by Chairman M. L. Zirul.

It was announced that before dinner a group of members had made an inspection tour of the new Royalite Oil Refinery adjoining the Golf Club. Following a discussion, it was proposed to try to arrange a tour of the Okanagan Flood Control Project to precede the next meeting at Penticton.

After the business meetings, John Wach, superintendent of the Royalite Refinery at Kamloops, was guest speaker. He was introduced by Dan Campbell, construction superintendent for the refinery.

## Halifax

K. F. Marginson, M.E.I.C.,
*Secretary-Treasurer*

F. H. Tremain, M.E.I.C.,
*Branch News Editor*

***Joint Meeting***

The Halifax Branch of the Engineering Institute of Canada held a joint meeting with the Military Engineers Association of Canada, on Tuesday evening, April 6, 1954, in the Officers' Mess (R.C.E.) Halifax Armouries. Major H. L. Mitcheltree, R.C.E. was the guest speaker and gave an illustrated address on "Engineering Problems in the Arctic".

A regular monthly supper meeting was held at the Nova Scotian Hotel on Thursday, April 22, 1954. The guest speaker was E. D. Brown, vice-president and general manager, National Gypsum (Canada) Limited, Halifax, Nova Scotia.

Mr. Brown gave a very interesting talk on the "National Gypsum's New Development at Milford, N.S." The speaker outlined the development at the quarry or mine, the quantity of the mineral being very extensive in this area as proven by diamond drilling. Shipment is by rail from Milford to Bedford Basin where it is loaded on ships and taken to the foreign market.

Approximately sixty members attended each of these meetings.

***Supper Meeting***

A buffet supper meeting was held in the Wright Auditorium, Y.M.C.A. Building, Halifax, N.S., on Tuesday, May 11, 1954. The special speaker was J. Herbert Smith, vice-president and general manager, wholesale division, Canadian General Electric Company, Limited, Toronto. His subject was "A Plan for Unity".

His talk covered a plan to unite the Engineering Institute of Canada and Dominion Council of Professional Engineers into one body. This body would be able to speak more effectively as one national organization for all engineers in Canada.

A discussion period followed the talk in which several of the members participated.

This was the last general meeting of the Halifax Branch until the fall.

## Lakehead

G. E. Cook, M.E.I.C.,
*Secretary-Treasurer*

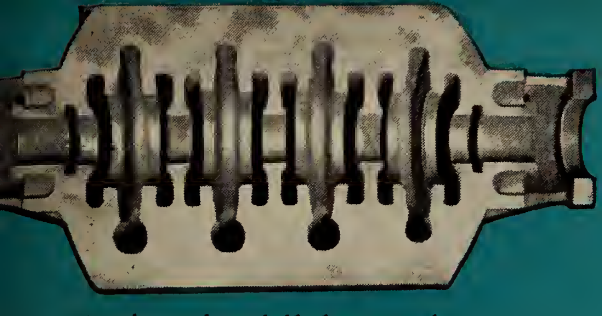
H. Penner, Jr.E.I.C.,
*Branch News Editor*

***Annual Meeting***

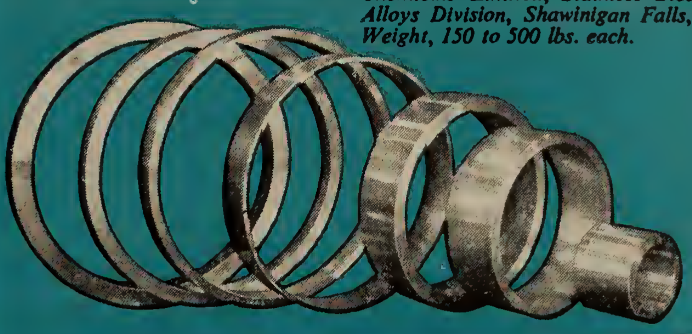
The annual meeting of the Lakehead Branch of the Engineering Institute of Canada was held Tuesday evening, June 22, 1954, at the Port Arthur Country Club. Sister professions, represented by Dr. C. A. Shaffer of the dental association, John Carrel of the law society, Dr. R. J. G. Park of the medical society and Mr. Walker Love of the pharmaceutical association, brought greetings to the engineers. The various committee chairmen of the Lakehead Branch then read the reports of their activities for the past year. All indications were that the Engineering Institute had a banner year. The nominating committee under the chairmanship of W. H. Small, presented the slate of officers for the coming year. These were as follows:

Chairman, F. E. Ayers; Vice-chair-

**W. H. Moore, chairman of the Student Guidance Committee, Montreal Branch, shakes hands with high school student, Denis Gravel, on the occasion of another of a series of forums organized by the committee. Left to right: Henri Gaudefroy, dean of Ecole Polytechnique; Jacques Laurence; J. A. Lalonde, past chairman Montreal Branch, guest speaker; A. Dupré, director of French high schools; W. H. Moore; Henri Audet, vice-chairman of the committee, chairman of the forum; Denis Gravel. Each year the committee holds two forums for students of English high schools and two for French high school students.**



*Interior view showing lower half of pump made of high nickel alloy by Shawinigan Chemicals Limited, Stainless Steel and Alloys Division, Shawinigan Falls, P.Q.*



*Centrifugally cast high nickel alloy jet aircraft engine rings produced by Shawinigan Chemicals Limited, Stainless Steel and Alloys Division, Shawinigan Falls, P.Q. Weight, 150 to 500 lbs. each.*

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*14" Blow Valve, electrically operated, for digester in sulphite pulp mill. Made of CF-12M cast stainless steel by Welland Electric Steel Foundry Ltd., Welland, Ont.*

The high nickel-chromium-iron alloys are essential to provide long uninterrupted service life in cast parts of equipment exposed to corrosion and high temperature effects. These materials, as a class, are characterized by (1) resistance to many corrosive liquids and gases at ordinary and elevated temperatures; and (2) unusual strength at very high temperatures, frequently up to 2000°F.

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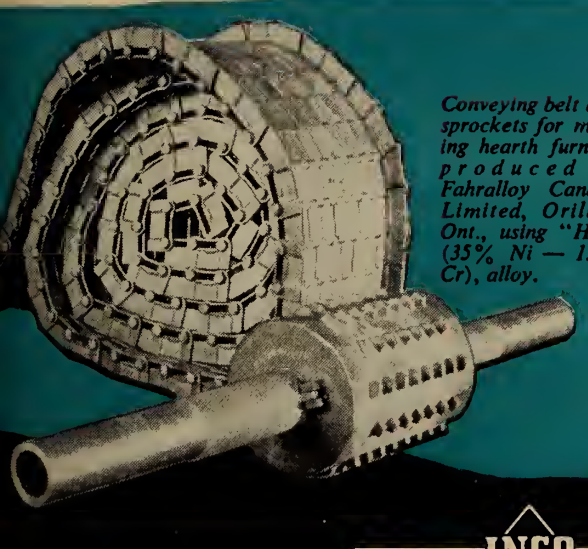

*Conveying belt and sprockets for moving hearth furnace produced by Fahralloy Canada Limited, Orillia, Ont., using "HT" (35% Ni — 15% Cr), alloy.*

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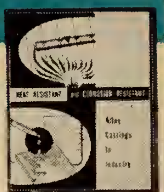

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1st Annual
Professional Engineers Ball

Sponsored by
E.I.C.'s Niagara Peninsula Branch,
Niagara Chapter of the Association of
Professional Engineers of the
Province of Ontario.

**Friday, October 15, 1954.**
**Hotel Sheraton-Brock,**
**Niagara Falls, Ont.**

Dinner: 7:00 p.m.
Dance: 9:00 p.m. to 1:00 a.m.
Dress Optional

Advance tickets available: $9.00 per couple.

man, E. T. Charnock; Secretary-treasurer, G. E. Cook; Directors: Fort William, W. D. Beckett, G. B. Anderson, D. B. McKillop; Port Arthur, G. Eriksen, L. B. Walker, W. D. McKinnon; Past chairman, G. S. Halter; Councillor, H. M. Olson; Eastern district representative, J. H. Hargrave; Western district representative, M. S. Fotheringham.

G. S. Halter thanked the branch for the privilege of serving them as chairman before handing over the gavel to F. E. Ayers, the incoming chairman. Mr. Ayers thanked the branch for the honour which it had bestowed on him and expressed his desire to do a good job in the coming year.

## Northern New Brunswick

G. Melanson, jr.e.i.c.,
*Secretary-Treasurer*

R. W. Rankine, jr.e.i.c.,
*Branch News Editor*

### Annual Meeting

At the first annual meeting at Kent Lodge on June 12, G. A. Robb, of Dalhousie, was elected chairman of the Northern New Brunswick Branch of the Engineering Institute of Canada for 1954.

Other officers are:

Vice-Chairman: W. S. Hosking, Bathurst. Secretary-Treasurer: Gerard J. Melanson, Bathurst and Dalhousie.

Executive members for the three counties covered by the branch were chosen as follows:

Gloucester: G. P. Milton, G. E. McLellan, both of Bathurst.

Restigouche: D. C. MacCallum, Dalhousie; T. Turgeon, Campbellton.

Northumberland: A. V. Tracy-Gould, M. E. Cyr, both of Newcastle.

Retiring Chairman Robert C. Eddy presided at the banquet held in the evening. After introductory remarks and a short history of the young branch, he called for financial and auditors' reports, which were adopted as read.

### Emphosis on Profession

The evening's guest speaker, R. J. Love, head of the Department of Education of the University of New Brunswick, was introduced by J. G. Chalmers.

"Engineering is becoming more important as our society becomes more complete. It has great appeal for youth, and hereby poses a problem," said Mr. Love, who was speaking from an educator's point of view. "While the adoption of the profession comes from three motives, to improve man's welfare, to meet an interest, and for money," the speaker continued, "there is the danger of the subject not being properly adapted."

Mr. Love cited the qualifications of a good engineer as skill in problem analysis, adeptness at mathematics and physics—so he could think in the abstract. "The engineer must be thorough," he went on, "be able to accept responsibilities, have a sense of accuracy and order and be able to get things done."

"Engineering trains one to be a potential manager and is a foundation also for a varied career." The speaker demonstrated this point by mentioning such outstanding personalities as C. D. Howe, Rube Goldberg, Hon. R. W. Winters and Arthur Murray. "It requires a co-ordination of the natural laws, personal and professional knowledge and intellectual techniques acquired in college, as well as specialized skills learned in practice. But a college certificate does not make an engineer. Originality and creative spirit is necessary."

Referring to the financing of education, Mr. Love mentioned that since the province paid 50 per cent of the overall cost, the municipalities should not complain too much. University professors are paid lower salaries than most high school teachers, he noted, so it was difficult getting competent people, because most are not interested unless they have a sideline to augment meager salaries.

Criticising the plight of students with great ability but no money, Mr. Love said that unlike Canada, students in the United States are well aided with scholarships. There are 30 per cent between the ages of 18 and 24 studying under scholarships, compared with 6 per cent in Canada.

The scholarships, he went on to say, are often underwritten by large corporations to train men who will later become competent members of their staffs. The speaker paid tribute to a Canadian firm, Canadian Union Carbide, which has recently decided to spend half a million dollars in scholarships at the rate of two hundred $500 bursaries a year.

"Professional improvement must be constant," concluded Mr. Love, in emphasizing the importance of organizations such as the Engineering Institute, whose suggestions to universities in improving their courses will be greatly welcomed.

G. A. Robb thanked the speaker.

After the meeting members and guests attended an enjoyable dance at the Lodge.

## Peterborough

R. A. Blount, jr.e.i.c.,
*Secretary-Treasurer*

G. T. Davis, jr.e.i.c.,
*Branch News Editor*

### Public Relotions

The speaker at the May 6 meeting of the Peterborough Branch of the Engineering Institute of Canada was C. S. Watson, vice-president, public relations, O'Keefe's Brewing Company. Mr. Watson, speaking on "Public Relations" emphasized that in both private and business activities, public relations should be given serious consideration by everyone. As an example of this, a public opinion survey taken in 1943 revealed that 54 per cent of the Canadian population were antagonistic towards the brewing industry. The industry set out to develop its public relations policies and in 1953, when a similar survey was taken, public opinion was only 24 per cent adverse.

A concerted effort towards the improvement of public relations is also desirable in certain of the professions in Canada. The speaker described how a public opinion survey can, with honest interpretation, be a very useful tool in determining along which avenues of approach public relations efforts may be directed.

### From the President Down

In an industry, public relations must be foremost in the minds of all employees, from the president down, if the best results are to be obtained. For this reason, his company had decided that public relations was a matter of executive importance and had included a public relations officer at the executive level. In this way decisions by company management are not made without approval of someone well qualified to consider the problem from the point of view of public relations. At the same time, however, it is equally important that persons having contact with the public be carefully chosen so that they will have the most desirable effect on all the people they meet. It is also important that people who do not normally meet customers during their normal duties be public relations minded so that they will not adversely affect the people they meet during their off-duty hours.

### And in Community Life

Public relations is not a subject to be considered only by large companies or by commercial groups but has an equally important place in community life. Without good public relations, the success of neighborhood enterprises cannot be guaranteed.

After the formal part of his presentation, Mr. Watson ably replied to the questions of his audience.

### Engineering in Peterborough

The regular monthly meeting of the Peterborough Branch of the Engineering Institute of Canada was held at the Kawartha Club on Thursday, June 3, 1954.

The Branch chairman, J. C. Watts, presided over a gathering to which students and others new to the community were particularly invited. The program was devised to make more widely known the scope of engineering activities in the city and was presented by a group of local members representing various prominent industries.

### Oats

The first speaker of the evening was A. J. Bonney, chief engineer of Quaker Oats, who outlined briefly the methods of handling and processing the various products of the mill.

The plant is capable of receiving twenty carloads of grain in eight hours which after weighing and sampling is transferred by automatic handling equipment to thirty-six grain storage tanks having a capacity of one and one-half million bushels.

The output of the mill in flour, feeds, "ready to eat" products and rolled oats amounts to some forty carloads per day.

Mr. Bonney described in some detail the process of puffing wheat and made brief reference to services provided by the control laboratory.

***Dairies***

The next speaker was O. J. Frisken, chief engineer of the DeLaval Company, who briefly outlined the past history and associations of the company and referred to its contribution to the mechanization and development of the dairy industry. The Canadian plant is chiefly concerned with the design and production of milking machines, pasteurization equipment and storage facilities for farms and dairies. Such equipment has contributed very largely to the high standards of hygiene now prevailing throughout the dairy industry.

***Clocks***

The third speaker was F. R. Pope, superintendent of Western Clock company's plant, manufacturers of Westclox watches and clocks. Mr. Pope said that the science of chronology is not one appearing in the engineering curricula of the engineering schools and colleges and in point of fact there is only one such school on the continent. There have been few changes in the basic design of clock mechanisms for some two hundred years and progress has been largely along the lines of refinement and development to permit the use of mass production techniques. Manufacture involves the maintenance of very close tolerances, high finishes and close control of assembly methods. It is a highly competitive business in which the material content of the product is low and costs can be brought down only by mechanization and reduction of labour.

***Paper and Tape***

The fourth speaker was Garth Wade, plant engineer of the Nashua Paper Company, manufacturers of gummed papers and tapes, and of specialty waxed papers for containers and wrappers. In general Kraft papers are used in the gumming division and sulphite papers used in the waxed paper division.

Mr. Wade dealt at some lengths with the problems associated with the wax treatment of papers and described in detail a method developed for handling the wax in a liquid state from the original vendor and throughout the process, in place of the original method of purchasing in solid form.

***Friction Materials***

The final speaker of the evening, J. S. Munro of Canadian Raybestos, discussed in some detail the properties and application of the various friction materials produced by his company. Coefficient of friction, wear resistance, absence of noise, freedom from moisture absorption and absence of brake fade are the principal factors involved in the selection of material and process. Asbestos base materials may be woven and pressed, or may be moulded using a resin or rubber base binding agent. The engineering application of these materials in the automotive and other industries is largely based on experience rather than theoretical considerations and any completely new application may be the subject of trial and error until a satisfactory solution is reached.

At the conclusion of each paper there was a short, lively discussion.

The vote of thanks extended to the speakers by E. Cotton was heartily endorsed by the meeting, which was one of the most heavily attended of the season.

A buffet supper concluded the meeting with a period of social conversation.

## Sarnia

R. A. McGeachy, M.E.I.C.,
*Secretary-Treasurer*

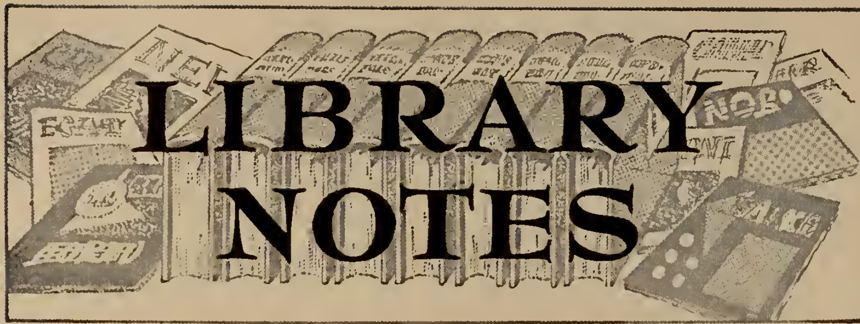
C. N. Lund, Jr.E.I.C.,
*Branch News Editor*

***Annual Dance***

The annual dinner-dance of the Sarnia Branch was held on June 18 at the Harrington Hotel, Port Huron, Michigan. This is the third year that this purely social event has been held, and it is hoped that it will develop into a regular annual attraction.

The members and their ladies enjoyed a steak dinner, after which Bob Meade's orchestra provided music for dancing in the ballroom. A feature of the evening was the presentation of the Plummer Medal, awarded by the Institute for the best paper on a chemical or on a metallurgical subject, to Mr. J. S. Moloney. The presentation was made by G. R. Henderson, regional vice-president. (See Month to Month Section.)

Preparations for the affair were under the chairmanship of Frank Belshaw. The Branch chairman, S. V. Antenbring, presided at the dinner.




## Additions to the Institute Library

**Reviews — Book Notes — Abstracts**

### BOOK REVIEW

**Climate and architecture.** J. E. Aronin. New York, Reinhold, 1953. 304 pp., illus., $12.50 (U.S.).

In the many books being published on architecture now considerable emphasis is being placed on the adaptation of design to climatic surroundings.

This volume, however, goes even farther, and the aim of the writer is "To acquaint architects, architectural students, engineers, city planners, builders, present and prospective home owners and others, expecially those in North America, with the demands and phenomena of the large and small scale climate, known respectively as the macroclimate and microclimate; and to inform them how to apply this knowledge to the design and orientation of buildings and towns."

All types of climates are included, along with the appropriate building materials.

Chapter headings include Sun, Temperature, Wind, Precipitation, and other climatic factors, including lightning and humidity. Copious photographs and illustrative diagrams demonstrate or enlarge on each topic as it is considered, and fourteen pages of pertinent bibliography are included.

The author should be of particular interest to our Canadian members, as he graduated from the University of Manitoba, and took his master's degree at McGill.

In nineteen forty-six, while still a student, he went as a correspondent on Exercise Muskox, representing Canadian University students, and the seed of this book was probably sown at that time.

It will be of technical interest and value to the engineer and architect, but the amateur interested in building design and preservation will also find his fancy taken. E.K.

### BOOK NOTES

**Prepared by the Library**
**The Engineering Institute of Canada**

*Review provided through the courtesy of the Engineering Societies Library in New York.

**Abaques ou nomogrammes.** A. Giet. Paris, Dunod; Montreal, Fomac, 1954. 224 pp., figs., $7.50.

Regardless of the academic level of the student or engineer using this book, it will be of value, in that it instructs the user in how to prepare or construct tables and nomogrammes for his own use.

It is a theoretical study and a practical presentation which should be of great value in the mechanical, electrical and physical fields.

***Air conditioning, refrigerating data book, 1953-54.** New York, American Society of Refrigerating Engineers, 1953. irreg. paging, diagrs., $7.50 (U.S.).

A comprehensive coverage of refrigeration design, theory, thermodynamics, refrigerant properties, and related topics written by authorities in the various fields. There are new chapters on the heat pump, absorption and steam jet units, and abbreviations and symbols, and many chapters have been considerably revised. A buyer's guide is included.

**Atomic power symposium held at Chalk River, September 1953. Report.** Chalk River, Atomic energy of Canada, 1953. 202 pp., figs., $2.00. (CRR-548-A. AECL-82).

This report contains the unclassified papers presented at the Atomic power symposium held last September at Chalk River. The idea of the symposium was to permit personnel of various companies manufacturing power and power equipment to exchange ideas on atomic power with the staff at Chalk River, and with each other.

The papers included cover the present methods of producing power, and give the most comprehensive view of research at Chalk River ever presented to private industry. Topics discussed include the design and control of reactors, the disposal of fission products, radiation hazards, etc. In contrast, there are papers on steam electric generating systems, and another on Canadian power resources, excluding atomic energy.

**Calcul et exécution des ouvrages en béton armé. v. 2. Fondations et superstructures des bâtiments. Silos, canalisations, réservoirs,** 3rd ed. V. Forestier. Paris, Dunod; Montreal, Fomac, 1954. 232 pp., figs., $5.00.

This second volume of the third edition of this work, besides being brought up to date on all points as indicated in the subtitle, includes also special chapters on mushroom beam, coated beam and prestress concrete decking, and should be a valuable addition to the field.

***Chambers's shorter six-figure mathematical tables.** L. J. Comrie. New York, Chemical Publishing Company, 1954. 387 pp., $6.50 (U.S.).

Tables essential for purposes requiring more than four-figure accuracy are presented in this volume. Many are reprinted from the two-volume edition, although some have been reset with a wider interval of argument. Among the tables included are logarithms of trigonometrical functions of angles in degrees, minutes and seconds; trigonometrical functions of angles in degrees, minutes and seconds; circular functions, or trigonometrical functions with the argument in radians; exponential and hyperbolic functions; and many others.

**Conquest of the moon.** Cornelius Ryan, ed. Toronto, Macmillan, 1953. 126 pp., illus., $5.25.

The first collection of scientific factual information regarding potential travel to the moon, this book is the result of a scientific symposium which appeared in Collier's magazine under the title "Man on the Moon".

The Space station, Building the moonships, the journal itself, and the possibilities afforded after landing, are all presented, based on accepted scientific facts.

Watch the teen-age members of your family on this one, our future space engineers.

**Dictionnaire technique anglais-français chauffage industriel.** I. Dusnickis. Paris, Dunod; Montreal, Fomac, 1954. 144 pp., $3.55.

Although not indicated by the title, this dictionary is both English-French and French-English, and will fill a great need in the industrial heating field, covering as it does, five thousand words.

It is divided into five separate parts, Abbreviations and Conversions of Meas-

## LIBRARY REGULATIONS

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A library deposit of $5.00 at par in Montreal is required, for which two items may be borrowed at a time. Temporary deposits (30 days or less) $10.00. Books are sent anywhere in Canada, and carrying charges are payable by the member concerned.

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Any book or pamphlet may be ordered through the library. All publications of affiliated societies, whether books, pamphlets, or periodicals, should be ordered through the library, as reduced rates are applicable on these to all members. Except in the case of library deposits **please make no payments in advance.** Non-members may consult the library, but may not borrow material. Please address all requests to **The Library.**


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ures, General and Technico-Commercial terms, Steam generators and auxiliaries, Furnaces and Metallurgy, and Control and regulation.

**Effects of taxation: depreciation adjustments for price changes.** E. C. Brown. Boston, Harvard graduate school of business administration, 1952. 161 pp., $3.25 (U.S.).

This study is a comprehensive attack on the problem of depreciation allowances for tax purposes brought on by changing price levels.

Section One treats of the effect on national income and federal income taxes if replacement costs depreciation were applied for tax determination; and an analysis of the efforts made by companies and individuals to meet the price changes problem.

The second section deals with the possible effect of this on the national economy, and all is then summarized in the author's conclusions.

***Electronics.** G. F. Corcoran and H. W. Price. New York, Wiley, 1954. 459 pp., $7.00.

Designed for a first course for junior students, this text emphasizes circuitry aspects of the subject but does not neglect basic principles. It includes chapters on vacuum-diode operations and mobile charges, conventional material on linear and non-linear operations, and chapters on feedback circuits, germanium diodes, transistors, and oscillators.

***Elementary fluid mechanics,** 3rd ed. K. Vennard. New York, Wiley, 1954. 401 pp., diagrs., $5.50.

Fundamentals, physical properties, and fluid statics are discussed first, and then follows a chapter on one-dimensional flow presented as background for general treatment of fluid flow problems. Incompressible ideal fluid flow and the impulse-momentum principle are similarly considered, as important tools for future use. The discussion of basic facts of flow of a real fluid leads to flow in open pipes and channels, and fluid measurements are dealt with. A chapter on flow about immersed objects concludes this edition which has been critically reviewed and revised.

***Elements of mechanism.** V. L. Doughtie and W. H. James. New York, Wiley, 1954. 494 pp., diagrs., $6.00.

Completely rewritten, this edition of a standard textbook gives the fundamentals of kinematics in the field of mechanical movements. Early chapters cover motion in general, velocity and acceleration analysis, and linkages. Cams, gears, belts and trains are considered in detail in the later chapters. The last chapter discusses miscellaneous mechanisms.

***Engineering contracts and specifications.** R. W. Abbett. New York, Wiley, 1954. 429 pp., $6.00.

Legal and business aspects of the engineering profession are presented in this book which has been revised and expanded throughout. Material on contracts, specifications and the presentation of legal rights and obligations in construction work has been considerably amplified, and other sections have been rewritten in the light of current professional practice.

***Engineering mechanics,** 2nd ed. F. L. Singer. New York, Harper, 1954. 525 pp., diagrs., $6.00 (U.S.).

Fundamentals are presented in a manner that shows how they may be applied to practical engineering problems. As in the previous edition, both analytic and graphic methods are used, and equations have been interpreted in terms of their geometrical equivalents. The complete text has been rewritten, with some discussions expanded and others simplified. Summaries at the end of each chapter aim to make the text useful for a review of the subject in post-college work.

***Flow and fan.** C. H. Berry. New York, Industrial Press, 1954. 226 pp., $4.00 (U.S.).

The data needed and methods used for finding the aggregate resistance of ventilating systems, and for selecting a fan for particular purpose are presented in simple terms for the student and practicing engineer. Flow measurements, losses, fan performance, and fan operation and control are among the subjects covered. The material appeared previously in "Heating and Ventilating".

**French-English dictionary for chemists,** 2nd ed. A. M. Patterson. New York, Wiley, 1954. 476 pp., $6.50.

Although intended primarily for chemists, this dictionary includes non-technical words and terms taken from related sciences and industry which are likely to be encountered in a technical book.

Various technical vocabularies were consulted in order to make this new edition as complete as possible, chemical nomenclature has been revised in accordance with the latest practices, and there are in all about forty-two thousand entries included.

Where words have different meanings in different connections, this is indicated. Formulae are given for many substances, and the English meaning of many French abbreviations is also included.

This new edition of this French-English dictionary will be a useful addition to the reference shelf.

**Graphic problems in petroleum geology.** L. W. LeRoy and J. W. Low. New York, Harper, 1954. 238 pp., spiral binding, figs., $4.50 (U.S.).

Intended basically as a textbook and manual for petroleum geology, the topics covered in this volume include lithofacies mapping, geologic cross-sections, contour maps, oil field development, stereographic projection and interpretation of air photographs. There is, in addition, a list of suggested readings. The book has a spiral binding for convenience in use, and has been prepared primarily "to teach the student how to apply what he knows".

***Graphics in engineering and science.** A. S. Levens. New York, Wiley, 1954. 696 pp., illus., $7.00.

Graphics is treated as a means of communication for the engineer and scientist. The first part emphasizes fundamental principles, primarily of orthogonal projection, and applies these to a variety of space problems in engineering. The second part covers standards; representation of threads and fasteners, cams, and gears; dimensioning practices; and the preparation of working drawings. Part three deals with graphical analysis and graphic methods of computation. Appendices give symbols, standards, and other data, and there is a selected bibliography.

**High altitude rocket research.** H. E. Newell. New York, Academic press, 1953. 298 pp., illus., $7.50 (U.S.).

Written to be easily read by the general scientific public, this is the first book to be written on the use of rockets for studying ionosphere, earth's magnetic field, solar radiation, and cosmic rays, atmosphere. The WAC corporal, V-2 Aerobee, and Viking rockets are all described, and all the upper-air research firings conducted by United States agencies from nineteen forty-six through nineteen fifty-two are listed.

The book is both illustrated, and indexed and the chapters include bibliographical references.

**Introduction à l'électronique.** P. Grau. Paris, Dunod; Montreal, Fomac, 1954. 212 pp., figs., $7.75.

Serving as a general introduction to the vast field of electronics, this volume touches on electronic measuring, telecommunication, electronic acoustical devices, pilotless planes, servo-mechanisms, etc.

It carries a detailed table of contents, and has over two hundred illustrations.

***Liants hydrocarbonés; mortiers et bétons bitumineux.** M. Duries and J. Arrambide, Paris, Dunod; Montreal, Fomac, 1954. 728 pp., figs., $25.20.

A comprehensive treatise on hydrocarbon-base binders. The introductory chapter reviews such topics as viscosity, plasticity, surface phenomena, and the nature of colloids. Succeeding chapters deal with the preparation, composition, and properties of coal and petroleum tars and their derived products; with the influence of time, temperature, and environment on their rheological characteristics; and with their use in highway and airport runway construction and as sealing materials for buildings and for dams, embankments, and other hydraulic structures. Tests, analyses, and specifications are given.

**Métallurgie. v. 2 Elaboration des métaux,** 2nd ed. C. Chaussin and G. Hilly. Paris, Dunod; Montreal, Fomac, 1954. 202 pp., figs., $4.15.

Brought up-to-date in this second edition with new statistical information and exercises, volume two of Métallurgie deals with the newest developments in the elaboration, finishing and improving of metals and alloys, and will be of particular value to technical students.

**The new architecture in Great Britain, 1946-1953.** E. D. Mills. London, Standard Catalogue Company, 1953. 209 pp., illus., 40/.

Being volume one of a planned larger work, this book is composed of articles contributed to Architectural Design from nineteen-fifty-one to nineteen fifty-three.

Opening with a historical chapter to present-day architecture, and a list of important modern buildings in Great Britain up to nineteen forty-five, fifteen different examples of buildings are then discussed in detail from the technical, engineering, and aesthetic viewpoint.

Photographs and plans are on every page, making of the whole production a fascinating overall picture of the modern trend in general.

**Specialized home and portable radio manual,** v. 8. New York, Rider, 1954. 96 pp., diagrs., $1.65 (U.S.).

The specialized series of Rider radio manuals of which this is volume eight has been prepared to provide service technicians with factory prepared dependable service information on particular makes of radio receivers.

This volume deals with home and portable radio receivers produced by the Radio Corporation of America during the period June 1951-December 1953.

**Specification writing for architects and surveyors.** A. J. Willis. London,

# How to get 3 years' lighting from a Fluorescent Lamp

*Specify G-E Fluorescent Lamps. Operating at 48 hours a week, they provide an average of three years of lighting. (Based on a spectacular rated life of 7500 hrs.)*


**G-E Fluorescent Lamps** not only provide an *average* of 3 years' lighting, but they are so uniform in quality that even after the first two years, nearly every lamp is still in operation. Apply the benefits of the consistent long-life performance to your lighting problems . . . see how you can reduce replacement and maintenance costs to the very minimum.

Rigid manufacturing standards give G-E Fluorescent Lamps their outstanding superiority. By specifying 'G-E' you assure low overall lighting costs . . . combine good lighting with good business. Investigate all the advantages of G-E Fluorescent Lamps by contacting your G-E Lamp Distributor or mail the coupon below.

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Please send me FREE booklets on Money-Saving Lighting Maintenance.

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EJA LAD 40303

Crosby Lockwood, 1953. 88 pp., spiral binding, 7/6.

Intended both for students and those in active practice, the aim of this book is to provide a list of the main points which should be covered in each of the sections of a specification. The author's intention in doing this is to provide some means of ensuring that there will be no gaps left in the specification when completed.

The author has referred throughout to British standards, and Codes of practice published by the British Standards institution, and in listing the points to be included has followed the British standards sequence of trades and items.

This should prove a useful book for all of our members who have at any time to prepare a building specification, and the handy spiral binding makes for ease of use.

**The superhet manual**, 5th ed. F. J. Camm. Toronto, British Book Service, 1954. 143 pp., diagrs., $1.30.

The majority of modern radio receivers work on the super-heterodyne, or superhet, principle. This manual is concerned with different aspects of superhet design, operation and servicing. The first chapter covers the fundamental principles of radio, leading up to the problems of selectivity which it is the special function of the superhet to solve. There are many wiring diagrams included in the text, and the manual should prove useful to all those interested in this aspect of radio design.

**TV manufacturers' receiver trouble cures**, v. 5. M. S. Snitzer. New York, Rider, 1954. 120 pp., diagrs., $1.80 (U.S.).

The fifth volume in this series, this book deals with television receivers manufactured by firms whose names begin with the letters S to Z. The trouble cures given are those suggested by the manufacturers themselves, and this book, taken together with the other four volumes in the series covers practically the whole field of sets manufactured in the United States.

**Tables of barometric pressures at varying temperatures.** J. D. W. Ball. Toronto, Longmans, Green, 1953. 23 pp., $1.25.

The five sets of tables in this book record:

1. The equivalents of millimetres of mercury in kilogrammes per square centimetre.
2. The equivalents of inches of mercury in pounds per square inch.
3. The equivalents of inches of mercury in pounds per square foot.

(All the above at temperatures varying from 0°C. to 40°C.)

The other two tables are provided to convert:

1. Kilogrammes per square centimetre to bars at standard gravity, and
2. Kilogrammes per square centimetre to bars at Greenwich.

These tables should prove useful to those engaged in making calculations based on atmospheric pressure when it is desirable to use one of the above basic units of pressure rather than pressure recorded in terms of inches or millimetres of mercury.

**Who's who in engineering**, 7th ed. W. S. Downs and E. N. Dodge, eds. New York, Lewis, 1954. 2861 pp., $17.50 (U.S.).

The seventh edition of Who's who in engineering, this is the second to be published under the auspices of the Advisory Committee of the Engineers Joint Council. The editors emphasize that now, more than ever, inclusion of an engineer is in no way influenced by purchase of the book.

The principle qualification for inclusion is at least ten years' active practice, a minimum of five of which shall have been spent in charge of an important engineering work. Teachers of engineering subjects at an accepted college or university are included if they have been in charge of a major engineering course for at least five years.

Engineers in the volume include all those in the 1948 edition who signified their wish to be included again. In addition, members of the various American national and state societies qualified for admission were invited to submit information for inclusion, so that coverage of the profession could be as complete as possible.

The great majority of engineers listed, however, are from the United States. The geographical listing shows only a handful of Canadians, and a few engineers from other parts of the world.

With the limitations as cited above, this new edition will be a useful volume for the library reference shelf, both for the biographical data included, and for the list of nation- and state-wide engineering and allied societies included.

## BOOKS RECEIVED

**Achieving your career; a vocational guidance manual.** J. S. Kopas and

W. Garrett. Youngstown, Industrial Information institute, 1953. 138 pp., figs., $1.50 (U.S.).

**Airplane structures,** v. 1, 4th ed. A. S. Niles and J. S. Newell. New York, Wiley, 1954. 607 pp., figs., $7.75.

**Bibliography of interlingual scientific and technical dictionaries,** 3rd ed. United Nations educational, scientific and cultural organization. Toronto, University press, 1953. 178 pp., $1.75.

**Canada's tomorrow; papers and discussions. Canada's tomorrow conference, Quebec City, November 1953.** G. P. Gilmour, ed. Toronto, Macmillan, 1954. 324 pp., $3.50.

**Classified directory and buyers' guide, 1954.** Engineering industries association. London, Standard Catalogue, 1954. 474 pp., 32/6.

**Design and operation of septic tanks: third European seminar for sanitary engineers.** World Health Organization. New York, Columbia University press, 1953. 124 pp., $1.50 (U.S.). (WHO Monograph series, No. 18).

**Electrical ignition equipment.** F. G. Spreadbury. Toronto, Longmans, Green, 1954. 227 pp., illus., $4.50.

**Engineering analysis.** D. W. Ver Planck and B. R. Teare. New York, Wiley, 1954. 344 pp., figs., $6.00.

**Ferrous process metallurgy.** J. L. Bray. New York, Wiley, 1954. 414 pp., figs., $6.50.

**Flow properties of disperse systems.** J. J. Hermans, ed. New York, Interscience Publishers, 1953. 445 pp., illus., $9.90 (U.S.).

**The molecular theory of gases and liquids.** J. O. Hirschfelder, C. F. Curtiss and R. B. Bird. New York, Wiley, 1954. 1219 pp., $20.00.

**New Brunswick almanac, 1954.** Fredericton, Brunswick Press, 1954. 224 pp., pa. $1.00.

**Plastics progress, 1953.** Phillip Morgan, ed. London, Iliffe, 1953. 439 pp., illus., 50/-.

**Principles of geomorphology.** W. D. Thornbury. New York. Wiley, 1954. 618 pp., illus., $8.00.

**Slide rule: the autobiography of an engineer.** Nevil Shute. Toronto, McLeod, 1954. 240 pp., illus., $4.00.

**Statistical methods in electrical engineering.** D. A. Bell. Toronto, British Book Service, 1953. 175 pp., $4.25.

**The steel skeleton. v. 1. Elastic behaviour and design.** J. F. Baker. Toronto, Macmillan, 1954. 206 pp., illus., $7.15.

**The structure of metals and alloys,** 3rd ed. W. Hume-Rothery and G. V. Raynor. London, Institute of metals, 1954. 363 pp., figs., $5.50.

**A textbook of metallurgy.** A. R. Bailey. Toronto, Macmillan, 1954. 560 pp., illus., $5.00.

## TECHNICAL BULLETINS AND PAMPHLETS RECEIVED

**Agricultural institute review.** Reprint: The use and conservation of Canada's farm lands. March-April 1954.

**British institute of management:** Construction of Esso refinery, Fawley; a study in organization, by A. P. Gray and Mark Abrams. 3/6.

**Canada. Dominion coal board:** Canadian energy sources, by C. L. O'Brian. Reprinted from the Canadian institute of mining and metallurgy. Bulletin, June 1953.

**Central mortgage and housing corporation:** Normes de construction (maison d'appartements non comprises). Ottawa, 1954. 104 pp.

Small house design: bungalows and split-level houses. 1954. 87 pp.

**Dominion fire prevention association:** Proceedings of the thirty-second annual conference of the Association of Canadian fire marshals and the thirty-fifth annual meeting of the Dominion fire prevention association, Winnipeg, May 1953.

**Engineering foundation. Council on wave research:** Gravity waves; tables of functions, by R. L. Wiegel. 30 pp. $1.00.

**Institution of metallurgists:** The microscopy of metals. 132 pp. 15/6.

**Purdue University. Engineering experiment station:** Research activities, 1952-1953.

**Purdue University. Engineering extension dept. Engineering bulletin:** No. 82—Excessive moisture in homes, by W. T. Miller and F. B. Morse. No. 83—Proceedings of the eighth industrial waste conference, May 1953.

**Royal society of arts:** Bicentenary issues of the Journal, April 1954.

**Winnipeg water district:** Annual report of the Greater Winnipeg water district for the year ended December 31st, 1953.

# STANDARDS REVIEWED

**American society for testing materials, 1916 Race Street, Philadelphia 3, Pa.**

**Report on the principles involved in the determination of absolute viscosity.** 1953. pa. $1.00

The purpose of this report was to encourage the recognition and use of instruments yielding results in standardized units having true physical dimensions that will convey the same meaning in all laboratories.

Prepared by Subcommittee 9 on rheological properties of ASTM committee E-1, this report was published originally in the 1951 ASTM Proceedings. While not to be considered a laboratory manual, but rather an introduction to rheology from a practical point of view resting on a sound theoretical base, this book will prove a valuable asset to those concerned with viscosity determination. It is well illustrated with drawings, and includes a bibliography. An appendix lists the names of fourteen American suppliers of viscometers.

**Standards on engine antifreezes.** 48 pp., pa. $1.25.

This publication includes all ASTM methods of test pertaining to engine antifreeze in one convenient book, and is sponsored by ASTM committee D-15 on engine antifreezes. Of eight methods, five included in the previous edition have been revised and one is new; also both specifications have been revised. Methods cover sampling and preparing aqueous solutions for testing purposes; freezing point of aqueous solution; physical tests for boiling point of engine antifreezes, and specific gravity of concentrated engine antifreezes by the hydrometer; chemical tests for ash content; reserve alkalinity; pH of concentrated engine antifreezes; and water in concentrated engine antifreezes by the iodine reagent method.

The book should prove of value to both producers and consumers interested in this field.

**Selection and use of engine antifreezes.** 16 pp., pa. 40 cents. (Special technical publication No. 120).

An excellent companion book to the above, providing information and advice on engine cooling system antifreezes and corrosion inhibitors. The detrimental effects which can occur when improper antifreezes are used are discussed and there are a number of illustrations showing the results of the use of faulty antifreezes on engine parts.

**British standards. British standards institution, 2 Park Street, London, W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.**

**B.S. 2064: 1953 — Dimensions of diamond abrasive wheels and tools.** 4/-.

This Standard specifies dimensions and tolerances for diamond abrasive wheels and tools of the following types in resinoid, vitrified and metallic bonds: peripheral wheels, straight cup wheels, double cup wheels, taper cup wheels, bull-nosed cup wheels, dish wheels, cut-off wheels, chip-breaker wheels, milling tools, hollow drills, stone saws and hones. The information is given in tabular form, and some is also shown diagrammatically.

**B.S. 2082: 1954 — Code on disappearing-filament optical pyrometers.** 6/-.

The disappearing-filament optical pyrometer occupies an important position in the field of high temperature measurement. In the metallurgical, heavy chemical and coking industries it is used either directly as the temperature-control instrument or as the reference standard for other instruments. It is thus important that these pyrometers should be capable of giving high accuracy and reliability. In order to make known the possibilities of improved design the British standards institution has published this standard.

The Code should prove useful to both manufacturers and users of optical pyrometers, for a wider field is covered than simple recommendations on design. The reasons for certain features of design are fully discussed and this has led to the inclusion of a summary of the basic principles of optical pyrometry; in order, however, to avoid digression from the main arguments, certain aspects of the subject are separated into appendices of which there are seven. The main text is divided into five parts under the headings:—1. General (including definitions and a description of a typical optical system): 2. Principles of optical pyrometry: 3. Design requirements: 4. Calibration procedure: 5. Selection and training of operators.

In part three no rigid specifications are given but only an indication of the design requirements so that originality of design may not be prevented. Among the appendices there is for example a discussion on the precautions necessary in the use of optical pyrometers, including emissivity data and emissivity corrections to be applied to pyrometer readings; another of the appendices considers a scheme for the statistical assessment of observers, while a third sets out the method of calculation of the effective wavelength of the red glass of an optical pyrometer in some special cases in continuation of the discussion on this subject in the main text of the Code.

**B.S. 2084: 1954 — Cotton covered round copper wires (metric units).** 2/6.

This is a metric edition of B.S. 1791, which has the same title. It has been prepared primarily from the point of view of exports and differs from the 1951 edition of B.S. 1791 only in that all qualities are expressed in metric units, and the range of diameters covered is 0.150mm. to 5.00mm.

For normal purposes in the United Kingdom B.S. 1791 is still the appropriate standard to be used. The technical details contained in the new specification are taken entirely from B.S. 1791 with the addition of an Appendix giving constants and reciprocals of constants for coverting resistances at various temperatures to those at the standard temperature of 20°C. It gives details of diameters, resistances and thickness of covering, together with tests relating to bending and elongation of the covered wire. It includes an Appendix on measurement of conductor diameter and overall diameter.

**B.S. 24 Part 5: 1954—Railway rolling stock material—copper.** 4/-.

This revised edition of the standard specifies requirements for copper in the following forms:

Specification No. 11—Copper plate for locomotive fireboxes.

Specification No. 12—Copper rod for locomotive stay bolts, rivets, etc.

Specification No. 13—Copper tubes for locomotives.

Specification No. 14—Brass tubes for locomotive boilers, which was included in the earlier edition of the standard has been omitted, as the small demand for brass tubes for locomotive boilers is met by the existing British standard 885—Brass tubes for general purposes.

Details of chemical composition have not been included. In some cases tolerances and mechanical properties have been modified and a gassing or hydrogen embrittlement test has been added for deoxidized material in the form of plate and rod. Wherever possible the individual specifications have been modelled on the corresponding general purpose standard, but the main requirements are substantially unaltered from the earlier edition.

**B.S. 327 Part 2: 1954—Derrick cranes (hand-operated)** 6/-.

This is the third revision of this standard, and follows similar lines to the previous editions in that it indicates the minimum requirements for hand-operated derrick cranes of the normal type and is intended to secure the general observance of such fundamental principles as appear desirable to secure reliability and safety without hampering the freedom of the crane maker in his selection of the most appropriate design for the purpose in view.

The standard deals with hand-operated cranes of the Scotch derrick and guy derrick types and specifies requirements for the design of the crane structure and moving parts. Hoisting equipment and brakes are dealt with, and an Appendix gives the requirements to be observed when a hand-operated crane is converted to power operation.

The clauses on electrical wiring and cables have been brought into accord with the twelfth edition of the Regulation for the electrical equipment of buildings published by the Institution of electrical engineers, and the Appendix on the design of struts has been revised so as to follow the general method of application of the Perry-Robertson formula for struts adopted in other British standards.

**B.S. 336: 1954—Fire hose and suction hose couplings, branch pipe and nozzle connections.** 4/-.

This revised British standard applies to the following:

Delivery hose couplings and connectors of the instantaneous pattern, hose couplings with ribbed and multi-serrated tails and single lug twist release connector.

Suction hose couplings.

Branch pipe and nozzle connections.

The revisions in this standard include the introduction of an instantaneous connector with twist release, and a material clause which provides for the use of both copper alloys and aluminium alloys.

This standard also provides for both ribbed type tail pieces and multi-serrated type tail pieces.

The standard size of coupling adopted is that known hitherto as the '2½ in. gauge'.

The design of the suction hose couplings has been modified and now provides for an external locking ring instead of an internally screwed sleeve. For suction couplings, a two-ribbed type of tail end has been introduced in place of the serrated type. A slight modification has also been made to the branch pipe in that a shroud has been provided to ensure that the washer is adequately retained in position.

**B.S. 1991 Part 1: 1954—Letter symbols, signs and abbreviations. Part 1. General.** 6/-.

When it was decided to revise two well established and partly overlapping British standards, B.S. 560—Engineering symbols and abbreviations, and B.S. 813—Chemi-

cal symbols and abbreviations, it was thought desirable to take this opportunity of combining them so as to remove unnecessary conflict and pave the way to the development of a consistent system for the whole field.

The committee entrusted with this work decided that, in the first instance, attention should be focused on the more fundamental quantities of common concern to all branches of pure and applied science, on conventions relating to their use, and on abbreviations for relevant words, especially the names of unit. This standard is the outcome of this decision, and it will be left to groups of experts in specialized fields to build in various directions on the foundations thus laid.

It is recognized that the attainment of a reasonable measure of agreement will entail the abandonment of a few practices that are well established in certain fields of work. Departures from well-established usages are recommended, however, only where they are considered to be of serious importance.

The standard is intended to give guidance towards the development of a general system. It urges that the general principles put forward should be accepted and followed rather than that there should be rigid adherence in all instances to recommendations on the use of individual symbols or abbreviations.

**B.S. 2051 Part 2: 1954—Olive, soldered nipple and flared types of copper and alloy tube fittings for engineering purposes.** 12/6.

This new standard provides for the complete dimensional standardization of the copper tube fittings known as olive, soldered nipple, flared and inverted flared fittings for use with copper and copper alloy and other suitable tube designated by its fractional o.d. size for a wide range of engineering purposes and covers the following classes and ranges of fittings:

a. Olive fittings of sizes ranging from 1/8 in. to ¾ in. inclusive.
b. Soldered nipple fittings of sizes ranging from 1/8 in. to ¾ in. inclusive.
c. Flared fittings of sizes ranging from 1/8 in. to 1 in. inclusive.
d. Inverted flared fittings of sizes ranging from 1/8 in. to ¾ in. inclusive.

These fittings are provided with 'B.S.P. Whitworth' threads to B.S. 84 or Unified threads to B.S. 1580. Material requirements and tests for porosity are specified, and also details of the maximum working pressures for these fittings.

Illustrations of the fittings together with tables of dimensions of each type of fitting are included in this standard.

**B.S. 2079: 1954—Steam receivers and separators.** 12/6.

This new British standard forms one of a series for land boilers and unfired pressure vessels. It applies solely to steam receivers and separators used for piping installations for and in connection with land boilers. It is not intended to cover process vessels or steam receivers and separators, the design temperature of which exceeds 900°F.

The standard applies to welded and riveted receivers and is divided into four parts: general, materials, construction and workmanship, and scantlings.

Two appendices illustrate typical methods of attachment for branches, pads and bosses secured by welding alone, and also typical acceptable methods of attachment of receiver ends.

**B.S. 2451: 1954—Chilled iron shot and grit.** 2/-.

The primary purpose of this standard is to assist in overcoming the difficulties which have been experienced by users in obtaining uniform grades and sizes of chilled iron shot and grit for use in shot blasting and kindred applications.

The main object in preparing the standard has, therefore, been concerned with the separation and sizing of the chilled shot and grit and designating grade and size numbers. It has also been considered desirable to include requirements for hardness.

The grades and sizes of chilled iron shot and grit covered by this standard have been designated 7, 8, 9, 10, 12, 15, 18, 22, 30 and 40.

Screen sizes and tolerances are given to determine the particle size.

**Canadian standards, Canadian standards association, National research building, Ottawa.**

**C.S.A. B89-1954—1½ inch fire hose couplings screw thread and tail piece internal diameters, 2nd ed.** 50 cents.

The first edition of this standard was issued in 1948, and this second edition has been revised to cover the internal lip diameter and core diameter of the tail piece on both male and female couplings. The specification covers standard 1½ inch fire hose coupling screw thread for general use in fire protection equipment. The details are based on the latest edition of American standard B33.1, Hose coupling screw threads.



**C.S.A. B89.2-1954—2½ inch fire hose couplings and fittings,** 2nd ed. 50 cents.

This specification covers a standard 2½ inch screw thread for general use in fire protection equipment. The specification has been revised from the first edition issued in 1949 to include the internal lip diameter and core diameter of the tail piece on both male and female couplings. Included in the specification is an appendix giving calculations for arriving at thread form American national standard thread.

**C.S.A. Z102.10-1954—Skidding of machinery for shipment.** $2.00.

Prepared by the Committee on wooden containers this specification is one of a projected series covering nailed wooden boxes and crates, cleated plywood boxes and wirebound boxes, etc. The specification covers the design and construction of skids for machinery but does not provide for the design and construction of acrate superstructure, either open or sheathed. For machinery requiring these, the other appropriate specifications must also be used. There are many diagrams showing details of construction.

**C.S.A. A82.57—1954—Inorganic aggregates for use in interior plaster,** 2nd ed. 50 cents.

This specification covers the aggregates which are most commonly used in interior plaster. These include perlite, sand (natural and manufactured), and vermiculite, although others may be used if tests have proved them to yield plaster of satisfactory quality.

Information is given on the sizes and weights of aggregates, and methods of sampling are included.

**C.S.A. C22.2 No. 16-1954—Construction and test of insulated conductors for power-operated radio devices,** 4th ed. $1.50.

Providing minimum requirements, this specification applies to insulated conductors intended for use in power-operated radio devices, but does not apply to the supply cords.

Details are given of general requirements, conductors, insulation and braids to be used, and of tests for different types of conductors.

**C.S.A. C22.2 No. 103—1954—Construction and test of electric fence controllers.** $1.00.

This standard applies to indoor and outdoor types of stationary electric fence controllers for primary potentials up to and including 125 volts between conductors. It does not apply to electric fence controllers of a continuous (uninterrupted) current type, or equipment intended for indoor use, such as electric fly screens, etc.

Details are given for all phases of construction, including frames and enclosures, mounting, wiring, insulating, motors, grounding, etc. Tests are given for output requirements, temperature, dielectric strength, weatherproofness and endurance.

**C.S.A. C22.3 No. 3—1954—Inductive co-ordination; definitions, principles and practices,** 2nd ed. $1.00.

Another in a series of standards covering outside wiring rules, this revised edition of a standard originally published in 1936 covers the principles and general practices applicable to supply or communication systems, or both, for the purpose of effecting inductive co-ordination in cases where inductive interference exists, or is expected to occur.



Definitions are given of all the terms used in the standard, the principles which should be followed by parties owning oroperating communication systems are outlined, as are the practices which will promote the inductive co-ordination of supply and communication systems.

An appendix considers separately noise induction from two classes of harmonic current or voltage components on the supply line, that is, balanced components and residual components.

**C.S.A. S16—1954—Steel structures for buildings,** 4th ed. $1.00.

This fourth edition of the specification for steel structures for buildings differs in both content and form from the three previous editions. The changes have been made as it was desired to cast it in a manner acceptable to the National Building Code, and also in one suitable for adoption by municipalities. The numbering system has been completely revised, and the appendices deal with different subjects to those in earlier editions.

Among the subjects covered in the standard are types of design, materials, plans, loads and forces, stresses, beams, rivets and bolts, girders, lacing systems, steel joists, workmanship, shop painting, erection and inspection. The appendices cover the weighing and shipping of structural steel, the assembly of structural joints using high-tensile steel bolts, and specifications for cold riveted construction.

# Business & Industrial Briefs

*A Digest of Information*

*received by*

**The Editor**

## Appointments and Transfers

**New Jobs at Bird-Archer.** — Roy H. Standen has been appointed service engineer in the Toronto office of the Bird-Archer Co. Ltd., water treatment engineers.

Ronald S. Trump is the new Bird-Archer district representative in Quebec, with headquarters in Quebec City.

●

**Peacock Brothers.**—Following the annual meeting of Peacock Brothers Limited, the following executive changes were recently announced: W. P. Ferguson, M.E.I.C., president and general manager; F. A. Lucas, vice-president and director of sales; A. E. Patterson, secretary treasurer.

Elected to the Board of Directors were L. N. Harlock and F. H. Hunt Re-elected to the Board were J. D. Collier, W. P. Ferguson, W. D. Howitt, F. A. Lucas, A. E. Patterson and Hon. J. Kenneth Weir, C.B.E.

After 50 years with the company, John Bryson, former president and secretary treasurer, has announced his retirement.

●

**Inglis Expands.** — The Ontario Branch office of the John Inglis Co. Limited's refrigeration and air conditioning division has moved from the company's main plant on Strachan Avenue, Toronto, to new offices at 49 Niagara Street, Toronto.

Headquarters staff, under manager W. S. McLeese, has been increased.

R. R. Cox, Ontario branch manager, has a full staff of salesmen, engineers and mechanics to provide complete service and installation facilities for all customers in Ontario.

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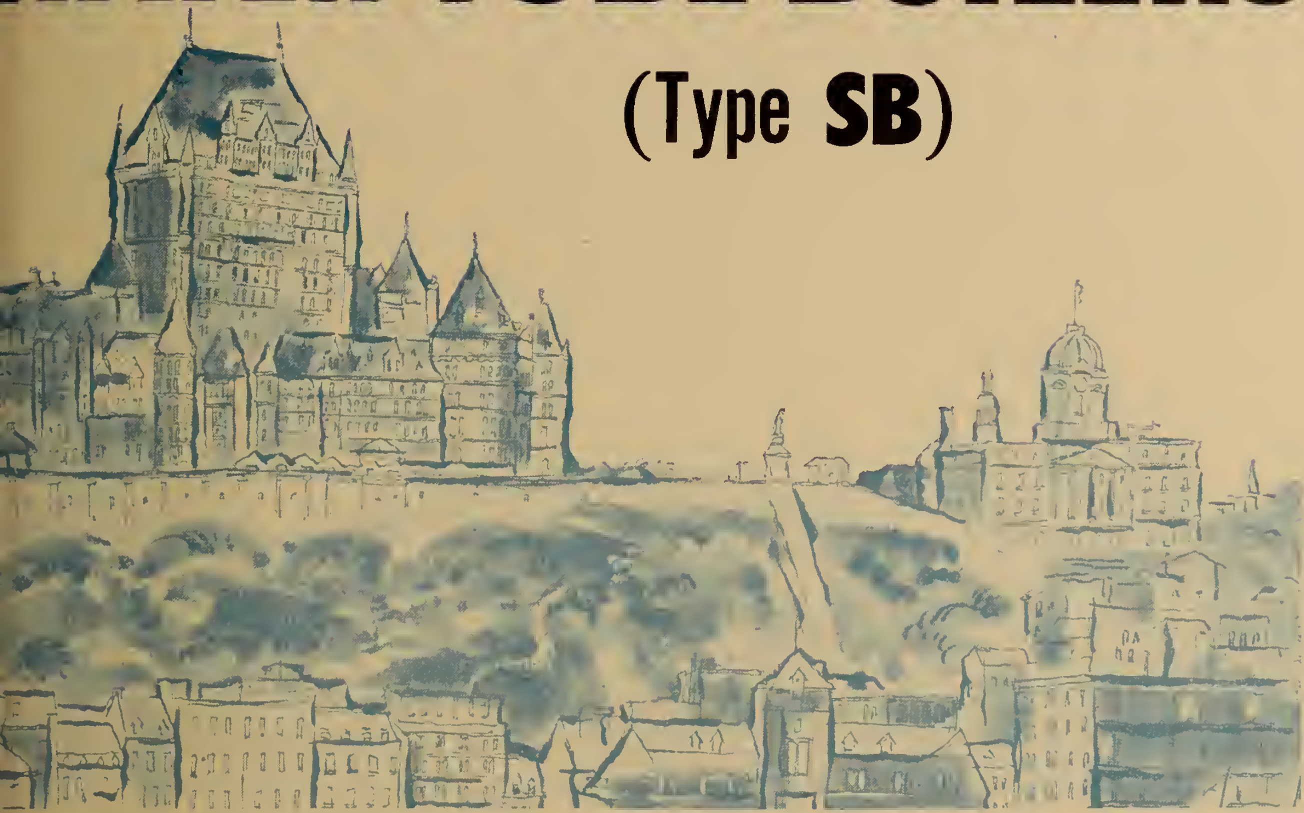
(*Continued on page 1038*)

**Roy H. Standen**

**Ronald S. Trump**

# WATER TUBE BOILERS

## (Type SB)



In the ancient city of Quebec — modern equipment and machinery is used to provide the vital public utilities.

For example: the two Dominion Bridge SB Water Tube ilers which produce steam for gas manufacture and heating purposes at the Quebec Power Company (Gas Division).

These boilers are of the latest type and designed for quick conversion from bunker "C" fuel oil and tar -product firing to coal firing by stokers.

The nature of the service causes rapid load fluctuations, which are easily accommodated by the boilers.

***Other SB features:***

- HIGH EFFICIENCY
- LARGE DRUMS
- EASE OF CONVERTIBILITY
- POSITIVE CIRCULATION
- WATER COOLED FURNACES
- ACCESSIBILITY

BOILER DIVISION*
**DOMINION BRIDGE**
COMPANY LIMITED

*Write for Catalogue No. BF-113*

*Other Divisions: STRUCTURAL • MECHANICAL • PLATEWORK • WAREHOUSE

*Plants at:* MONTREAL • OTTAWA • TORONTO • WINNIPEG • CALGARY • VANCOUVER

*Assoc. Company plants at:* AMHERST • QUEBEC • SAULT STE. MARIE • EDMONTON

J. H. Buttery

**Robbins and Myers.**—K. C. Berney has announced his retirement as executive vice-president, managing director and treasurer of The Robbins and Myers Company of Canada Limited. He will continue to act as a director and will be employed by the company in an advisory capacity. C. Allen Mills has been appointed as vice-president and general manager. He will also act as a director and as treasurer of the company.

•

**Otis Appointments.**—W. J. W. Reid, president, recently announced the election of William Gordon Robson as vice-president of Otis Elevator Company Limited, effective July 15, 1954.

Mr. Robson after extensive service in the International Division of the Otis organization, returns to the Canadian company, in which he will have general responsibilities having special regard to sales, service and construction operations.

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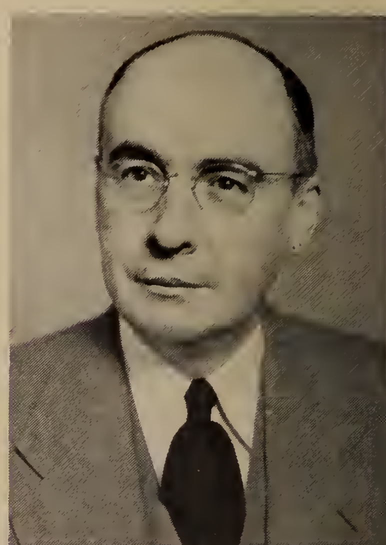
*(Continued on page 1040)*



C. Allen Mills

*(Continued from page 1035)*

**Trane Works Manager.**—Grant E. Cole, executive vice-president and general manager, Trane Company of Canada, Limited, has announced the appointment of J. H. Buttery as works manager responsible for all matters of the production division.

Mr. Buttery recently returned from Lille, France, where he was works manager for an international concern with extensive manufacturing operations abroad.

•

**Canadian Arsenals.**—Air Vice Marshal John L. Plant, CBE, AFC, CD, has been appointed a director of Canadian Arsenals Limited.

Recently Air Vice Marshal Plant was appointed Air Member for Technical Services at R.C.A.F. Headquarters in Ottawa. Prior to this appointment he had been Chief of Staff to the Commander in Chief of Allied Air Forces, Central Europe. In Canadian Arsenals he will replace Air Vice Marshal D. M. Smith, who was recently appointed chairman of the Canadian Joint Staff in London, England.

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# New Equipment and Developments

**Electrothermal Armoured Heater.**—The electrothermal armoured heater is a flexible heating cable constructed of a mineral core and insulated according to temperature range. A suitable resistance alloy is moulded in wire form beneath the insulation covering and the whole assembly is then enclosed in a braided nickel alloy sheath. The nickel alloy input terminals insulated with ceramic have been designed for trouble-free operation at maximum temperature.

The heater is produced for a wide range of heating applications for industry. It is ideal in circumstances where a high rate of heat transfer is required. The heater may be applied directly to metal vessels or pipes and may be lagged or close-coiled. When close-coiled on a metal vessel a loading of 20 watts per square inch (3.1 watts/sq. cm.) of surface area is attained with the 450° C. type heater and 30 watts per square inch (4.65 watts/sq. cm.) with the 800° C. type heater.

It has been successfully applied to metal reaction vessels, catalyst tubes, pipes, etc.

The electrothermal armoured heater is supplied in standard dimensions. In addition, any reasonable length can be made to suit individual requirements. It is suitable for operation on supply mains from 12 to 250 volts A.C. or D.C. with wattage ratings up to 60 watts per linear foot (200 watts per metre) in the 450° C. range and 100 watts per linear foot (330 watts per metre) in the 800° C. range. Manufacturer of the cable is Electrothermal Engineering Ltd., London, England.

●

**Research Laboratory.** — $1,500,000 research laboratory—first building of a five-unit research center—will be built at Kingston, Ontario, by Du Pont Company Limited, it was announced.

The laboratory, to provide facilities for about 80 technical and supporting personnel and to be completed in the fall of 1955 will have a three-fold purpose:

To give basic support to the highly technical sales and production programs of Du Pont of Canada in the chemicals, packaging films and textile fibre fields;

To investigate new processes and products directed toward diversification of the company's operations;

To advance scientific knowledge in fields of present and potential interest to the company without specific commercial objectives.

The project represents the beginning of what will be a sustained, independent program of basic industrial research pertaining particularly to Canadian needs in fields of present and potential interest to the company.

●

**Photosensitive, Anodized Aluminum Sheets.**—Photosensitive, anodized aluminum sheets, designed for photographic reproduction by standard darkroom methods, has been announced by the Metalphoto Corporation, 2903 East 79th Street, Cleveland 3, Ohio. Known as Metalphoto, the aluminum sheets, which measure 0.020 inches in thickness, and which are available in sizes 4" x 5", 8" x 10", and 10" x 12", may be used to produce such products as name plates, dial and watch faces, wiring diagrams, instructions, instrument and slide rule scales, and other products where resistance to abrasives is vital.

Photographs and drawings are processed from ordinary photographic negatives using simple darkroom techniques and standard solutions. The non-facing image is permanently sealed within the sapphire-hard anodized layer. This layer protects the dimensionally stable image from abrasion, temperatures up to 1000° F., and acids, salts and organic solvents.

Additional information may be obtained from the company at the above address.

●

**Voltage Regulator.** — Ferranti Electric announces the development of a new single-phase step-voltage regulator designated RS-32. The new product employs 32 steps to provide 10% or 15% voltage regulation in a wide range of standard voltage and current ratings.

The new regulator has been designed much smaller and lighter than the company's previous products of similar ratings. The control compartment of the new RS-32 contains the well known Astatic Voltage Relay as the main relay. There is also a line-drop compensator and operation counter in the control compartment.

The control compartment can be unbolted from the main tank and installed at the foot of the pole when the regulators are cross-arm or platform mounted. This provides access to the controls without pole climbing.

A position indicator is mounted on the side of the main tank and tilted to be easily read from ground level.

For further details, write to the company requesting Ferranti Flashes, Volume 19, Number 2.

●

**Portable Testing Machine.**—A portable testing machine announced by Soiltest, Inc., 4520 West North Avenue, Chicago 39, makes possible rapid on-the-job testing of concrete and similar materials with laboratory accuracy.

The 200,000 pound capacity Portable Testing Machine can be used in field and laboratory testing of concrete cylinders and beams and other construction materials. The tester is entirely self-contained and no electrical or pressure connectors are required.

The machine is simple to operate. Loads are developed by means of a hand operated, two speed concentric pump which actuates the piston of the main hydraulic system. The unit meets ASTM and AASHO specifications for design and accuracy of hydraulic concrete testing machines.

Use of the portable testing machine is not confined to concrete testing. It can be used as a high capacity shop or laboratory press; compression testing machine for castings or small vessels; experimental press for powdered metals work; and as a laboratory testing machine, for all types of routine work on small sized specimens such as ceramic pieces, rock cores, timber and welded sections.

●

(*Continued on page 1042*)

(*Contined from page 1040*)

**Water Chillers.**—Three larger size CenTraVac water chillers for comfort or process air conditioning have been introduced by Trane Company of Canada Limited. With the additional units the line now includes 8 sizes from 45 to 400 tons capacity.

Trane CenTraVac incorporate a hermetic centrifugal compressor that automatically matches power consumption to load variations from 100 per cent to 10 per cent of compressor capacity. Power input is limited to actual cooling requirements, reducing power costs.

The CenTraVac starts, stops and runs automatically with the controls interlocked for added safety.

The compressor motor is hermetically sealed inside the casing, eliminating need for shaft seals and consequent shaft seal maintenance and possible loss of refrigerant through the seal. The compressor is direct drive type.

For complete information write for Bulletin DS399 to Trane Company of Canada Limited, 4 Mowat Avenue, Toronto 3, Ont.

●

**Insulation Testing Set.** — A 2,500 volt portable insulation testing set, developed to meet the demand for a safe and economical device for making insulation tests required by the Canadian Standards Association on domestic and industrial appliances that are operated on 110, 220 and 500 volt circuits, is available from Canadian General Electric Company.

The range of secondary voltages will allow the testing of fractional horsepower motors, switches, wiring devices, hair waving equipment and small capacitors.

This easily portable set weighs only 42 pounds and is equipped with a convenient handle and a set of hangers for wall or post mounting.

The insulation testing set consists of a 0.240 k.v.a. air-cooled transformer contained within a metal case. The different high voltages are obtained by changing taps on the primary winding or supply side of the transformer by means of a plainly marked dial switch. The high voltage winding is connected directly to the testing leads.

For further information write to Specialty Transformer Sales, Canadian General Electric Company, Ltd., 830 Lansdowne Ave., Toronto, Ont.

●

**Hydraulic Overhead Loader.** — A new overhead loader and angledozer, known as the McEwen Hydraulic Overhead Loader, puts on the market for the first time a machine that automatically gives free and complete track oscillation while dozing and oscillation restriction while loading. This gives maximum efficiency in both operations. Instantaneous finger tip control and low hydraulic pressure are features. Simplicity in changeover from loader to dozer allows the operator to complete the job alone in less than 15 minutes. Designed for mounting on a D2 Caterpillar Tractor, it has a nominal bucket capacity of 1 cu. yd. Loading from a bank its 16 second load cycle allows a 5 cu. yd. body to be filled in from 1 to 2 minutes. In snow it has easily handled 4 cu. yds. per scoop. The manufacturers are receiving enquiries from as far away as Africa. Selling is through the Caterpillar dealers. Further information may be had from the manufacturers — The Atlantic Bridge Company, Limited, Lunenburg, N.S.

●

**New Company.**—H. K. Ferguson Company of Canada, Ltd., engineers and builders, with headquarters in Montreal recently announced the formation of a new British company known as H. K. Ferguson Company of Great Britain, Limited, with headquarters at 19 Berkeley Street, London, England.

The offices will be equipped to offer engineering and building services and will have accounting, estimating and purchasing departments.

Charles P. Stolberg, assistant chief of operation, will direct engineering and construction, and Raymond B. Aufmuth is chief engineer.

●

**New Steel.**—Coated with ice at 45 degrees below zero, four large closed pressure tanks of a new kind of steel were recently put through burst and impact test paces at Birmingham, Ala.

The vessels were made of a new quenched and tempered steel known as "Carilloy T-1". This new material is

(*Continued on page 1044*)

(*Contined from page 1042*)

the product of United States Steel Corporation's Research Laboratory.

Two separate test methods — burst tests and drop impact tests—were used to demonstrate the strength and toughness of the steel. Two burst tests were made on alternate days to determine how much internal pressure the tanks could withstand before they burst. In the drop tests a new method of testing full-scale vessels was used. A 26,700 pound steel weight was let fall upon the tanks from heights of 52, 73 and 101 feet to show the toughness of the steel at low temperatures. Internal pressure in the drop tests was 1,875 pounds per square inch.

Results of the tests performed on the four tanks were as follows: (1) June 29 burst test non-stress relieved vessel at 45 degrees below zero 2,850 pounds per square inch internal pressure at moment of burst. (2) June 29 drop test non-stress relieved vessel at 45 degrees below zero 26,700 pound weight dropped from 101 feet caused break. (3) June 30 first test on stress relieved vessel at 45 degrees below zero 2,850 pounds per square inch internal pressure at moment of burst. (4) June 30 drop test on stress relieved vessel at 45 degrees below zero, 26,700 pound weight dropped from 101 feet caused break.

•

**Heating Division, Marine Industries Limited.**—Establishment of a new sales and executive office in Montreal of the heating division, Marine Industries Limited, is announced by Omer E. Guevremont, manager of the division. The new office will head up the distribution of Dravo Counterflo and Paraflo space heaters which are manufactured in Sorel by Marine Industries.

Mr. Guevremont announced the introduction of a new type of space heater, the Paraflo, which has been designed to meet specific heating problems. It has an output capacity of 200,000 to 250,000 btu's per hour, suitable for machine shops, auditoriums and similar buildings. The larger Counterflo space heater output ranges from 400,000 to 2,000,000 btu's per hour.

•

**Static Frequency Converter.** — A 5-kw static frequency converter that provides 360-cycle square-wave current at 600 volts for high-frequency operation of fluorescent lamps has been announced as available from Canadian General Electric Co. Ltd.

Designed particularly for such applications as experimental and commercial plant growth rooms, television and radio studios, luminous ceilings and libraries, the G-E frequency converter increases light output and assists in the lowering of heat loss. Noise is reduced because the converter can be located remotely. Fixtures in the system are lighter and smaller since they do not require the familiar transformer-type ballast.

The completely packaged unit combines the functions of frequency converter, step-up transformer, current regulator, and square-current generator.

Further information may be obtained by writing to Specialty Transformer Sales, Canadian General Electric Co. Ltd., 940 Lansdowne Ave., Toronto.

•

**Titanium Electrolytically Produced.**—The Shawinigan Water and Power Co., has been successful in making high-grade titanium metal by an electrolytic process, and is planning to expand this work to the scale of a larger pilot plant as a step toward commercial production.

The company has applied for patents in many countries, and the experience derived from operation of the semi-commercial pilot-plant will be a guide in subsequent installation of units of full commercial size.

Comparable to steel in strength, and with a weight about halfway between steel and aluminum, non-corrosive and highly heat resistant, titanium meets many special requirements of modern design for defence and civilian purposes.

Work on the development of titanium has been underway since 1945, and Shawinigan believes that the electrolytic method is capable of being developed into a continuous process.

•

**The "Gammagage" Density Gauge.**—Designed as a versatile instrument that will meet a number of industrial uses, Isotope Products' new density gauge is currently on tour of a diversified group of industries to explore its range, accuracy, stability and value.

Just as the betameter can measure paper, sheet metal, rubber, plastics, asbestos and a wide range of other materials, the density gauge is designed to measure such diverse products as oil, liquid foodstuffs, chemicals, mine and mill concentrates, other industrial fluids and powdered solids.

It has been successfully tested and proven in many industrial applications and at the moment the instrument is at Isotope Products' Oakville laboratory where it is being tested for its use in controlling concentration of uranium from pitchblende ores. Thus, the latest device of atomic research may assist in production of atomic energy's basic raw material, as it may help in production of basic materials for many other industries.

The density gauge is one of that group of gammagage instruments which are harnessing gamma radiation to a range of applications. For example one type of gammagage is used to detect and plot corrosion patterns, another type measures liquid level in vessels.

•

**Soil Testing Equipment.**—A new line of soil testing equipment designed by Karol and Warner has been announced by the Tinius Olsen Testing Machine Company. Included in this line are unconfined compression machines, triaxial testers, consolidation load frames, direct shear machines, consolidometers, compaction molds and other related soil testing equipment. Information about the entire line is available upon request to Tinius Olsen Testing Machine Company, 3053 Easton Road, Willow Grove, Pa.

•

**Conversion Slide Rule.**—A conversion slide rule is available bearing 64 linear, liquid, energy and miscellaneous factors on one side plus a complete trig scale arrangement on the reverse side consisting of A, K, DF-CF, T, S, CI, C-D and L scales. By "positioning" a conversion mark opposite an index mark, any conversion is automatically set and read on the C, D, CF or DF scales without moving the slider or further computation. The same automatic conversion principle is adaptable to any set of specialized conversion factors on either pocket-size or 10-inch rules for any line of work. The new model 903-T single-setting conversion rules is made of light weatherproof metal alloy, is 12⅛ x 1¼ x 3/32 inches in size with white facing, and weights 2¾ ounces. Manufactured by Pickett & Eckel, Inc., 1109 S. Fremont Street, Alhambra, California.

•

**Dawe Instruments Ltd.**—Dawe Instrument Limited have announced the formation of a Canadian division located at 59 Crown Crescent, Ottawa, Ontario. They have announced that plans have now been finalized for the sales and service of Dawe Precision Electronic Instruments to be handled by MJS Electronic Sales Limited, 2028 Avenue Road, Toronto.

•

**Radioactive Tracer Techniques.**—Radioactive tracer techniques have been successfully applied to the plastics industry to measure defects smaller in size than the proverbial needle in a haystack.

Believed to be the first peacetime application of atomic energy to plastics molding, the new techniques can detect and measure one tiny bit of metal in twenty million plastic parts, according to a General Electric Company executive.

The technique involves irradiation of a plastics mold part in an atomic pile at Brookhaven National Laboratory at Upton, N.Y.

Further information may be obtained from the Molded Plastics Section, Canadian General Electric Company Limited, Cobourg, Ontario.

# Publications

**For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.**

**Please mention *The Engineering Journal* when writing.**

**Steam Generators.** — The publication "Power" is Canadian Vickers' latest release on Vickers Keeler steam generators. This booklet is divided into two sections; the first deals with boiler descriptive matter, while the second part carries a number of ready reference tables valuable to engineers.

A copy will be sent upon request. Write to Canadian Vickers Limited, P.O. Box 550, Place D'Armes Station, Montreal.

●

**Betratron Industrial Radiography Laboratory.**—Factors to be taken into consideration in planning and constructing a betratron industrial radiography laboratory are discussed in a new eight-page bulletin released by Canadian Allis-Chalmers Limited.

The bulletin describes and portrays features of Allis-Chalmers' betratron laboratory which was placed in operation at its West Allis Works in 1952. Its cost was completely amortized in less than a year by savings resulting directly from its use.

Several pages in the bulletin are devoted to a description of the construction of the laboratory. The bulletin also weighs the advisability of altering existing radiography facilities for betratron use and sets forth such general requirements as location, construction, work handling equipment, heating and ventilating, location of electrical gear, etc., to be considered in arranging for a betratron laboratory.

Copies of the bulletin, "Laboratory Planning and Construction - Industrial 22-MV Betratron Radiography, "31B8121, are available on request from Canadian Allis-Chalmers Limited, Box 37, Montreal, Quebec.

●

**Telemetering Bulletin.**—A new expanded edition of Bulletin M1710 telemeters and accessories has just been published by The Bristol Company of Canada Limited.

In addition to telemetering over telephone circuits, carrier current and private wires, the bulletin features microwave telemetering, telemetering with selective calling and time multiplexing telemetering.

Specific information and application illustrations are given on how Metameter telemetering may be applied to the measurement and transmission of pressure, flow, liquid and water level, mechanical motion, electrical units and totalized power load. Each category is treated separately.

Copies of the bulletin, may be obtained by writing The Bristol Company of Canada Limited, 71-79 Duchess Street, Toronto, Ontario.

●

**Gages and Valves.** — New Catalog No. 236 covers practicaly the complete Jerguson line of liquid level gages and valves with a condensed presentation of the most pertinent data and specifications. Included are illustrations of the various standard and special function Jerguson gages and valves, description of features and uses, materials used, steam ratings of gauges, dimensional drawings, and a full page table giving standard and optional construction features and specifications of Jerguson valves.

Write Peacock Brothers Limited, P.O. Box 1040, Montreal, Quebec.

●

**Maintenance and Construction.** — The Tremco "Quick Reference Guide" released by The Tremco Manufacturing Co. (Canada) Limited, Toronto, is a compact, illustrated 24 page booklet of special interest to all concerned with problems of building maintenance and construction. A number of Tremco products are described and various maintenance problems of roofs, floors, sash, masonry preservation, etc., are discussed.

Copies of the "Quick Reference Guide" may be obtained from your local Tremco representative, or by writing The Tremco Manufacturing Co. (Canada) Limited, 220 Wicksteed Ave., Leaside, Toronto 17, Ontario.

●

**Shipping and Packing Equipment.** — Canadian Steel Strapping Company Limited new catalogue (154) is a guide to shipping and packing equipment.

The first part of it is about the "Signode" system of tensional steel strapping. The second part covers miscellaneous packing and shipping room equipment. Shipping problems from light parcel post to heavy carload shipments are dealt with. Anchoring of loads in truck or freight cars is mentioned. Particulars are given of stencil equipment, gum tape machines, carton stitchers, tacking machines, nailers and other equipment.

A copy of this catalogue will be sent to those inquiring for it on their company's letterhead.

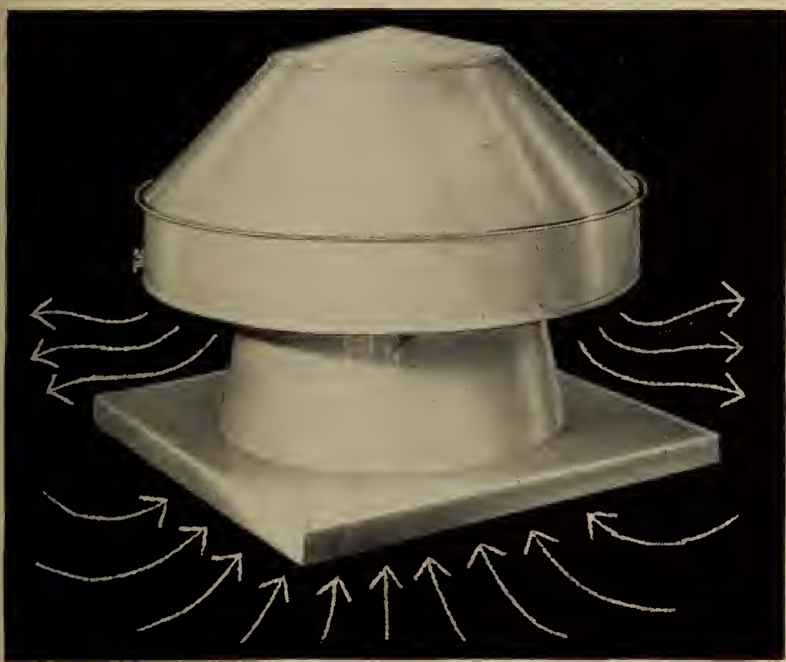
●

**Lighting.**—A Curtis-Miller 28-page catalogue recently announced features the complete Miller line of industrial and commercial lighting available in Canada through Curtis Lighting of Canada Limited, 195 Wicksteed Avenue, Toronto 17, Ont. Copies of this catalogue are available upon request from Curtis Lighting.

●

**Water, Sewage and Trade Waste Equipment.**—Hardinge Company, Incorporated, York, Pennsylvania, has released a 6-page, colour brochure describing its line of water, sewage and trade waste treating equipment. Included are several typical flow sheets

# DIRTY AIR?



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WINNIPEG: E. H. Price Ltd.
CALGARY and EDMONTON: Gorman's Ltd.
VANCOUVER: C. C. Moore & Co., Engineers, Inc.
VANCOUVER: E. H. Price (B.C.) Ltd.

## NEW PLYMOUTH HARBOUR BOARD NEW ZEALAND CONSTRUCTION OF WHARF

**Tenders will be received until 5 p.m. on 26th October, 1954, for the construction of Moturoa Jetty in reinforced concrete approximately 1,100 feet by 90 feet. Drawings and contract documents may be inspected at the New Zealand Trade Commissioner's Office, 609 Sun Life Building, Montreal, P.Q., and may be obtained from the Consulting Engineer, Mr. W. G. Morrison, 28 Buller Street, Wellington, New Zealand.**

and a brief description of auxiliary apparatus such as digestors and flocculating equipment. Ask for bulletin AH-442.

●

**Foundry Mechanization.** — Link-Belt Limited's complete line of equipment for mechanization of ferrous and non-ferrous foundries and its use in increasing production and producing better castings are covered in a new 40-page book No. 2423.

This comprehensive book will be helpful in selecting a specific piece of materials handling equipment to improve a particular phase of production or as an aid in planning a completely mechanized foundry operation. Descriptions of sand preparation and mold, core, casting and sand handling equipment are supplemented by over 70 pictures of actual installations.

A copy of the book will be sent on request from Link-Belt Limited, Box 173, Station "H", Toronto 13, Ont.

●

**Educational Aids.** — How industry furthers education programs in secondary schools is emphasized by an Educational Aids catalogue just released by Canadian Westinghouse Company Limited. Produced by the firm's public relations department, the publication describes a wide variety of free or low cost booklets, charts, posters, and other aids available to high school and vocational school teachers.

Educational topics include science, rural electrification, home economics, industrial arts and photography. The catalogue also has sections on lighting, technical publications and project aids for students and teachers.

Copies of the catalogue may be obtained from the public relations department, Canadian Westinghouse Company, Limited, Hamilton, Ont.

●

**Heating Control Bulletin.**—A new 12-page bulletin on simplified heating controls for all oil burners has been announced as available from appliance control sales, component product department, Canadian General Electric Company Limited, 212 King Street West, Toronto.

Especially written for oil burners dealers and servicemen, the two-colour publication includes step by step installation photographs on the complete line of G-E oil burner controls. It also provides information on the company's heating control exchange plan and free promotional aids available to all C.G.E. servicing distributors and dealers.

Designated GEA-6118, this new bulletin is available on request to appliance control sales, Canadian General Electric Company, 212 King Street West, Toronto.

●

**Developing Canada.**—"Ingersoll-Rand's role in developing Canada" is the title of an interesting booklet recently distributed by that company. Together with a brief history of the company's formation there are interesting notes about Canada's growth in plant construction, hydro-electric projects, etc. For emphasis two specific "miracles" are referred to in this article, the Kitimat project in B.C. and the Bersimis project in Quebec.

Montreal address of Canadian Ingersoll-Rand Co. Ltd. is 620 Cathcart St.

●




giving substance to dreams
Installation of this English Electric 106,000 KVA generator at Kemano marks another step in translating the vision of the planners into reality. English Electric is proud to have shared in equipping another of the world's great projects.
For hydro-electric stations the world over English Electric produces complete turbine generator units and associated equipment for any head and output. The quality of their design and workmanship has been proved under all conditions. There is an English Electric office near you, equipped to provide all necessary information on your electrical requirements.
*English Electric generator stator in transit from the service bay to its permanent location in unit No. 3 in the background. (Alcan B.C. project—photo courtesy Aluminum Co. of Canada Ltd.)*

**Corrosion.**—A 346-page book containing 3512 abstracts of articles and books on corrosion has been published and is now available from the National Association of Corrosion Engineers, 1061 M & M Building, Houston 2, Texas. The articles are from more than 500 periodicals published all over the world and are abstracted by some 30 agencies that authorize NACE to use their abstracts.

This third volume of abstracts published by NACE contains summaries of articles and books published in 1948-49, topically indexed and cross-indexed and with both alphabetical subject and author indexes. The two previous volumes covered articles published in 1945, and 1946-47. Copies of all are available from the association, a non-profit organization concerned with corrosion control.

●

**Safety Devices.**—The National Safety Council's new book, "Safety Devices and Ideas," describes more than 90 safety devices which have been tried and found effective in plant use.

The devices were originally part of a safety gadget show presented during the chemical sessions of the 1953 National Safety Congress. Although designed for use in chemical plants, the devices have application in other industries as well.

Most of the devices are not commercially available, having been thought up and constructed by plant personnel to meet some particular hazard.

Each idea is illustrated with a large photograph which shows clearly the details of construction. The text accompanying the pictures gives other pertinent data.

"Safety Devices and Ideas" is available for $1.25 to Council members and $2.50 to others. For further information write the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

●

**Gas Regulators.**—Air Reduction's complete line of gas regulators is fully described in the new 36-page catalogue now being offered. Cylinder, manifold and pipeline regulators are illustrated with complete descriptions covering specifications and operating data.

Each regulator has a chart showing types of gauges used with it, inlet and outlet connections, maximum flow cfh and maximum working pressure psi.

Also included are flow and pressure charts indicating at what point the regulators can be used to perform a particular job.

For complete information, request a copy of this catalogue by writing to Air Reduction Canada Limited, 905 Hodge Street, St. Laurent, Montreal 9, Quebec.

●

**Sewer Structures.**—The four important requirements for sewers are discussed in a new Armco bulletin—easy handling, fast assembly, long life, and installed economy. The theme of the piece is that all sewer problems are different. They may involve as many as eleven considerations. How, where and when to choose the right type of sewer structure for the right purpose frequently puzzles city officials, engineers and contractors. This bulletin should help. Write to Armco Drainage & Metal Products, Inc., Middletown, Ohio, for a free copy.

●

**Magnetic-Particle Tester.**—A new illustrated bulletin that explains the operation of a magnetic-particle test unit called Portaflux is available gratis from the research and control instruments division, North American Philips Company, Inc., 750 South Fulton Avenue, Mount Vernon, N.Y.

Data covers method used in quickly and economically checking steel and iron objects for surface cracks or discontinuities. Objects under study are magnetized either by passing a current through the metal or through a surrounding cable in the form of a coil.

Magnetic iron oxide or precipitated iron powder distributed over the surface aligns itself in such a way that surface defects may be clearly located. Powders are usually black, gray or red to make the pattern readily visible to the naked eye.

# THE ENGINEERING JOURNAL

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## CONTENTS




*Indexed in The Engineering Index*

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## STANDARDIZED MODULAR DIMENSIONS

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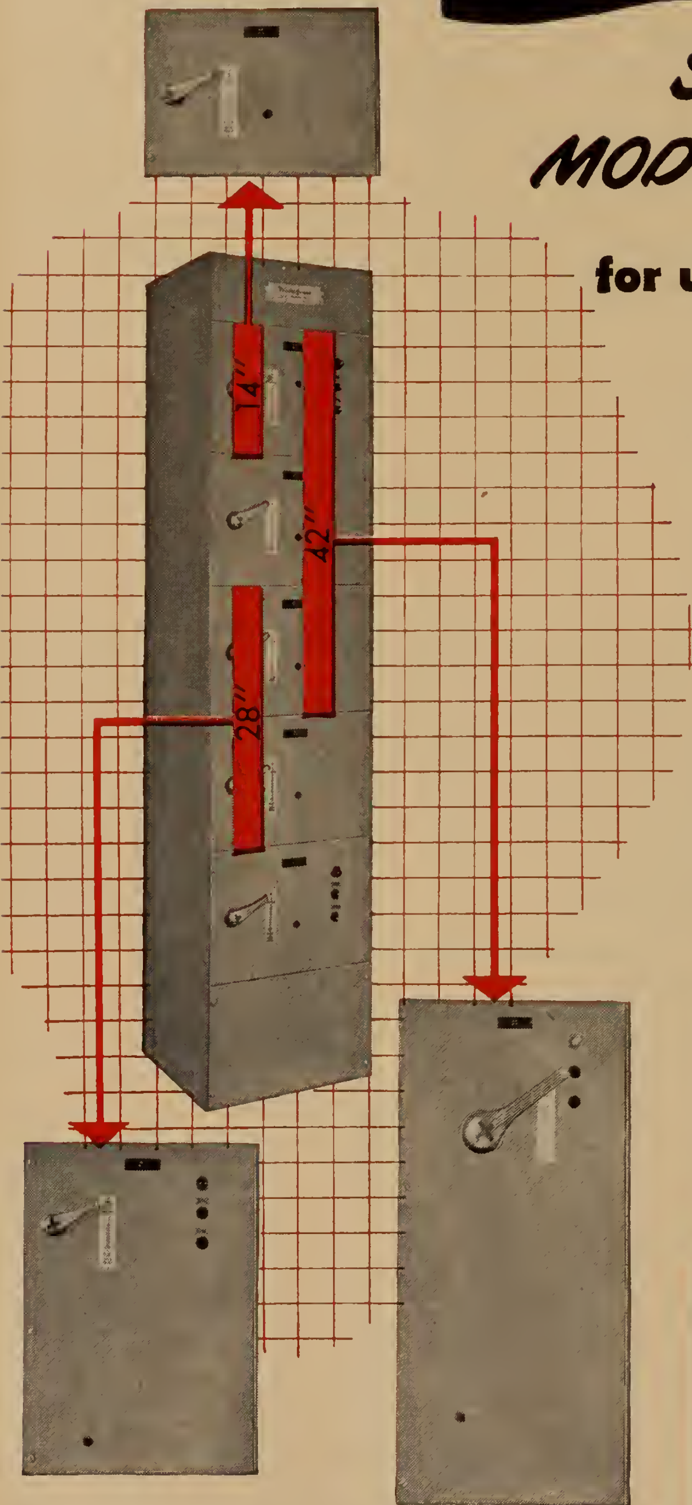


No other control center gives you so much flexibility as the new Westinghouse design. Standardized, modular dimensions are the source of this important advantage.

Vertical structures of standard width and depth are 76″ or 90″ in height. Starter units are 14″ high or in multiples of 14″. This modular design permits many combinations of starter units in single vertical structures. It provides for simple interchangeability between large and small units to meet changing requirements.

The new Westinghouse design also provides for back-to-back mounting without increasing depth. This permits a greater number of starter units to be installed in each vertical structure. To meet growing control requirements, additional vertical structures may be added to the group already in service.

**Consider all the advantages of this new control center!**

New Magna-Grip "plug-in" connectors for greater operating simplicity; a large vertical wiring trough for greater wiring convenience; interlocking handles and "tilt position" disconnect for extra safety. These are random examples. The complete story is in Booklet B-5621. For your copy, write to

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**CONTROL CENTERS**

# Engineering Aspects

of

# The Peribonka Developments

*by*

Dr. R. E. Heartz, M.E.I.C.,
*President,*

J. A. Thomas, M.E.I.C., and R. E. Grout, M.E.I.C.,
*Hydraulic Engineer.* *Senior Electrical Engineer.*

*Shawinigan Engineering Company,*
*Montreal, Que.*

*A paper presented before the 68th Annual Meeting of the Engineering Institute of Canada at Quebec, May, 1954.*

Built during years of material shortages due to the Korean War, both plants here described delivered power within 21 months of the time construction commenced. This speedy progress was partly due to replacing the conventional power house superstructure by a semi open-type design, with gantry crane to remove equipment to a closed repair bay at one end of the substructures.

As seen from Fig. 1, the Peribonka River empties into Lake St. John, Quebec, on the north side, by way of a narrow inlet some twelve miles long extending in an easterly direction. At its base is the village of Ste. Monique de Honfleur, and a mile up the river, at Chute à la Savane, the Peribonka No. 2 plant is located. Here, the river swings northward. The Chute du Diable site of the Peribonka No. 1 plant is located some 12 miles upstream, skirting the junction of the Precambrian Uplands and the pleistocene deposits of the Lake St. John Basin.

The earlier construction of the Isle Maligne and Chute à Caron plants on the Saguenay River first utilized the great storage capacity of Lake St. John. When Shipshaw No. 2 was commenced in 1941, the capacity of 1,200,000 h.p. pointed the way to storage development on the Grand Peribonka River, to increase the minimum regulated flow out of Lake St. John.

Accordingly, Lake Manouan and Passe Dangereuse storages, of 78.5 b.c.f. and 183 b.c.f. respectively, were built and placed in service in 1941 and 1943.

With the greatly increased demands for power following the Second World War, attention was turned to the two sites on the Peribonka River.

At Chute du Diable, the river dropped some 26 feet. There were three natural channels, separated by high, rocky outcrops. At the east was a narrow, deep gorge, and in the centre a shallow, boulder-filled passage, which, before development, was dry for flows below 14,000 c.f.s. The channel on the west side carried water only during freshet periods. With the exception of the gorge, the site was characterized by massive boulders and outcroppings of rock. A mile downstream, the river again divides into three channels with rock ledge bottoms which form a control to river flow.

At Chute à la Savane, the natural drop in the river was approximately sixteen feet. As compared to Chute du Diable, the terrain is more open, necessitating a long crest length of dam, and there is a comparative absence of rock outcrops. Half a mile downstream a narrow gorge forms a partial control for certain elevations of Lake St. John. However, when the Lake is full, it floods back to the foot of Chute à la Savane.

Surveys showed that gross heads of 113 and 115 feet could be developed at the upper and lower sites respectively, with forebays at elevations 488 and 375, and allowing for improvements in the tailwater elevations of both. The drainage area above Chute du Diable is 10,260 square miles, of which 6,420 is controlled by the Manouan and Passe Dangereuse storages, leaving 3,840 square miles to be controlled at the headpond.

Between elevations 488 and 463 of the headpond there is an estimated pondage of 13 billion cubic feet flooding back to Grande Rapide, some thirty miles upstream. Between the two sites the Alex River joins the Peribonka, providing an additional drainage area of 500 square miles.

The average monthly run-off from the watershed, based on thirty-six years of record, varies from a low of 0.50 c.f.s. per square mile in February to a high of 5.56 c.f.s. in May, with a yearly average of 2.0 c.f.s. per square mile. The regulated flow of the river for both plants is estimated at 19,800 c.f.s. Before construction it had been the practice of the Aluminum Company of Canada to draw heavily on the Peribonka storages to hold the level of Lake St. John.

Thus, commencing in December and extending through in most years until March, a flow of 40,000 c.f.s. was maintained. In March, the storages were greatly reduced, and the flow dropped off to 10,000 c.f.s. or less until spring floods replenished the reservoirs. This method of operation was maintained during construction, and had

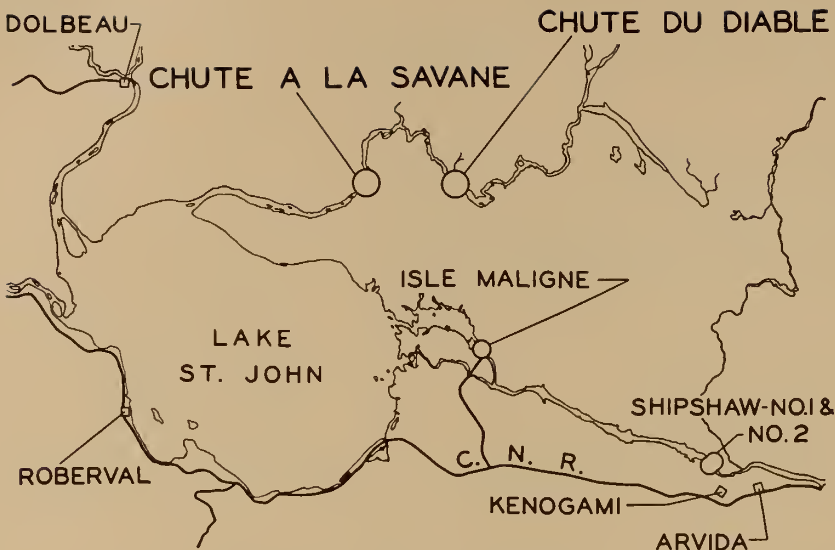



Fig. 1. Peribonka developments.

a very important bearing on the unwatering scheme, as well as the scheduling of the work.

The maximum spring flood on record occurred in 1928, and was estimated 225,000 c.f.s. from Quebec Streams Commission records. In the years following construction of the Passe Dangereuse and Manouan storages, it has not exceeded 90,000 c.f.s. Based on the regulated flow and a capacity factor of approximately 80 per cent, it was decided to install capacities of 275,000 h.p. and 285,000 h.p. at Peribonka No. 1 and No. 2 respectively.

In all, nine schemes were studied for the upper development and eleven for the lower, before selection of the final arrangements described hereafter as the most suitable from an operating and economic point of view.

#### General Description of Developments

Fig. 2 shows a general plan of the Peribonka No. 1 Development. Assuming the river to flow in a northerly direction, the regulating gate section is located on the east end of the dam, in the gorge previously mentioned. This section, in the initial stages of the development, formed the by-pass at which final closure was made. The base line of the structure is roughly at right angles to the direction of flow, and, to the eastward beyond a knob of rock, a cut-off 140 feet long was required to close the contours. The log chute is located to the west, followed by the power house and intake structures. On the west side of the power house a deep cut was made into the rock, and a drainage ditch provided. The lining of the ditch was carried up the rock face and topped by a low retaining wall.

At the top of the knob, the base line of the dam turns through 47°, stations east and west being dimensioned from this turning point. Between stations 2+95W and 6+90W, the spillway section is located, with a retaining wall on the east side of the flood channel downstream. At station 10+00W, the base line turns through an angle of 77°-15′ and the concrete bulkhead terminates some 30′ beyond. Along this base line, bed rock is below forebay level, as low as elevation 460. Due to the great length of seepage path and the relatively impervious nature of the overburden, it was decided not to pour concrete to close the contours against the bed rock. In the event of any tendency for the bank extending along the flood channel to slide, plans were prepared to provide a concrete retaining wall on rock. A roadway 16 feet wide is provided on top of the dam from the west abutment to the intake section, with provision to complete it to the east bank at a later date.

Fig. 3 shows the general arrangement at Peribonka No. 2. Here, the river flows southward. The regulating gate section, comprising the by-pass in the initial stage as in the upper plant, is located in the cascade, with the log chute and power house on the same base line to the east. Proceeding westward from the regulating section along this base line, the spillways are located on top of the west bank, with excavated approach and flood channels. A retaining wall some 215 feet long carries the flood discharge well below the dam before allowing it to fall over the bank into the river.

On the east and west ends, wingwalls turn back upstream. The west wingwall terminates on a rock knob, virtually at forebay level, and beyond it bed rock dips down below. The overburden in this area is relatively impervious, and forms an embankment to effectively impound the headwater. Beyond the east wingwall, however, the overburden is deep, and the ground drops off downstream to an elevation some 40 ft. below forebay level. There, special treatment was required, as described later.

#### Dewatering

The by-pass section at Chute du Diable was located in the gorge. It was designed to pass 70,000 c.f.s. with upstream water level at elevation 430. The design called for cofferdams Nos. 1 and 2, above and below the by-pass structure, to be constructed before the winter regulated flow of 40,000 c.f.s. commenced. While the by-pass concrete was being poured, the river flow, which in this period rose to 40,000 c.f.s., was to be passed through the centre

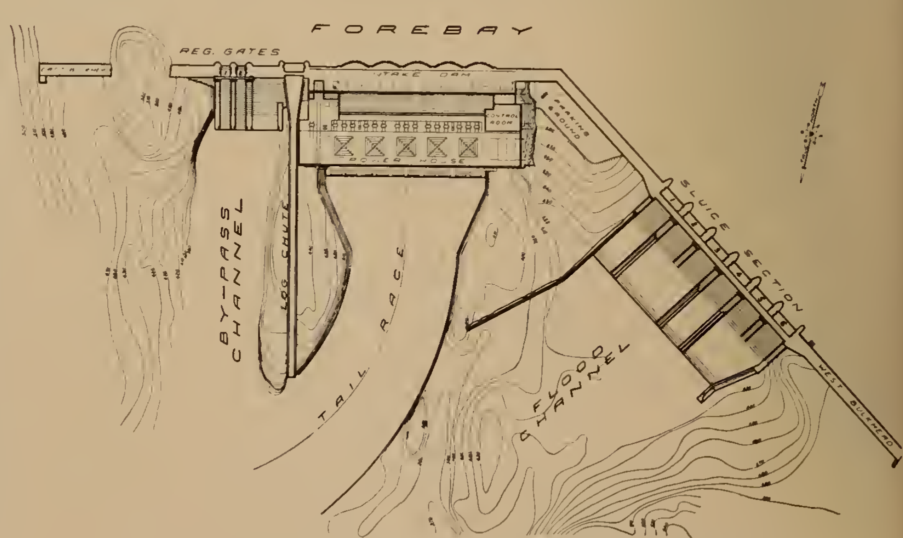



Fig. 2. General plan of the Peribonka No. 1 development.

channel (where the power house is located).

Following the completion of the by-pass structure, and before the following spring flood, the river was to be turned through the by-pass, and cofferdams Nos. 4 and 5 built to unwater the centre channel, No. 4 cofferdam being sealed against the bulkhead adjoining the by-pass. Since No. 6 cofferdam to unwater the tailrace could not be completed until after the spring flood, the auxiliary cofferdam No. 5 was provided below the power house to enable work to commence in this area, with excavation of the tailrace to proceed on completion of No. 6. Cofferdam No. 3 closed off the spillway area and was to be built with cofferdams Nos. 1 and 2.

As matters turned out, construction was commenced later than anticipated, and the heavy draft from storage was required earlier. It proved impossible to cofferdam the gorge with the higher flow, and an auxiliary by-pass channel was put through at the location of Nos. 4 and 5 spillways. The story of how the gorge was finally cofferdammed will, it is hoped, be told at another time. This constituted one of the highest crib dams built in this country, being over 65 feet high.

At Chute à la Savane, the unwatering required the improvement of the secondary channel against the east bank to a width of 120 feet, to pass 40,000 c.f.s., while the closure section was unwatered and its concrete poured. An identical design of closure section with Peribonka No. 1 was used. Cofferdams here had a total crest length of some 1,300 feet.

**General Geology**

The Precambrian rock at both sites belongs to the Anorthosite Series, and is cut by acidic and structurally weak mica-rich dykes. Where unaffected by faulting, the anorthosite is a strong, dense rock, grey to black in colour. In some sections, jointing is well developed, and excavation had to be carried below the zone of weathering along these joints. Grouting was required to seal the joint cracks.

The pleistocene deposits consist of boulder till, laid down by the glaciers, and silty clay and sand laid down by a subsequent marine inundation. The boulder till is not everywhere present, and the silty clay is frequently found in contact with the bed rock. This Lake St. John clay frequently has a high water content; is thinly bedded or varved; is relatively impervious although it may contain sand lenses or zones. It is very sensitive to vibration. The sand deposits, usually found at higher elevations, are of variable thickness, and sometimes are water-logged and contain perched ponds.

At Chute du Diable, the main channel of the river was located by faulting in the bed rock. A multitude of parallel or intersecting faults were uncovered. Movement along the individual faults was of a minor nature, but the total residual horizontal movement was in the order of 30 feet.

It was necessary to carry out deep excavation, and while the rock finally uncovered was structurally sound, it was badly shattered and some of the faults were open. Extensive diamond drilling and pressure grouting was required to seal this section. In the log chute and intake section, further shattered rock was uncovered, and deeper than normal excavation was required to secure adequate foundations. Curtain grouting effectively sealed this area.

At Chute à la Savane, the main channel was located by faulting along a granitic dyke. It was found that this granite was so badly shattered by faulting that the upper material could be shovelled away. Clay gouge was developed along many of the faults. Here, again, movement along individual faults was minor, but the aggregate movement was in the order of tens of feet. Deep excavation was necessary to secure good foundations, and the subsurface rock was sealed with closely spaced grouting.

On the east side of the river, mica-rich, structurally weak dykes that crossed the east bulkhead area offered a serious foundation problem. Weathering was deeply effective along these dykes, and clayey gouge was developed at the contacts with the wall rock and along shear planes in the dykes. Deeper than normal excavation, and a tight grout seal to depth, were required.

As excavation progressed, deep troughs were found in the bed rock surface. Faulting exposed in the bottom of the troughs necessitated additional rock excavation and closely spaced diamond drilling and grouting to secure tight foundations.

At both sites the drilling for foundation investigation and for grouting was by diamond drills. The hole size used was AXT, which gave a hole 1-7/8 inches in diameter, and the core recovered was 1-5/16 inches in diameter. The depth of the holes varied from 50 to over 200 feet. This hole size allowed entrance of an injection and sealing assembly which made sectional water-testing and step-grouting possible.

All holes were washed after drilling; water-tested to determine the location of cracks and openings in the bed rock, then the holes were grouted to refusal in steps from the bottom up. After the grout had taken its initial set, the holes were washed and re-grouted to refusal.

Pressures used for testing and grouting varied from 10 to 20 psi. at the surface to over 200 psi. at depths over 100 feet. Grout used consisted of Portland cement and water; the water cement ratio varied

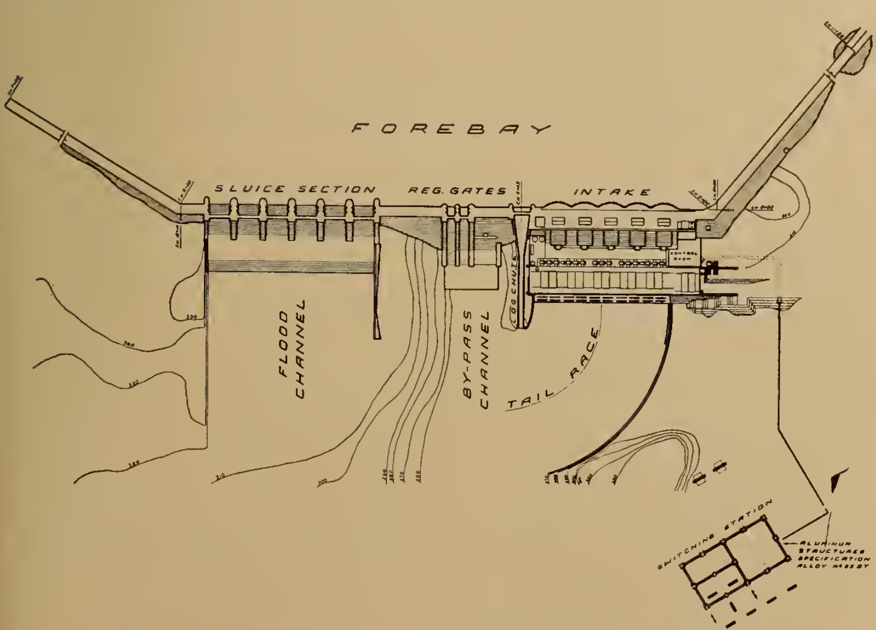



Fig. 3. General plan of the Peribonka No. 2 development.

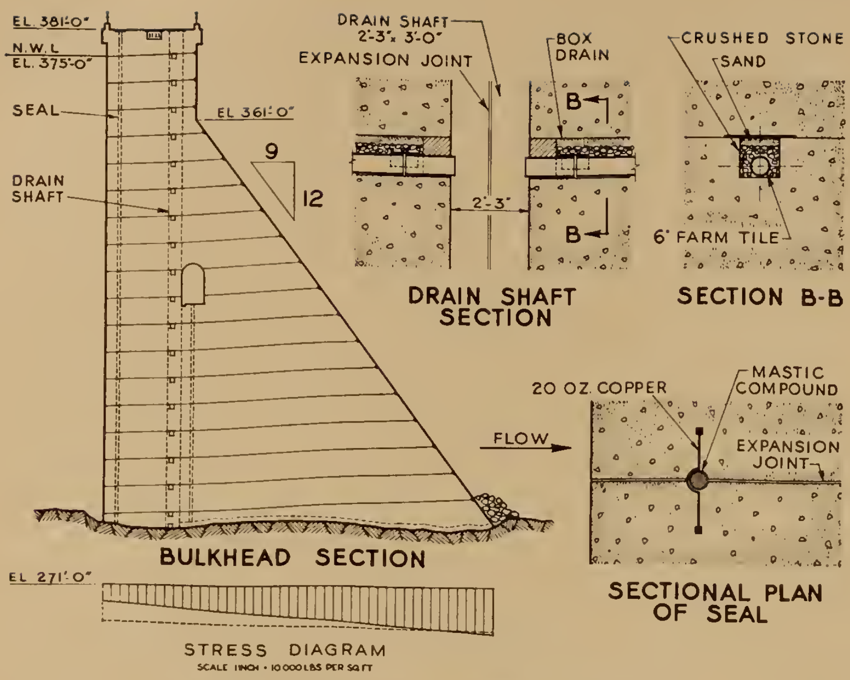



**Fig. 4. Typical bulkhead section, Peribonka No. 2.**

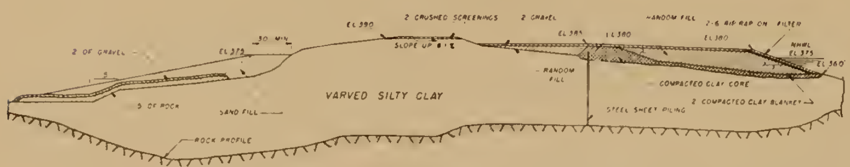



**Fig. 5. Developed section through earth dam. Peribonka No. 2 development.**

from 5.0 to 0.5; pumps were used to inject the grout.

The sealing program consisted essentially of the establishment of a grout curtain to depth, at or near the upstream face of the structures. In sections where foundation conditions were good, a single row of vertical holes was sufficient to seal all cracks and openings. In other sections, where the bed rock was badly shattered and faulted, it was necessary to drill and grout three or more rows of closely spaced vertical and inclined holes to depths of over 150 feet, to secure a tight cut-off.

### Bulkhead Section

The bulkhead section, which was the same in both developments, is shown in Fig. 4. It was designed as a solid gravity dam for a height above rock of 120 feet, this maximum height being required at the closure section. Design conditions were as follows:—

Horizontal Forces:

(a) Ice at 10,000 pounds per lineal foot acting one foot below normal forebay level.

(b) Water load for normal headpond level.

(c) Silt assumed as a hydrostatic load at 20 pounds per cubic foot in excess of water load for a height of 36 feet above the foundation.

or, alternatively:

(a) Water load for extreme flood within one foot of the top of the dam.

(b) No ice.

(c) Silt as above.

Vertical Forces:

Weight of concrete at 150 pounds per cubic foot.

Uplift:

(a) A rectangular upward loading diagram equal to tailwater elevation above foundation acting over 100 per cent of the area of the base.

(b) A triangular upward loading diagram equal to headwater minus tailwater at the heel, decreasing to zero at the toe, the pressure being assumed to act on 2/3 of the area of the base.

The dam was built with a top width of 20 feet, to accommodate the roadway clear across at the upper development and to the intake section at the lower. Vertical contraction joints are placed at fifty foot intervals, and sealed for protection against spalling by a sealing compound around the perimeter. At the upstream face of each contraction joint, a water seal is provided, consisting of a 20 oz. copper sheet extending into the pour on each side. The seal bounds the upstream semi-circle of a 6 in. hole, which is filled with a specially selected mastic compound, which retains its resiliency at low temperatures. Keys are provided at roughly ten-foot centres, and the face is coated with two coats of emulsified asphalt, to break the bond.

The drainage system consists of a French tile drain at each horizontal pour, located 14 ft. 6 in. in from the upstream face. These drains open into vertical chimney drains at each expansion joint, with embedded ladder rungs to permit inspection. A box drain on rock also runs into these vertical drains and then to

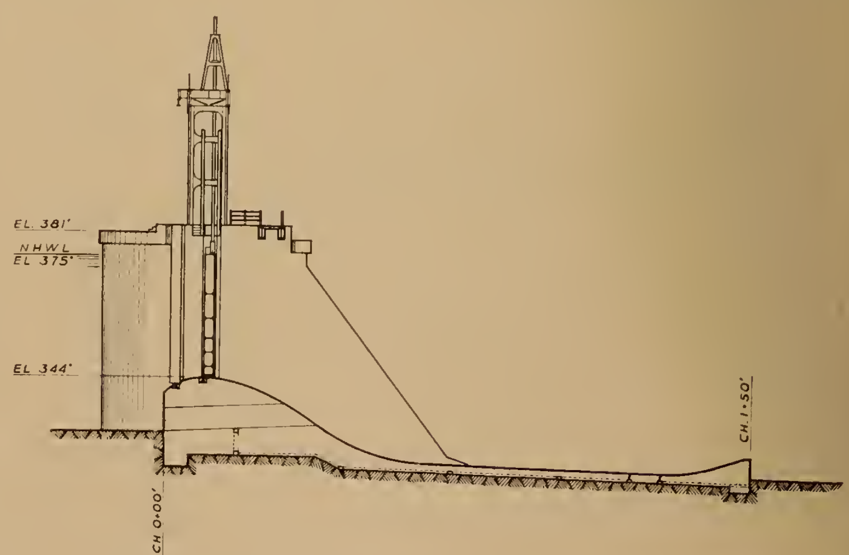



**Fig. 6. Typical section through spillway, Peribonka No. 2.**

the downstream face of the dam, where loose backfill is placed to prevent freezing during the winter.

At Peribonka No. 2, inspection tunnels were placed in the east bulkhead and in the gravity section which fills the 50 ft. opening of the by-pass. Six-inch pipes, on 5 ft. centres, extending down to rock, were embedded in the floor of these tunnels, and, through these, holes were drilled approximately 20 feet into rock. Thus, they form a relief against uplift at subfoundation levels, and indicate leakage. Additional grouting into rock can be performed at a later date from the inspection tunnel if necessary.

### East Bulkhead Extension

During the winter of 1951-52, a very extensive detailed geophysical and diamond drill survey was undertaken to determine the bed rock contour in the general area. This indicated that the bed rock topography was very irregular, and that excavation to depths of over 120 feet through the silty clay overburden, and consequent large volumes of concrete, would be required to found a concrete closure on rock.

The varved silty clay overburden was carefully investigated, and it was decided to form the closure with an earth dam that would utilize this inplace silty clay of the ridge as a core. Extensive strengthening was required to ensure the stability and water-tightness of this ridge.

In Fig. 5, a developed section through this earthdam, the final design is shown in detail. On the downstream side of the ridge, coarse rock topped with a free-draining gravel layer and a heavy sand fill to El .375 was placed. This not only added mass to the dam, but also would act as a filter should any seepage occur. On the forebay side, sand was stripped from the underlying clay; the surface was compacted, and a compacted clay blanket was carried up from elevation 360 and topped with a compacted clay core to elevation 383.

This whole area, and the section above the core, were protected by random fill. The top of the ridge and the fill were protected against erosion with a 2 ft. blanket of gravel or crusher screenings. The portion exposed to the forebay was protected with a gravel filter and rip-rap. The junction with the concrete of the bulkhead and the clay of the ridge was made with compacted clay. A section of sheet piling was embedded in the end of the concrete, and a row of sheet piling was to be driven to rock throughout the length of the dam.

### Spillways

The spillway capacity is the same for each development. (Fig. 6) It consists of six 50 foot openings, with sills 31 feet below normal forebay level, and two regulating gates each 21 feet wide, with sills 21 feet below normal forebay level. A 6 foot freeboard is provided on the dam, and the design is made so that, during extreme floods, the forebay can be allowed to rise within one foot of the top.

These openings are ample to pass the combined maximum discharge capacities of the storages above, with a conservative allowance for the uncontrolled run-off below them. Each regulating gate has a capacity approximately 40 per cent in excess of the rated discharge of one unit.

The sill shape of the spillway at Peribonka No. 2 is a parabola, with vertex 10 ft. from the upstream face, and having an equation: $X = 7.4y^{5/6}$, $y$ being measured as positive downward. Upstream of the vertex, the profile is a circle of 14 ft. radius, with centre 9 ft. 6 in. from the upstream face. This latter profile is somewhat fuller than the theoretical true profile, and is provided to allow for stop-log gains and sill beams, with sufficient clearance for working space in front of the gate. The complete profile was checked by model test to ensure that there is a positive pressure at all points on its surface.

A circle of 50 foot radius joins the sills and aprons tangentially. The apron consists of a reinforced concrete slab of 18 inch nominal thickness, extending below the base line. At its lower end, it sweeps up to a lip which serves to prevent erosion of the rock at the toe. It is particularly effective, and there is a marked dissipation of energy here. The drainage system is designed to prevent uplift on the slab due to high tailwater levels, and also to carry away gate leakage.

Expansion joints are provided on each side of the piers, which are

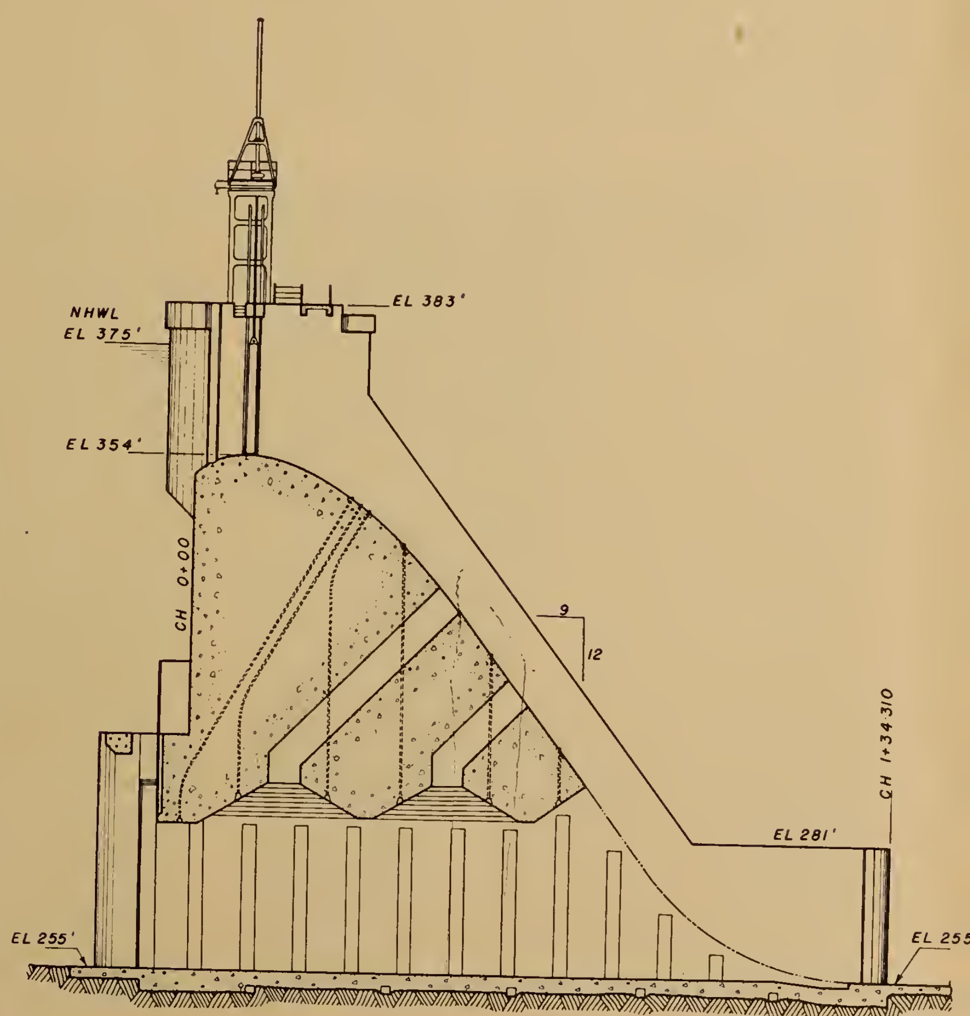



Fig. 7. Typical section through No. 2 regulating spillway showing by-pass opening.

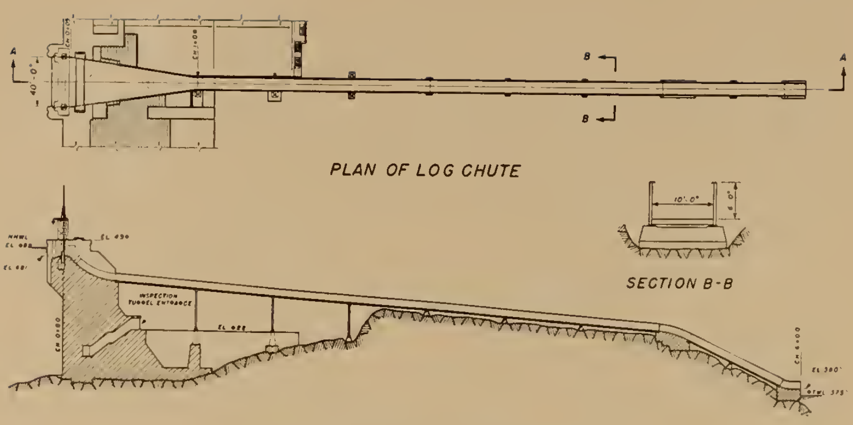



Fig. 8. Log chute, Peribonka No. 1.

fifteen feet thick. Sills and piers are therefore designed to be separately stable, and reinforcing steel is placed through the pour joints in the sills, to ensure safety against sliding.

The gates are 50 feet wide by 31 ft. 6 in. high, of the fixed wheel type, and operated by screw hoists carried on steel towers and bridges. In order to accommodate the maximum head over the crest of 36 feet, the piers were raised to El .383, two feet above the elevation of the top of the bulkhead, so that the tower height above concrete did not have to be increased over that of an existing design.

The towers are designed to withstand the loading due to a 30-mile wind acting at right angles to the gate in the fully raised position. Special anchorage steel is provided in the top of the pier to secure the tower bases. A monorail hoist, mounted on the towers, handles the stop-logs, only one set of which is provided for all gates.

The spillways at Peribonka No. 1 are similar, with the exception that the apron levels were varied to suit rock levels. Retaining walls are provided where the apron levels change. These are necessary to avoid cross-flow, which would decrease the effectiveness of the upturned buckets, and also to prevent undue scouring downstream of the deepest apron. On the west side, the retaining wall turns in on the No. 6 apron, to deflect the flow from a protruding rock face below. Bridges are provided to span the piers downstream from the gates.

The by-pass consisted of three openings: one, 50 feet wide and open to the top; the other two, 21 feet wide and roofed over for a height at the inlet end of 28 feet. Taking Peribonka No. 1 for descriptive purposes, the floor level of all openings was at El. 385. Maximum design capacity was 70,000 c.f.s. for a still water level upstream of El. 430.

An approach channel was excavated, with invert at such a grade that flow was at sub-critical velocities, both upstream and through the passages over practically all ranges of flow. At the downstream end the grade was increased, so that flow reached critical depth at this point, and proceeded onward at supercritical velocities. This was done to eliminate the difficulties of shooting or rapids flow at the gate and stop-log gains.

The scheme of closure called for the 50 foot opening to be closed first, when the river flow had drop-

Fig. 9. Log chute model test in the hydraulic laboratory of the National Research Council.

Fig. 10. Prototype flow in Peribonka No. 1 log chute.

ped after the spring flood to 10,000 c.f.s. Stop-logs were placed in gains, formed in the piers at both upstream and downstream ends, the 50 foot steel stop-logs from the spillways being used in the upstream gains. Hence, while the reduced flow was being passed through the remaining two 21 ft. openings, the bulkhead closing off the opening was to be poured to El. 470, or to the top, as time permitted.

Following this, the two 21 foot openings were closed simultaneously by dropping closure gates, using hoists temporarily installed on the piers above. At this stage, the sills of the regulating gates were poured, and stop-logs were in place. The spillway sills were scheduled to be completed by this time, so that, as the forebay level rose, discharge commenced over these, reaching a capacity of 40,000 c.f.s. at El. 468, a figure which was considered conservative for the season of the year.

With timber stop-logs in place at the downstream end, placing of concrete could be carried out to fill the openings. The roofs of the openings were shaped somewhat like inverted bins, (Fig. 7), to which openings 6 ft. square were led from the sill faces. These were designed so that concrete could be chuted in to completely fill the openings, and, at the same time, provide massive keys against punching shear due to hydrostatic pressure. Grout pipes were led to annular grooves around these openings, and the grouting program was arranged for final grouting one month after pouring the plugs.

These high roofed openings served another interesting purpose. Calculations showed that, for the maximum by-pass flow, the entrances would be submerged so that they would act as orifices under low heads. The openings thus permitted ample aeration of the opening downstream from the entrance, so that the flow here would retain the characteristics of open channel flow. In this way it was estimated that the openings could pass the flow without dangerous vibration for a head of some 40 ft. above the centre-line. Actual flows of this order were never reached during construction, thus, there is no confirmation of this point. The regulating gates are of similar construction to the sluice gates, and are 22 feet high by 21 feet wide.

**Log Chutes**

The log chutes at both developments are designed on the same basic principles, although their profiles differ. Each has a depressed type gate 40 feet wide, and a rectangular flume 10 feet wide by 6 feet deep. The gates are operated by screw hoists, and provision is made for lifting the gate clear of its well for servicing and winter storage.

Stop-logs are set in grooves upstream from the gate. These are put down in winter, and, with the gate lifted clear, any leakage is interrupted by the gate-well and drained off clear of the flume. The well is heated to prevent accumulation of ice, reducing the otherwise heavy ice load on the spans of the flume.

Each chute has a capacity at 50 per cent efficiency of 1,980 cords of pulpwood per hour, with a head of 3 feet over the crest. The discharge is 640 c.f.s., corresponding closely to 3 cords of wood per c.f.s. Provision is made for a variation of forebay level of 4 ft. during the log-passing season.

Fig. 8 shows the log chute at Peribonka No. 1. The concrete crest is at El. 481, and immediately downstream the profile drops off on a curve such that the nappe will strike it tangentially for all positions of the gate. Aeration, to prevent depression of the nappe for raised position of the gate, is provided by a slot in each side pier just below the gains. A circle of 52 ft. radius is run in, tangent to this curve and the 8 per cent grade of the flume. At the lower end, the flume drops off on a circle of 65 ft. radius and proceeds on a 1:2 slope to a horizontal lip at El. 380, which delivers the logs to the tailrace.

The flume is steel-lined throughout its entire length, and designed as continuous beams in three sections, to allow for thermal expansion. Where the rock is low, it is supported by three pin-connected bents, and, at other places, on concrete piers. The bents allow for the lateral movement due to the expansion, with a negligible effect on the alignment of the flume. At the lower end, concrete walls and a massive concrete base are provided against ice action.

These chutes are designed for super-critical velocities of flow at all points from the gate downward. The calculated velocity in the flume is 44.5 ft./sec. for a depth of 1.43 feet. Actual depths and velocities are affected by aeration, which has the effect of reducing the velocity and increasing the depth.

It is probable that the logs actually skid on the steel plate liner, but this in no way detracts from its operation. Similar chutes have been designed where the depth of unaerated water was six inches. In these cases, the logs definitely skid on the bottom, and yet there has never been a jam in the flume.

In order to direct the flow from the wide gate section to the relatively narrow flume, at these high velocities, the transition must be carefully designed. Here a shock type of transition was used in which negative shock waves are super-imposed on positive waves so that, below the transition, the wave effect is zero.

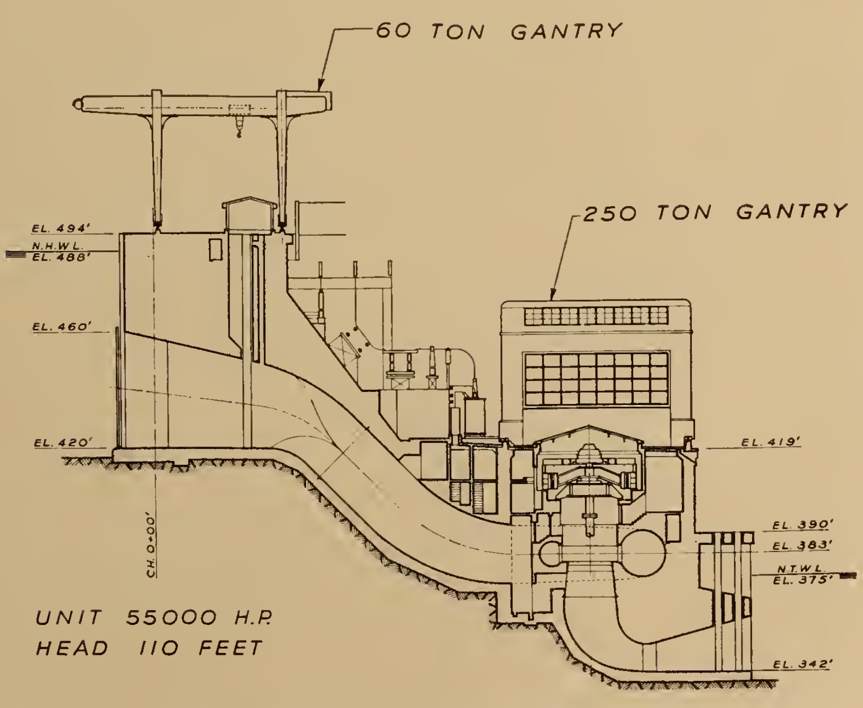
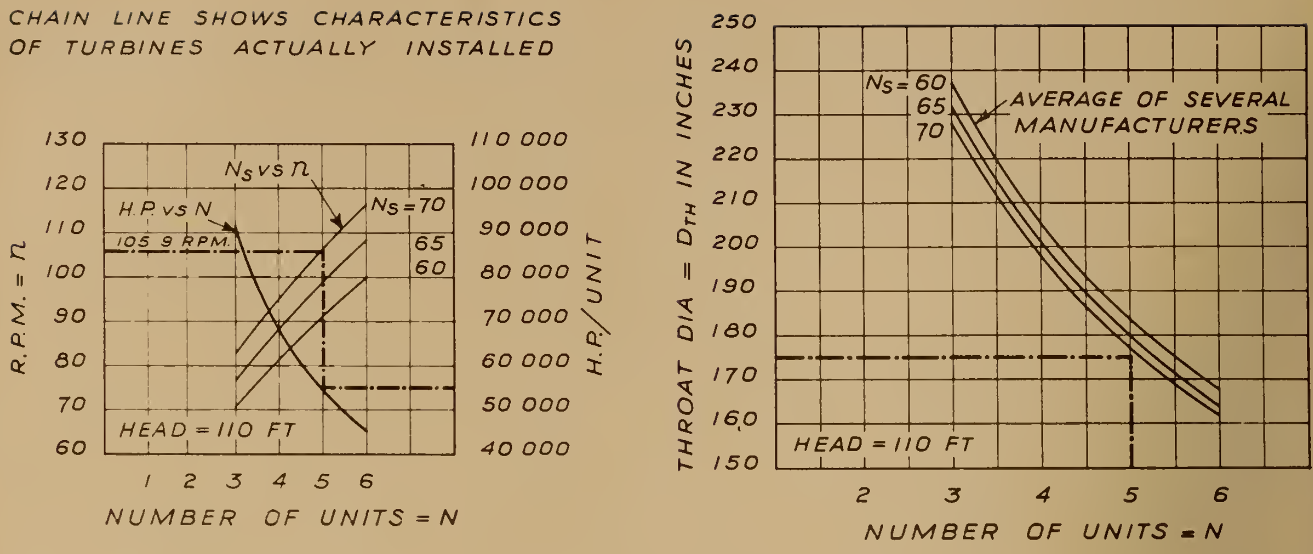



**Fig. 11. Section through intake and powerhouse, Peribonka No. 1.**




In practice, this is not perfectly achieved, but the waves, which would otherwise overtop the sides and kick the logs clear of the flume, are reduced to a negligible value. The transition was perfected by model tests in the hydraulic laboratories of the National Research Council. Figs. 9 and 10 show model and prototype. Close agreement is evident.

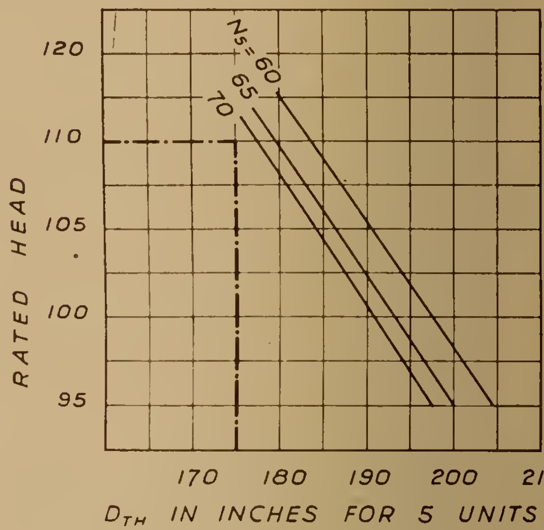



**Fig. 12. Peribonka No. 1 turbine selection chart. Based on plant flow of 25,000 cfm.**

### Intakes

The intakes of each plant are the same except for minor adjustments due to difference of drawdown. While the general design is that of an integral power house and intake, the latter is made separately stable, since it has contraction joints between units while the power house has not, thus necessitating a sliding joint between the two structures, and also because the shear could not be developed at the up-stream wall of the power house.

As can be seen from Figs. Nos. 2 and 11, each of the five intakes has four sets of racks, each 14 feet wide by 40 feet high, but only one head gate, 22 feet by 30 feet. Intakes are 60 feet on centres, with contraction joints between. The transition from rectangular to round occurs on the arc of a 45 degree bend commencing just below the gate. A steel penstock 23 feet in diameter provides the water passage from the transition to the scroll case inlet, being entirely embedded in concrete.

At Peribonka No. 1, the floor of the intake is at El. 420, and the roof is at El. 460 at its entrance, thus providing for a drawdown of 25 feet from a normal forebay level of 488. At Peribonka No. 2, the corresponding permissible drawdown is 18 feet. The depth of the opening is partly fixed in the latter case, to ensure proper submergence of the gate during normal operation, and it is doubtful if the full drawdown will ever be used.

Upstream from the gate, the water passages have the appearance of a wedge-shaped fan which is opened out to the contour of the side-walls. Three steel piers, filled with concrete, support the roof and the gains for the racks. They are shaped to offer a minimum obstruction to the flow. With this arrangement it is possible to obtain a gradual acceleration of the flow from 2.5 feet per second at the racks to 8 feet per second at the gate.

Motor-driven drum gate hoists are provided for each head gate, arranged for remote tripping from the control room in the event of a penstock failure or runaway of a unit with wicket gates inoperative. A 60-ton gantry is provided on the intake for installing and removing head gates, and, in the case of Peribonka No. 1, to service the transfer bay. This gantry has a cantilever extension of its bridge, to handle trash racks and emergency gates.

The covers for the gates are removable as a unit. To provide a light-weight structure, yet resistant to corrosion, these are clad entirely in aluminum. Since the gate vents open inside the structure, large grilles are built in under the eaves. These grilles allow entrance of air above a false ceiling.

In this ceiling, weight-controlled dampers are provided so that, if a gate tripped, they allow a large inflow of air with small reduction in pressure inside the cover. Under normal conditions, they are closed, and thus the heating load is reduced. Additional dampers, by the same method, allow outward flow of air.

This design of intake permits large rack areas per foot height of opening, thus saving excavation. At the same time, the steel reinforcing design is simple, and contraction joints are easily provided. Hydraulic losses are low, and the number of gates, with their sets of embedded parts and hoists, is reduced to one.

At Peribonka No. 1, an elevator is provided at the west end of the intake. Here, also, a washroom, gauging pit, and the headworks 575 volt power distribution centre are located. A tunnel runs from an intermediate landing the full length of the intakes, with adits to the inside of each hoist cover, thus permitting inspection without going outside.

Since all equipment must be handled via the roadway on top of the intakes, a transfer bay is located at the east end, by means of which equipment is lowered to a truck running on tracks at the power house roof level. At Peribonka No. 2, there is no transfer bay, since equipment is brought in under the crane on a roadway coming in to the east end of the power house.

### Power House

Fig. No. 11 shows a cross-section through the power house at Peribonka No. 1, and applies, also, except for different elevations, to the lower development. It is designed as a semi-open type; that is, a roof is brought over at the level of the aluminum generator covers, and a gantry crane is provided in place of the more conventional overhead travelling crane used in power houses with superstructures.

The covers over the generator can be removed, and the units thus dismantled. These are the first of their kind to be built in Canada. In addition to being the most economical type where a sufficient number of units are installed, it has the great advantage of speeding up the construction schedule, and, consequently, the on-power delivery date.

There are five units at 60 foot centres in each power house. They number from right to left looking upstream. To the right of Unit No. 1, a service bay is provided consisting of five levels. The sump is at El. 338.5 (for Peribonka No. 1), and, above it, an intermediate deck at El. 359. The sump pumps are set on the 373 floor. On the 387 and 397 floors, the latter being the generator floor level, the station auxiliaries are located.

Still further to the right, a space 38 ft. x 59 ft., extending from the 387 level to the roof at El. 420, forms the repair bay. There is sufficient room for two rotors at one time here, or one rotor and the principal turbine parts. The cover of the repair bay is built of aluminum, in halves, which rest on rubber seals in the closed position, and are raised, then rolled back to provide the opening through which the equipment is lowered by means of the gantry. A 15-ton travelling crane is provided inside the repair bay.

The transformers and switching structures are located between the power house and intake, with transformer pipe tunnel, conduit tunnels, etc. below. The transformer oil filtering room opens off the pipe tunnel to the left of intake No. 5. Downstream of the units, a governor pipe tunnel at El. 387 runs the full length of the power house.

The office section comprises three levels, and extends from the elevator shaft down to the upstream wall of the repair bay. On the397 floor, there is the conduit chamber directly under the control room, and a corridor running back to the elevator. Power supply and control cables to the top of the dam run back from the conduit chamber to the cable shaft rising beside the elevator.

On the 423 floor are located the control room, offices, battery room, small stores, first-aid room, telephone, and air-conditioning rooms. These are arranged around a corridor giving exit on the transformer deck and running back to the elevator. On the 440 floor above, a mess room and a lavatory are provided for the operating staff.

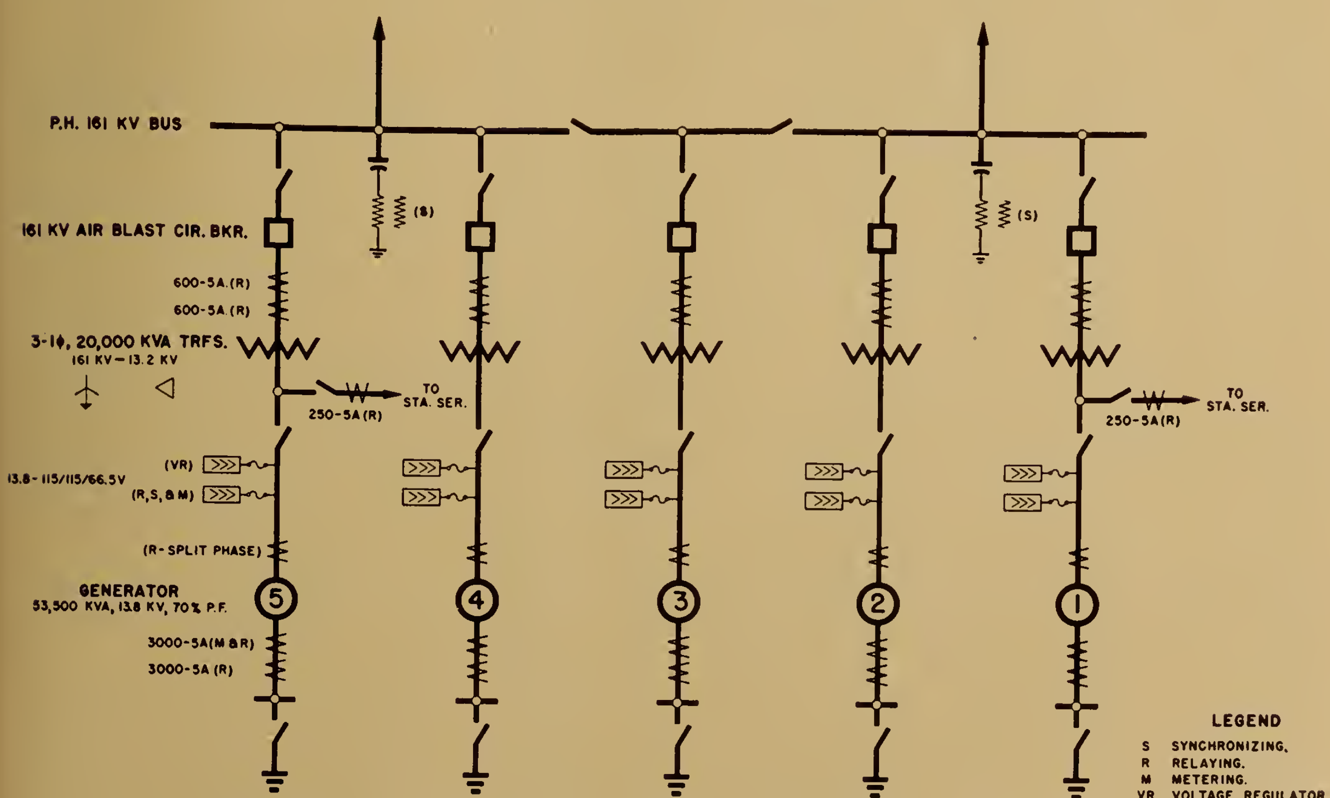



Fig. 13. Peribonka developments power house. Single line diagram.

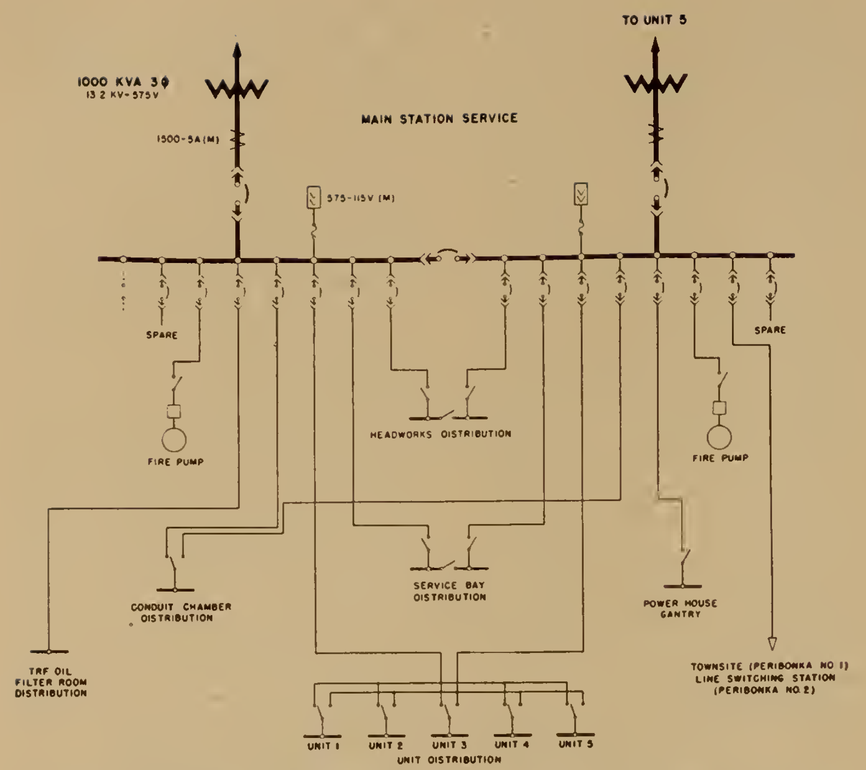



Fig. 14. Peribonka developments station service. Single line diagram.

### Turbines

Preliminary studies at Peribonka No. 1 contemplated the installation of four adjustable blade units of 71,250 hp. capacity, at a net effective head of 110 feet. Further investigation showed, however, that delivery could not be arranged to meet the on-power date, and a final decision was made to install five vertical-shaft Francis turbines. The rating of these units was fixed at 55,000 hp. at 110 feet effective head for a speed of 105.9 r.p.m. Maximum efficiency is guaranteed at 90 per cent for an expected output of 49,000 hp. Maximum horse power is at least 56,500. The expected variation in peak efficiency for the variation in head of 25 feet is approximately 2.5 per cent.

When the decision was made to install these units, it was urgent to determine the best rating and the approximate physical dimensions, in order to proceed with power house layouts. Accordingly, the preliminary selection curves shown in Fig. No. 12 were prepared. With the aid of these, it was possible to select the units and to proceed with the power house design while the final design of the turbine was proceeding. Physical dimensions are a function of the throat diameter of the units, so the latter is the key dimension.

The Peribonka No. 1 units have plate steel scroll cases of all-welded construction. Centre-line of distributor is at El. 383, and normal tailwater level is at El. 375. The units at Peribonka No. 2 are rated at 57,000 hp. under 110 ft. effective head for a speed of 105.9 r.p.m. Centre-line of distributor is at El. 266 for a designed tailwater level of 260. Plate steel scroll cases here are welded, except for the connection to the stay ring, which is rivetted.

### Power House Auxiliaries

A gantry consisting of a steel frame 48 ft. high, 63 ft. wide, and 42 ft. long, clad with .04 in. thick corrugated aluminum mill sheets, operates on the open deck of the power house. The trolley is equipped with a main hook of 250-ton capacity and an auxiliary hook capable of handling 25 tons. The function of this gantry is to transport any transformer or generator to the repair bay, should the need arise.

Retractable doors permit it to pass over the generator housings and to admit the transformers. The gantry is propelled by four 30 hp. motors, and is designed to resist a 30 lb. wind. For safety reasons, the usual practice with outdoor cranes of limiting the travel to a 5-lb. wind (35 m.p.h.) is stipulated.

The strained water supply and governing system of both plants are arranged on the unit system. Strained water of sufficient capacity to supply cooling water to the generator air coolers, thrust bearing, and turbine and generator guide bearings, is drawn off each penstock and passed through an automatic strainer. These are interconnected by a 10 inch header, and water to fire systems is taken off this header. Provision is made at each unit to connect in a dual strainer, should the motorized strainer be inoperative, and two dual strainers are installed, thus providing spare capacity for fire in addition to the above-mentioned service.

In the same manner, each unit has its own governor oil pressure pump, sump, and accumulator tanks. Pressure and return lines to the governor actuators of each system are interconnected by headers, and each oil pump has sufficient capacity for normal regulation of two units. The pump is controlled by an unloader, and each accumulator tank can be interconnected with others to make the pump control effective for more than one unit. Two 25 cfm. compressors, operating at 225 psi., are provided at the service bay to charge these accumulator tanks.

Additional auxiliaries include lubricating oil filtering system, transformor oil filtering system, purified water supply, and 210 cfm. general service air compressor. Two sump pumps—one of 4,000 gpm. capacity and the other 1,000 gpm. capacity—are located over the sump.

### Single Line Station Diagrams

Fig. 13 "Power House Single Line Diagram" may be considered as applying to both developments. Power is generated at 13.8 kv.; the H.V. busses and lines operate at 161 kv. High voltage switching only is employed; there are no low voltage circuit-breakers between the generators and transformers. Each generator, transformer bank, and high voltage circuit breaker is connected as a unit; there is no low voltage bus. The 161 kv. power house bus is sectionalized by two disconnecting switches, permitting Unit No. 3 to be connected to either bus section when the station is being operated with sectionalized busses.

A manually operated disconnect switch is provided in the low voltage bus between each generator and transformer bank to permit isolation for testing and maintenance. Power for station service is taken from Units 1 and 5 to separate station service transformers. The generators are connected for solidly grounded neutral operation; a manually operated single pole disconnecting switch permits isolation of the generator neutral for testing purposes. At Peribonka No. 1 the two 161 kv. transmission lines feed out directly from the power house busses to the Isle Maligne Switching Station.

At Peribonka No. 2 the two 161 kv. power house bus sections are connected to a 161 kv. transmission line switching station adjacent to the power house. Two lines connect to Isle Maligne and two lines feed a large paper mill load at Dolbeau. For both developments, all 161 kv. disconnecting switches are motor-operated and remotely controlled, and control circuit interlocks are provided to prevent incorrect operation.

### Main Power Apparatus

The generators at each development are rated 53,500 kva., 70 per cent power factor, 13.8 kv., 60 cycles, 105.9 rpm. The stator coil insulation is continuous mica tape. Generators are all totally enclosed and water cooled. The field poles are provided with non-continuous amortisseur windings. The generators at Peribonka No. 1 are of the umbrella type, having a thrust bearing and single guide bearing mounted below the rotor.

The generators at Peribonka No. 2 are a modification of normal design, and have the thrust bearing and an upper guide bearing installed above the rotor, with provision only for the lower guide bearing in the future if necessary. Special consideration was given in the designs of these generators so that stator coils may be replaced in the minimum possible time without removing the rotor.

Each generator is connected to three single phase transformers, connected low voltage delta—high voltage grounded wye. Each transformer is rated 20,000 kva., 55°C. rise, type ONW, 13.2 kv.-172 kv. with full capacity off-load reduced voltage taps on the high voltage winding. One spare single phase transformer is provided at each power house.

It is of interest to note that one bank of three transformers at Peribonka No. 1 is constructed with aluminum windings. These three transformers are the same physical size as the other transformers and weigh approximately 1.5 per cent less. While the transformers for the two developments are not identical in physical size or arrangement, the power house and transformer designs are arranged so that the transformers are interchangeable to meet emergency conditions.

The 13.8 kv. low voltage connections between the generators and transformers are designed as open buswork fabricated on the job, with aluminum ducts or sheet metal screens for protection. The main three-phase busses consist of two 4 in. aluminum channels, alloy No. 50S-A33, in a square configuration, and are rated 2,500 amps. The delta connections to the single phase transformers are 2-1/2 in. I.P.S. aluminum tubes, also alloy No. 50S-A33.

Flexible connectors and slip-fit bus clamps are used to provide for the thermal expansion of the aluminum conductors. The insulators are

**PROTECTIVE & ALARM FUNCTIONS—GENERATING UNITS.**

CODE: ● PRIMARY OPERATION. ○ SECONDARY OPERATIONS VIA CONTROL CIRCUIT SEQUENCE.

| APPARATUS | FAULT OR ABNORMAL CONDITION / RESULTING OPERATION | TURBINE: REDUCE TO SPEED-NO-LOAD | SHUT DOWN TO 0 GATE | CLOSE HEAD GATE | APPLY BRAKES | TRIP MAIN EXC. FLD BKR. | GENERATOR: TRIP GEN. FLD. BKR | REDUCE P.E. FIELD CURR. | REDUCE M.E. FIELD CURR. | TRIP 161 KV CIR. BKR. | GONG | MISCELLANEOUS: BELL | ANNUNCIATOR LAMP | INDICATING INSTRUMENT | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TURBINE & GOVERNOR | GUIDE BEARING COOLANT TEMP. HIGH | | | | | | | | | | | ● | ● | | |
| | GUIDE BEARING TEMP HIGH | | | | | | | | | | | ● | ● | | |
| | GUIDE BEARING COOLANT FAILURE. | | | | | | | | | | | ● | ● | | |
| | WATER SEAL WATER SUPPLY FAILURE. | | | | | | | | | | | ● | ● | | COMBINED ON 1 ANNUN POINT |
| | GUIDE BEARING OIL LEVEL LOW | | | | | | | | | | | ● | ● | | |
| | GOVERNOR OIL PRESSURE LOW. | | | | | | | | | | | ● | ● | | |
| | GUIDE BEARING FAILURE. | | ● | | ○ | ○ | ○ | | | ○ | | ● | ● | | PERIBONKA NO 2 ONLY |
| | OVERSPEED | ● | | | | ● | ● | | | ● | ● | | ● | | |
| | 85 % SPEED. | | | | | ● | ○ | | | | | | | | OPERATE ON ANY SHUTDOWN TO 0 GATE POSITION |
| | 50 % SPEED & 0 GATE POSITION. | | | | ● | | | | | | | | | | |
| GENERATOR | THRUST & GUIDE BEARINGS COOLANT FAILURE | | | | | | | | | | | ● | ● | | |
| | THRUST BEARING TEMP HIGH. | | | | | | | | | | | ● | ● | | |
| | GUIDE BEARING TEMP. HIGH. | | | | | | | | | | | ● | ● | | |
| | STATOR WINDING TEMP. | | | | | | | | | | | | | ● | |
| | ROTOR WINDING TEMP. | | | | | | | | | | | | | ● | PERIBONKA NO 1 ONLY. |
| | GENERATOR COOLANT FAILURE | | | | | | | | | | | ● | ● | | PERIBONKA NO. 1 ONLY. |
| | THRUST & GUIDE BEARING OIL TEMP. HIGH | | | | | | | | | | | ● | ● | | |
| | THRUST & GUIDE BEARING OIL LEVEL HIGH OR LOW | | | | | | | | | | | ● | ● | | |
| | THRUST BEARING FAILURE. | | ● | | ○ | ○ | ○ | | | ○ | | ● | ● | | PERIBONKA NO 2 ONLY |
| | GUIDE BEARING FAILURE. | | ● | | ○ | ○ | ○ | | | ○ | | ● | ● | | PERIBONKA NO 2 ONLY |
| | NEUTRAL OVERCURRENT. | ● | | | | ● | ● | | | ● | ● | | ● | | VIA TRIP RELAY NO 2 |
| | SPLIT PHASE. | ● | | | | ● | ● | | | ● | ● | | ● | | VIA TRIP RELAY NO 1 |
| | GENERATOR FIELD GROUND. | | | | | | | | | | | ● | ● | | |
| | GENERATOR FIELD FAILURE. | ● | | | | ● | ● | | | ● | ● | | ● | | VIA TRIP RELAY NO 2 |
| | GENERATOR OVERVOLTAGE. | | | | | | | | ● | | | ● | | | |
| | PILOT EXCITER OVERVOLTAGE. | | | | | | | ● | | | | | | | |
| | OVERALL DIFFERENTIAL. | ● | | | | ● | ● | | | ● | ● | | ● | | VIA TRIP RELAY NO 2 |
| TRANSFORMER | OVERCURRENT (LINE PROTECTION) | ● | | | | ● | ● | | | ● | ● | | ● | | VIA TRIP RELAY NO. 1 |
| | H.V. NEUTRAL OVERCURRENT. | ● | | | | ● | ● | | | ● | ● | | ● | | VIA TRIP RELAY NO 2 |
| | SUDDEN GAS PRESSURE. | ● | | | | ● | ● | | | ● | ● | | ● | | VIA TRIP RELAY NO 1 |
| | GAS ACCUMULATION. | | | | | | | | | | | ● | ● | | |
| | OIL LEVEL LOW. | | | | | | | | | | | ● | ● | | COMBINED ON 1 ANNUN POINT |
| | OIL TEMPERATURE HIGH | | | | | | | | | | | ● | ● | | |
| | TRANSFORMER WINDING HOTTEST SPOT | | | | | | | | | | | | | ● | |
| 161 KV BKR | LOW AIR PRESSURE. | | | | | | | | | | | ● | ● | | |
| | HEATERS OFF | | | | | | | | | | | ● | ● | | |
| | CONTROL SEQUENCE FAILURE. | | | | | | | | | | | ● | ● | | |
| MISC | EMERGENCY TRIP SWITCH. | | ● | | ○ | ● | ● | | | ● | | | | | |
| | AUTO START-UP BLOCKED. | | | | | | | | | | | ● | ● | | |

Fig. 15. Peribonka No. 1 and 2 developments. Tabulation of protective and alarm functions-generating units.

**Fig. 16. Chute du Diable—looking south. From left to right the dam sections are—regulating gates, log chute, head block and powerhouse, bulkhead over the island, sluice gates.**

CEMA strength Class 40, and have an impulse withstand of 150 kv. To minimize the quantity of spare insulators required in power house stores, the same porcelain insulators are used throughout the 13.8 kv. system for bus supports, disconnecting switches, and fuse supports.

The 161 kv. circuit breakers for the generating units in both power houses are 3 pole, high speed, air-blast circuit breakers rated 800 amps. and have a symmetrical interrupting capacity of 2,500,000 kva. Separately mounted 161 kv. oil-filled current transformers are installed on the transformer side of these air blast circuit breakers. All 161 kv. disconnecting switches are motor-operated, 3 pole, rated 800 amps., and are of the centre-break two-rotating insulator stack type. The one circuit breaker installed at the present time in the line switching station at Peribonka No. 2 is a conventional 3-tank motor-operated oil circuit breaker.

The insulators used for all 161 kv. buswork have the standard impulse withstand of 750 kv. In general, all buswork is constructed of 795 MCM A.C.S.R. conductor, 54/7 stranding. Compression type connectors are used exclusively, including special spring-loaded T-connectors for the bus taps. Extra-flexible braid connections are used at the air blast circuit breakers and current transformers to reduce the stresses on the porcelain insulator columns due to vibration. Self-supporting aluminum tubes alloy No. 1-S are used for the 161 kv. connections from the transformers.

The 161 kv. air blast circuit breakers, current transformers, and disconnecting switches in the power house switching stations are mounted on platforms above the level of the transformer deck. These platforms and connecting walkways consist of galvanized open-type gratings carried on galvanized steel structural members.

All towers, trusses, and switch structures in the line switching station at Peribonka No. 2 are fabricated of aluminum alloy No. 65ST, with galvanized steel bolts, as are the two intermediate towers carrying the two lines from the power house. The design of these structures conforms to Alcan specification No. 136 "Specification for Design of Outdoor Station Aluminum Structures".

#### Station Service Power Distribution

The major components of the station service power distribution system is typical for both developments. (Fig. 14). The utilization voltage for station service is 575 volts. Each of the two station service transformers is rated 1,000 kva., 55 C. rise, type ONS, 3 phase, 13.2 kv.—575 volts, connected delta-delta, with off-load ratio taps only. These transformers are installed outdoors with the main power transformers, and are connected to the 13.8 kv. busses without circuit breakers.

The 575 volt main station service switchboard is of self-supporting, totally-enclosed, dead-front construction, and is installed in the low voltage bus tunnel. Air circuit breakers are used throughout. At Peribonka No. 2 all breakers are of the draw-out type; at Peribonka No. 1, only the main transformer feeders and bus tie breakers are draw-out.

Each sub-distribution switchboard is of dead-front, totally-enclosed construction, and air circuit breakers are utilized throughout for the branch circuits. Duplicate radial feeders are provided from the main station service switchboard to each sub-distribution switchboard, except for the transformer oil filter room where only a single feeder is provided. Interlocks are provided throughout, to prevent paralleling the two main power sources.

The subdistribution switchboard in the service bay is actually a motor control centre, and contains all branch circuit breakers, motor starters, and the motor control-circuit equipment. Echelon control is provided for the governor and circuit breaker air compressors.

A separate sub-distribution panel is provided at each generating unit, and each 60 ft. generator bay in the power house is supplied with auxiliary power for motors, lighting, and heating on a unit basis.

Single phase, dry-type distribution transformers rated 575—115/230 volts are located indoors, and generally adjacent to the sub-distribution switchboards for the lighting, heating, and power supply to fractional horse-power motors in each of the sub-distribution areas.

#### Control, Metering, and Relay Equipment

The control room equipment at each power house consists of four major items—benchboard, duplex board, voltage regulator board, and operator's desk. All of this equipment was factory assembled and wired, ready for installation and connection at the site.

The benchboard is of conventional design, having a sloping top for the mimic bus, control switches, and indicating lamps. The station annunciator, and remote control and position indication for the headgates and regulating gates are included on the benchboard. The duplex board is a tunnel-type switchboard with the indicating instruments on the front panels and protective relays on the rear panels. The front panels also contain the main 125 volt d-c. distribution panel, water level indicators, and temperature recorder. The rear panels also contain the relays for the unit remote-automatic "start-stop" control.

The regulator board is a self-supporting enclosed switchboard having one panel per unit containing the voltage regulator, main exciter and pilot exciter overvoltage relays, and one panel for the clock, frequency recorder and station total load recorder. The operator's desk is a standard steel office desk with a special console added for the operator's communication circuits, signalling equipment, and the governor synchronizing motor controls.

The panels of all of the foregoing equipment are of steel, and are painted "eye-rest" green. The control room itself is finished with an acoustic tile ceiling, plaster walls, and a rubber tile floor. The size of the control room is approximately 37 ft. x 30 ft.

A generator field cubicle is located on the generator room floor adjacent to each unit. This cubicle contains the main exciter field circuit breaker and motor-operated rheostat, the 125 volt d-c. sub-distribution panel for the unit, and the turbine and generator bearing thermometers.

These cubicles are totally enclosed self-supporting steel structures, and are set flush in the upstream partition wall between the generators. The generator field circuit breaker, discharge resistor, and shunt are mounted in a separate cubicle located on the frame of the generator inside the generator housing. These field cubicles were all factory assembled and wired.

Fig. 15 is a tabulation of the protection and alarm features for a typical generating unit. The annunciator plate containing the alarm lamps is located in the centre section of the benchboard. The lamps are coded and mounted in symbols representing the station single line diagram. Similarly coded lamps are mounted in legend plates to identify the annunciator points. The alarm circuit utilizes one alarm relay per point. A bell and repeating single stroke gong are used to give audible distinction between the alarm points which annunciate only and the protection points which actually trip the unit off the bus.

Fig. 15 includes a list of the types of relay protections utilized for the generator and transformer. Draw-out type relays are utilized extensively, but rear mounted blocking switches are provided to isolate the relays for testing wherever non-draw-out relays are used. Neon supervisory lamps are installed to indicate the presence of d-c. voltage on the trip relays. The protective relays are grouped on two hand-reset trip relays which trip the various circuit breakers.

A feature of the voltage regulating equipment is the inclusion of an a-c. overvoltage relay, which, on the presence of overvoltage, inserts a block of resistance in the field of the main exciter and at the same time operates the main exciter motor operated field rheostat in the "lower" direction. This feature gives a degree of back-up voltage regulation, both with and without the actual voltage regulator in service.

An interesting feature employed to assist the operating staff in their duties is the facility for remote starting and shutting down of the generators from the control room. The unit can be started only after a chain of supervisory switches is closed signifying the presence of proper governor oil pressure, cooling water on the bearings, brakes are released, etc. By pressing the "Start" control button, the unit will automatically come up to speed-no-load and normal voltage ready for synchronizing. Automatic tripping of the various circuit breakers in the correct sequence and automatic braking are used to bring the machine to standstill when shutting down.

The usual metering arrangements have been provided, but are not listed in detail herein. A remote speed indicator for each unit is provided on the duplex board, calibrated both in rpm. and cycles per second. The station total load recorder is operated from thermal converters, and is equipped for future telemetering. Manual synchronizing only is provided, utilizing capacitor potential devices on the 161 kv. bus sections and potential transformers on the generator busses.

All control circuits operate at 125 volts d-c., from a 60 cell, 17 plate battery having a capacity of 40 amps. for 8 hours to 1.75 volts per cell. One such battery is installed in each power house, and space provision has been made for a duplicate battery to be installed in the future. Two fully automatic battery charging selenium rectifiers, each having a maximum charging rate of 17.5 amps., are provided, with switching facilities so that either or both batteries may be charged.

**Fig. 17. Chute-à-la-Savane, looking north. Left to right: west wingwall, sluice gates, regulating gates, log chute, headblock and powerhouse, east wingwall. The aluminum switching station is in the foreground.**

#### Fire Protective Equipment for Transformers

All main power and station service transformers are protected in case of fire by fixed nozzle water spray systems. The nozzles for each bank of three main power transformers are controlled by an electrically operated, remotely controlled, manually reset deluge valve. The push button control station for these deluge valves is in the vestibule leading to the transformer deck, within sight of the transformers.

A hose station is located adjacent to each transformer bank; one deluge valve is used to control all hose stations. The nozzles on the station service transformers operate whenever the nozzles on the adjacent power transformers operate. Water is supplied to the system by two 1,000 U.S. gal. per min. booster pumps, which operate automatically upon the opening of any of the deluge valves. Provision has been made for automatic thermostatic operation of the deluge valves in the future if required.

#### Cables, Trays, and Ducts

In general, all cables for control, metering, and relaying are multi-conductor with 600 volt thermoplastic insulation and thermoplastic outer covering. A lead, rather than thermoplastic, outer covering is used for all cables installed in the line switching station at Peribonka No. 2. All 575 volt single and three conductor power cables for station service distribution are either varnished cambric or heat resistant rubber insulated with a neoprene jacket. Mineral insulated cables are used extensively for connections to outdoor apparatus and outdoor lighting.

All cables in the power house and intake section are run on open sheet steel cable trays. Perforated sheet steel trays in 3 in. to 12 in. widths are used extensively for branch cable runs. The cables in the bulkhead sections of the dam are run in fibre conduit duct banks, with a manhole at each expansion joint.

The cables for the line switching station at Peribonka No. 2 are installed in precast haydite surface trenches. These trenches were cast in 8 ft. sections, having inside dimensions of approximately 12 in. wide x 7 in. deep, and are provided with removable checkered steel cover plates. This trench also serves as a walkway between the power house and the line switching station.

#### Heating—Power House

One large central ventilating fan having a capacity of 36,000 cfm. is provided for air circulation in the general areas and tunnels in the power house. For winter heating, heat is extracted from the hot air chambers of the generators and circulated throughout the power house. For summer ventilation, outside air is drawn in and the heated air from the power house is discharged to atmosphere. Certain specific areas in the power house and intake section are provided with thermostatically controlled electric blower heaters.

Offices and individual rooms are heated by wall mounted electric heaters controlled by 3-heat switches. The control room and telephone room are provided with a central air conditioning system containing air filters, thermostatically controlled electric heaters, and automatic humidification, with provision for the future installation of cooling equipment if required.

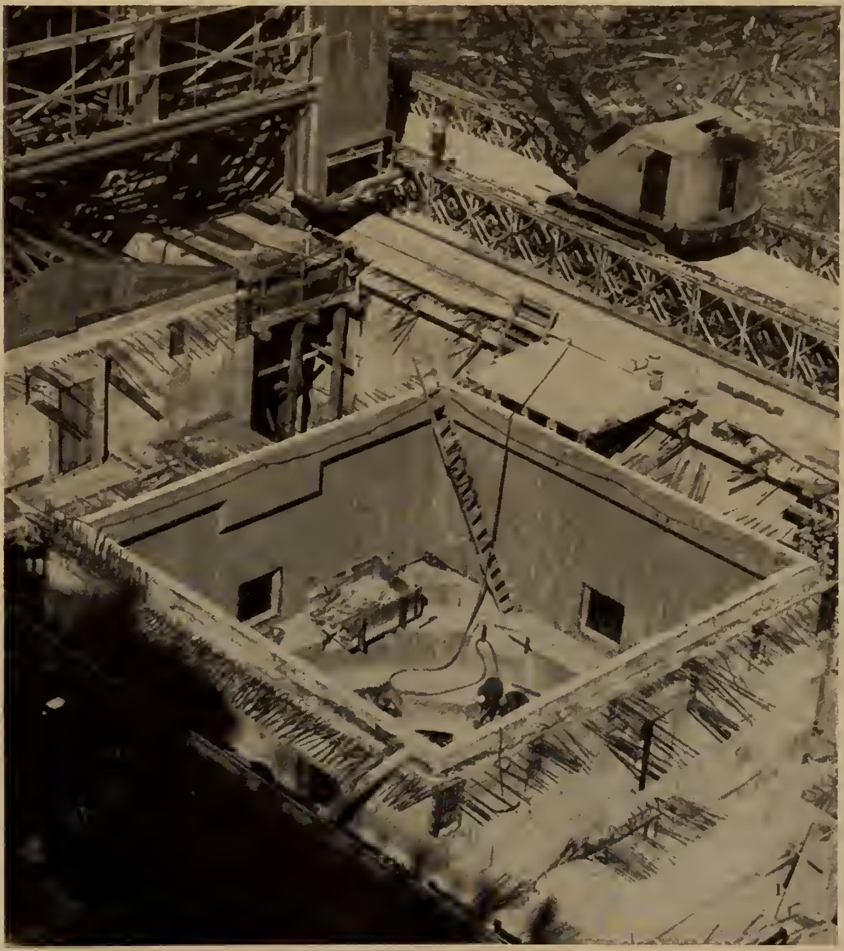


Fig. 18. Concrete pit for generator at Peribonka No. 1.

#### Heating—Regulating and Sluice Gates

Two regulating and two sluice gates are heated at each power house, to permit winter operation of these gates should this ever be necessary. The gains are heated by long tabular heaters installed in ducts extending the full height of the gate and located close to the upstream and downstream guides. These heaters are 550 volts, single phase, of 4 kv. and 6 kv. capacity for each of the regulating and sluice gate guides respectively.

The gates proper are heated by enclosing the downstream side with insulating sheeting, and circulating warm air inside the gate chambers. For each regulating gate, a fan having a capacity of 1,250 cfm. at 1.25 in. s.w.g. and a 15 kw., 550 volt, 3 phase heater is used. For each sluice gate, two fans, each with a capacity of 3,500 cfm. at 2.0 in. s.w.g., and two 15 kw. heaters are used.

Sheet metal supply and return ducts with adjustable registers are installed within the gate for the warm air distribution to each chamber. These gate heating systems are designed to prevent ice formation on the skin plate down to a minimum ambient air temperature of −40°. The heaters are thermostatically controlled to give intermittent

Table I. Data on the Schedule of Developments.

| | *Peribonka No. 1* | *Peribonka No. 2* |
|---|---|---|
| Engineering Agreement Signed | July 3, 1950 | March 1, 1951 |
| Construction Started | Nov. , 1950 | May , 1951 |
| Unit No. 1 in Service | Aug. 18, 1952 | Jan. 13, 1953 |
| Unit No. 5 in Service | Dec. 20, 1952 | Apr. 17, 1953 |
| Installed Capacity | 275,000 h.p. | 285,000 h.p. |

| | *Peribonka No. 1* | *Peribonka No. 2* |
|---|---|---|
| Turbines | Canadian Allis-Chalmers Ltd. | Dominion Engineering Co. Ltd. |
| Governor Actuators | Woodward Governor Co. | Woodward Governor Co. |
| Penstocks | Sterling Engineered Welderies, Ltd. | Horton Steel Works, Ltd. |
| Gantry Cranes | Dominion Bridge Co. Ltd. | Dominion Bridge Co. Ltd. |
| Generators | Canadian Westinghouse Co. Ltd. | Canadian General Electric Co. Ltd. |
| Power Transformers | Canadian General Electric Co. Ltd. | English Electric Co. of Canada Ltd. |
| Control, Meter, Relay and 575 Volt Switchboards | Canadian Westinghouse Co. Ltd. | Canadian General Electric Co. Ltd. |
| 161 kv. Air Blast Circuit Breakers | Brown Boveri (Canada) Ltd. | Brown Boveri (Canada) Ltd. |
| 161 kv. and 13.8 kv. Disconnecting Switches | Eastern Power Devices Ltd. | Eastern Power Devices Ltd. |

operation at higher ambient winter air temperatures.

### Lighting

Incandescent lighting is used throughout the general areas in the power houses, using prismatic refractor-type glass luminaires. The average values of illumination designed and achieved in these areas are in the range of 15—25 foot candles. Fluorescent lighting is used in the control room and office sections; the fixtures in the control room are set flush in the acoustic tile ceiling, and are provided with ribbed glass covers. The measured values of illumination in the control room vary between 35 and 50 foot candles.

Some of the incandescent units used for normal lighting are arranged to provide emergency lighting from the station battery through an automatic a-c./d-c. transfer switch. These units are located at the major equipment, stairs, and passages throughout the power house. Separate small incandescent units are installed in the control room for this emergency lighting.

Power for lighting is taken from dry type transformers for each of the sub-distribution areas in the power house. Each 60 ft. generating unit bay is thus provided with a separate transformer, panel and branch circuits for the lighting in that bay.

### Communication Systems

Each power house is provided with a PAX (private automatic exchange), having 30 lines with provision for 20 additional lines. This exchange is fully automatic for local calls within the power house area, but employs magneto ringing for outside trunk calls. Three outgoing trunk circuits are provided via microwave equipment to the Shipshaw generating station. A feature of interest which is provided by the PAX equipment is the automatic code call service via signal bells throughout the power house area to contact a person who cannot be reached at his regular telephone.

Communication between the various generating stations of the Saguenay system is achieved by a microwave network. There are five microwave stations in all—one each at Shipshaw, Isle Maligne, Chute du Diable, and Chute à la Savane, and an unattended repeater station at St. Charles, between Shipshaw and Isle Maligne. The outgoing trunk calls from each power house thus connect directly to the operator at Shipshaw via this microwave network.

### Grounding System

In both power houses, reasonable locations for low resistance earth connections were found for driven ground rods in the flooded areas in the forebays; 50 and 82 copper clad ground rods were driven at Peribonka Nos. 1 and 2, respectively. It was impossible to drive ground rods in the area of the line switching station of Peribonka No. 2, but the grid of ground conductors buried just below the surface assists in lowering the ground resistance through capacity coupling to earth.

The counter-poise and overhead ground wire connections from the transmission lines are connected to the station grounding systems. It was calculated that the ground resistances of these installations would not be greater than one ohm at each power house. Ground busses were installed in the power houses in the conventional manner for the grounding of power apparatus and equipment.

Pertinent data on the schedule of the developments is briefly summarized in Table 1. A list of the manufacturers of the major apparatus in these two power houses is also included.

The general contractors were Fraser-Brace Engineering Co. Ltd., for Peribonka No. 1, represented by G. R. Stephen, vice-president, and F. J. Palmer, project manager; and the Pentagon Construction Company, Limited for Peribonka No. 2, represented by H. R. Montgomery, vice-president, and D. G. Ross, project manager. Excavation was carried out by C. A. Pitts Construction (Quebec) Limited and Peacock & McQuigge Limited respectively, with grouting on both projects by Concrete Repairs & Waterproofing Co., Ltd. Canadian Comstock Limited carried out the electrical installation.


### Acknowledgment

The Peribonka Power Developments were built by the Aluminum Company of Canada, Ltd., the Canadian production subsidiary of Aluminium Limited. R. E. Powell is president; A. W. Whitaker, Jr., vice-president and general manager; McNeely Dubose, vice-president; and W. L. Pugh, chief engineer.

The Shawinigan Engineering Company is indebted to the executive, the management, and the engineering division of the Aluminum Company of Canada for their great assistance and prompt action on all questions referred to them. Closely associated with this work were:— W. L. Pugh, chief engineer; R. F. Ogilvy, co-ordinating engineer; A. O. Hawes, construction manager; G. T. Malby and F. A. Dagg, resident engineers, responsible for the supervision of construction at Peribonka Nos. 1 and 2 respectively. Dr. W. K. Gummer, geologist, supplied all geological data for both projects. Professor Hurtubise was retained by Alcan for soil problems.

Associated with the engineering company was Dr. A. Casagrande, consultant on soil mechanics. W. P. Harland and J. H. Scovil were resident engineers for the Shawinigan Engineering Company on the work.

# Discussion

### H. R. Montgomery[1]

We have listened, I am sure, with a great deal of interest to the paper so ably presented describing the work recently carried out along the Peribonka River. As our company was one of the two contractors engaged in this work, the paper was of especial interest to me.

Both the Peribonka developments were carried out as rush programs, dependent not only upon a very tight construction schedule, but also upon the delivery of vital manufactured components according to a predetermined pattern. All efforts in the field to achieve the target dates would have been pointless without the efforts put forward by the manufacturers of hydraulic parts and electrical equipment to meet their scheduled dates of delivery. Consistent consultation with these manufacturers on the part of the Engineering Department of the Aluminum Company and regularly held job meetings were successful in bringing all parties together and achieving deliveries on time and completion of various parts of the work according to the requirements of the schedule. In these arrangements recognition had to be made of the fact that road conditions between the railhead and the site would not permit heavy loads to be transported during the spring breakup.

Joint railhead facilities were set up at the terminus of the A. & J. Railway at Isle Maligne. Through this yard passed practically all the materials and components for the two jobs, including many thousands of tons of timber, cement, structural steel, turbine parts, generators, transformers and so on. Cement was brought in bulk by rail, stored in large tanks at the railhead and transported by a fleet of special tank trucks over the 25 miles of road to the two sites.

Due to the extreme turbulence of the river at both sites, it was impossible to predetermine exactly the shape or nature of the foundations for the rock filled coffer dams. Actual conditions found were, for the most part, less favourable than anticipated and necessitated considerably more work to be carried out than the allotted time. In the same fashion as disclosed in Mr. Heartz' paper, it was found that rock excavation had to be carried deeper for sound foundations and hence more concrete had to be placed than was anticipated but all within the allotted time, since the owner's requirements for hydraulic head to be maintained at Lake St. John was of paramount consideration and the timber blocking of part of the channel by coffer dams had to be integrated with these flows from upstream storage.

Both sites were distant from a large center of population and it was therefore necessary, immediately upon receiving orders to proceed, for the contractors to rush the construction of camp sites and facilities while at the same time commencing the work of clearing and coffer dam construction. Modern camp sites capable of housing and feeding several thousand men were erected at both jobs, including not only the usual bunk houses, mess halls, staff houses and so on, but upwards of twenty houses for married personnel. These houses were moved to other locations at the termination of the work and now house the operating personnel and their families.

One unusual feature of these projects not met in Canada heretofore is the semi open type of power house which was called for. As far as the work of construction is concerned, this design requires a different treatment, specially in the stages nearest completion, for there is no generator floor at a convenient level for use in transporting materials and components along the axis of the power house to the various units. Some other method of handling materials and heavy parts must be adopted which will be independent of the power house itself. At Peribonka No. 1 this was accomplished by a "sky hook" consisting of a 25-ton cableway so located as to cover the whole power house area.

At Peribonka No. 2 we used a travelling revolver crane of large capacity which could move along a temporary steel trestle erected parallel to the axis of the power house between the power house and the head works and able to span from the upstream side of the head works to the tailrace side of the power house. Other construction equipment was free to use the same trestle and to move through the space occupied by the revolver since it was mounted on a gantry with standard railway clearance. This afforded plenty of elasticity for different operations and the possibility of carrying out concreting operations or other work at several points along the power house or head work simultaneously. The steel legs of the trestle were buried in the concrete as it rose and were later burned off.

As stated earlier, the successful completion of these two projects within the short space of time allotted to them was due to the collaboration of many firms and individuals. Mention also should be made of the assistance of the provincial, municipal and church authorities in helping to avoid troubles which might, without their assistance, have arisen through the major dislocation of road traffic and the segregation of large bodies of men remote from their homes.

[1]Vice-president Pentagon Construction Co. Ltd. Montreal.

### F. L. Lawton, M.E.I.C.[2]

The authors are to be congratulated on the manner in which the paper has been presented, as dealing with two different developments in one paper, in a co-ordinated fashion, is not too easy.

The Chute du Diable and Chute-à-la-Savane hydro-electric developments afforded an unusual opportunity to use the same basic design for the several elements, this arising from the relative similarity of physiographic features, flow and head. This tends to reduce costs of development.

An interesting opportunity is also afforded in the two developments for comparison of performance, in the years to come of the main generating units. One feature of this opportunity grows out of the use of the umbrella-type design at the Chute du Diable or No. 1 development, with a thrust bearing and single generator guide bearing mounted below the generator rotor, as contrasted with that at the No. 2 development where the thrust bearing and upper guide bearing are installed above the rotor, with provision only for the lower guide bearing to be installed in the future if necessary. Performance to date shows that the lower guide bearing is not necessary. The omission of the lower guide bearing at the No. 2 plant arises from the close coupling of generator and waterwheel.

It would be helpful if the author would indicate the factors, engineering and cost, influencing the selection of the screw-hoist-operated spillway gates.

It is noted the author indicates no provision was made for earthquake stresses in the design of the bulkhead section. Presumably this is

[2]Chief engineer, Power Department, Aluminium Laboratories, Limited, Montreal.

due to the relative freedom of the area from other than infrequent and minor earth tremors.

In connection with the semi-outdoor design of the power plants, it should be noted that the No. 1 and No. 2 developments are, so far as known, the farthest north in the world; at least, climatic conditions are the most severe.

**Robert F. Ogilvy**[3]

It has been a pleasure indeed to follow the excellent presentation of Mr. R. E. Heartz and his two associates in describing design standards and details for the two Peribonka power developments. This very thorough review has recalled the many months of intensive work on the part of the consulting engineers, and the discussions with Alcan's management and engineering staff as the initial decisions were made which permitted the job to take shape gradually, and then the later discussions with the contractors as details were modified or confirmed as the result of field conditions which developed or were disclosed as construction progressed.

Design may be divided into three sections,—the very rough outlines of possible arrangements, the preparation of complete drawings for the scheme selected, and then the modification of such designs as may be required by field conditions. These three phases are decidedly different in character.

(a) The first must progress to a rapid conclusion reached by the owners after discussion with the consulting engineers. Preparation of nine layouts for Diable and eleven for Savane indicates only partially the volume of work to be done in the office before actual working drawings can be started and certainly long before actual construction can start in the field.

(b) The second phase consists of a great volume of steady work to produce perhaps 1,000 drawings detailed for field construction. There were about 1,000 drawings for each of the two Peribonka jobs.

(c) The third phase involves modification or amplification of design, and may be emergency effort under great pressure. The field requires immediate instruction because of some unexpected development. Construction of the 65′ deep cofferdam was in this category. The entire scheme was examined and planned for months, but when the cofferdam actually was being built, water in the river was higher than expected. Then Alcan introduced the desire to bring down the Peribonka River from headwater storage just about double the already high flow! That was an emergency which had to be examined in great haste, and thoughts had to be clear—and complete!

Our consulting engineers carried out all phases of this work expeditiously and capably, and co-operated fully in maintaining very pleasant relations with the owners' and contractors' staff organizations. This paper has described the technical aspects of a job which involved personnel contacts also, all of which were completed most satisfactorily.

[3]Aluminum Company of Canada, Limited, Montreal,

**The Authors**

The authors are very grateful to those who have given their time to comment and enlarge upon various phases of these projects.

We assume that Mr. Lawton's query regarding the engineering and cost factors influencing the selection of the individual screw hoists for the spillway gates is made with the alternative of a gantry crane or cranes in mind.

The screw hoists were selected as providing the most economical and dependable method of raising and lowering the gates. With a continuing trend towards automatic operation of hydro-electric plants, the screw hoist is the most readily adaptable from the point of view of remote operation, although for lowering, special precautions must be taken to ensure that the screw will not be buckled.

With respect to the Peribonka developments, where six sluice gates are installed, and two regulating gates not immediately adjacent to the sluice gates, two gantries would be required for the sluice gates only, in order to ensure positive operation of the gates. The cost of these two gantries would be greater than the total cost of the individual screw hoists. At the same time, if one gantry, located near mid-position of the sluice section should have its travel mechanism inoperative, only the gates which could be reached by the other gantry would be available for operation. In addition, while we do not recommend that these large gates be used in a partly open position, this condition very often occurs in practice, and with gantries it would be necessary to provide a dogging device.

A project requiring a great number of gates presents a different economic picture. A point is reached where the cost of the gantries is less and the factors favouring individual screw hoists become relatively less important. Stop-log gains can be designed to accommodate the gate, and the use of gantries makes it a simple matter to transfer the gate to the upstream position if necessary.

However, gantry ropes must be periodically renewed, thus imposing a not inconsiderable increase in operating cost which is not present with screw-operated hoists. In our experience, the latter have given dependable service, with little or no maintenance cost, over a period of years. √

# Death by Automobile

A tabulation showing deaths from automobile accidents was published recently in the Monthly Bulletin of the Royal Automobile Club of Canada.

The average number of deaths resulting from automobile accidents per 10,000 registered motor vehicles indicates how small has been the progress made in accident prevention in the past 20 years in Canada, and particularly in the province of Quebec, as compared with the United States. These statistics are compiled from reports of the Dominion Bureau of Statistics insofar as Canada is concerned and of the Highway Research Board, Washington, D.C. for the United States. It should be remembered that even though there is a decline in the average, actually the number of fatalities and accidents are increasing each year, and it is because of the great increase in the number of motor vehicles registered that the average decreases. As no figures for 1952 or 1953 from the Province of Quebec have been made available to the Dominion Bureau of Statistics, the comparative averages for those years cannot be given.

| | Average for Canada | Province of Quebec |
|---|---|---|
| 1931....... | 10.96 | 19.77 |
| 1936....... | 10.61 | 20.43 |
| 1941....... | 11.78 | 20.89 |
| 1946....... | 10.98 | 18.89 |
| 1951....... | 9.36 | 16.34 |

| | Province of Ontario | Average for United States |
|---|---|---|
| 1931....... | 10.21 | 13.0 |
| 1936....... | 9.56 | 13.5 |
| 1941....... | 11.30 | 11.6 |
| 1946....... | 10.25 | 9.8 |
| 1951....... | 8.22 | 7.1 |

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# The Application of Computors to Industry

*by*

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Two types of computors are available today, the analog and the digital. The former are inexpensive and easy to understand but limited in accuracy. the latter are required for such uses as accounting and inventory control where greater accuracy is desired.

These electronic brains control airport traffic, keep track of airline reservations, take inventories and make stock reports, calculate load distribution on power networks, predict election results and even translate Russian speeches.

The future role of computers for supervision and control in the automatic factory is only beginning to be realized, when fully exploited its impact on industry will really be felt.

Many of the popular magazines, such as *Time, Fortune* and *Scientific American*, have told us of the various computing machines. These are the so-called "Electronic Brains" which are coming to the aid of engineers and scientists everywhere, in the solution of problems which would otherwise take a lifetime to solve. Perhaps the reader has wondered whether these machines, which apparently give the answers to some fabulous equations in atomic physics and relativity, can also be applied to some of the more down-to-earth problems which arise every day in industry.

The answer is, of course, that they certainly can. A great deal of effort is now being directed toward finding ways in which they may be used in such fields as inventory control, census and insurance calculations, and engineering design. Before delving into some of the specific instances in which computors have been used, however, let us take a look at what sort of thing a computor is, how they work, and what they can do.

The various computing machines available today can, in general, be divided into two distinct classes—analog and digital. Their basic difference lies in the fact that the analog depends on the measured value of various physical quantities and the relationship between them, while the digital relies on the spacing and logical use of pulsed or on-off data with time. Analog computors use the technique of models, or more specifically, mathematically equivalent models. Digital computors, on the other hand, use a language, the language of counting.

### Analog Computors

The analog computor operates by setting up either the physical analog of the system or device being studied, or by representing the various mathematical equations involved with analogs of mathematical operations. The analog is then either displaced from its balanced state by the insertion of an initial condition, or excited by the use of some arbitrary disturbance or forcing function. The manner in which each variable in the analog subsequently behaves provides the information leading to the solution of the problem.

Analogs have been achieved by mechanical means, by electric circuitry or, as is most common nowadays, by the use of electronic operational amplifiers with feedback. This latter type of analog is probably one of the most widely used general-purpose computors today, being relatively inexpensive and easy to understand. It is capable of operating on a 1 : 1 time scale, that is, in real time, and may be used either to solve a complete equation or to simulate certain functions in connection with actual equipment.

Since analog computors rely on the measurement of physical quantities for determining the value of various parameters, however, their accuracy is usually limited to one part in 1,000, or at most, one in 10,000. This accuracy is, in many cases, sufficient, especially in development work where one is usually satisfied with trends, and absolute accuracy is unnecessary. If, however, greater accuracy is desired, as in accounting and inventory control one must turn to a digital machine.

### Digital Computors

Digital machines, since they work with discrete quantities, can be made as accurate as desired, since it is only necessary to provide a sufficient number of significant figures. One digital computor, the Harvard Mark I for example, is capable of handling up to 23 significant figures in the decimal system. This is an early computor, using relays, which was built by I.B.M. and given to Harvard in 1944.

The operation of the digital computor may be compared to that of using a modern desk calculator for solving a problem. The exception is that every operation is automatic from the time the machine reads from the input device the operation required, and the numbers to be operated on, until the answer is displayed by the output device. In the interests of reliability, however, the machine uses devices in which only two stable states exist, such as a relay or its electronic equivalent, and this predicates that all information concerned with the problem be reduced to the point where the solution can be determined by a sequence of yes or no decisions.

It is like using a desk calculator with a human operator of no intelligence, capable of following instructions and of exerting no judgement. The setting down of these minute instructions, or programming as it is called, is what consumes time in digital computor operation. While carrying out a solution with the machine is probably a matter of minutes, the programming may take a couple of weeks. Fortunately, however, a program, once written, may be stored on tape for future use and a library of programs or routines built up. The usefulness and flexibility of a computor is thus enhanced by a large library of these routines.

As in a desk calculator (where slips of paper are used), only one set of numbers can be operated on at one time. Some device must be provided for the storage of numbers and instructions while they are not being used. The memory units determine the capacity of the computor. Devices used for this purpose include magnetic drums, tapes, magnetic flip-flops, punched cards, cathode-ray tubes, and delay lines. They are characterized by their "access" time, the time required to find and extract a given bit of data.

The fact that the digital computor is calculating one mathematical operation at any instant, rather than the complete problem, prevents its use as a simulator in the usual sense. However, where the physical variation is slow compared to the time required by the computor to make the desired calculation, the digital machine may have some application in the simulator field.

### Use in Power Networks

Turning now to applications, let us take a look at how computors are being used today. Computing machines are of most value where the calculations involved, though simple, are long and tedious. One activity where such problems arise is in the calculation of load distribution and stability in large electrical power transmission networks. A form of analog computor, the network analyzer, has been in use now for over 30 years and it is estimated that there are more than 25 of these instruments in existence today.

An indication as to their usefulness is given by the fact that seven private utilities in the United States have decided to build a new $400,000 analyzer at the Franklin Institute in Philadelphia, using private capital. This analyzer is to have the equivalent of 28 generating stations, 270 transmission lines and 90 loads.

### For Aircraft and Guided Missile Development

Another industry which has made considerable use of computors is that concerned with the design and development of aircraft and guided missiles. This group alone, in connection with defence contracts, has probably been responsible for most of the post-war computor (especially analog) development to date. At least three companies have been actively engaged in computor development which has resulted in actual general purpose computor design.

An indication of the importance of computors in aircraft development may be obtained by considering the following statistics relating to the computing section of one of the large aircraft companies:

Equipment available or on order:
- 2 I.B.M. Defence Calculators
- 5 I.B.M. Card Programmed Calculators
- 1 Electric Analog Computor
- 1 Electronic Operational Analog Computor.

At the end of 1952, it was estimated that this equipment would require a staff of about 73 persons, occupy approximately 11,000 square feet of floor space and would use about 425 kva. of electric power. Costs directly chargeable to the operation of the equipment, including salaries, was estimated to be in the neighbourhood of $75,000 per month.

### For Pilot Training

In addition to development work, computors are also being used by the aircraft people for training pilots, in the form of flight simulators. Some attention has recently been given in the press to one such simulator under development in Canada. These simulators compute for a given flight condition realistic instrument readings, which are displayed in a simulated cockpit where the trainee sits. Whatever action he takes to correct the situation is fed back to the computing section which calculates the new instrument readings.

Apart from the obvious advantage of preventing loss due to improper response, these simulators present a real saving in costs of training personnel. The cost per hour for operating a flight simulator is in the neighbourhood of $10.00, whereas the cost of flying an F-86 is about $150, a B-50 $400, and a B-36 bomber $1,000.

### For Airport Traffic Control

Another problem, to which computors have recently been applied is airport traffic control. This system, known as Volscan, or Volume scanner, determines by radar the position of each aircraft approaching the airport at ranges up to 60 miles. It automatically calculates the optimum time of arrival of each aircraft and the flight path it must follow, at constant speed, to arrive at the prescribed time. Instructions are then transmitted to the aircraft.

Arrangements are provided to ensure that two aircraft do not arrive at the same time, and to recalculate the flight path and arrival time if an error is made in following the instructions or an emergency develops. With this system, it is possible to land up to 120 jet aircraft per hour, where formerly only 40 per hour could be landed, and that only in good weather.

### The "Reservisor"

Airline reservations data handling is another phase of the aircraft business which has received some assistance from computing machines. Normally, this information was handled by placing a large blackboard indicating open flight space within sight of a number of sales agents with telephones. Under the best conditions, this board was several minutes behind schedule and could only handle data for a three- to five-day period.

A recent development, the "Reservisor", which uses a magnetic-drum memory, is capable of checking seat availability, and selling or cancelling from one to four seats of any eight flights at one time, on a total of 1,000 flights per day for a ten-day advance period. Requests for information may be entered from remote stations by telephone link, and during a normal ten-hour day, 22,000 calls are handled. The machine was developed by the Teleregister Corporation, in co-operation with American Airlines, at a cost of $500,000. It was placed in operation in New York in July 1952.

#### Used by Mail Order Houses, Restaurants, Groceries

Another application, also using magnetic-drum memory, is the "Distributon", which keeps track of inventories for a mail-order house in Chicago. The machine takes account of 13,000 items, and prepares totals as to number of orders, number of cancellations and current inventory balance. The first real trial of the device occurred last Christmas, when it replaced 60 part time clerks with ten operators with input devices. The machine can not only take care of 90,000 tallies per day, but it can also be set to type out a daily stock report at night. The time required to complete one operation is about 0.4 seconds.

Over in England, the firm of J. Lyons & Co. Ltd. have sponsored the construction of a digital computor for use in their large restaurant and grocery business. This machine, which they have named "Leo", the "Lyons Electronic Office", is not only to be used for office accounting, but also for controlling stocks of foodstuffs. The programming of a machine to handle such problems is of course a formidable one, and this phase is still being worked out.

At present, the machine only works about five hours per week for the company, but the remainder of the time it is profitably contracted out to defence industries. All told, the computor occupies about 1,100 square feet, weighs 15 tons and requires six operating and maintenance personnel. It can carry out, in one second, calculations requiring eight minutes by existing office machinery.

#### UNIVAC Predicts Election Results

Quite a lot of work is also being done with computors in the field of statistics. It is here probably that the digital computor finds its most important use, since statistics after all is mostly counting.

Most of you are probably aware of the use made of computors in the last U.S. election to predict the outcome, and perhaps some of the details concerning the use of UNIVAC would be of interest. A study of how UNIVAC might be used for this purpose was initiated some six months in advance of election night.

The whole country was sub-divided into a number of sections as indicated by their past voting habits, and a mathematical system set up whereby the machine could predict:

— the probable outcome of each state, and the majority.

— the number of states for each candidate.

— both the electoral and popular vote for each candidate.

— the relative chances of each candidate.

Three to one, and ten to one odds were worked out in each case. Three complete machines were used, two acting as a check on one another, and the third standing by. A time of 6 minutes was required to make a prediction on a given group of data.

How well it worked is illustrated by what actually happened. At 8.30 p.m. on election night, when only 3,400,000 votes were in, and 21 states were unheard of, the machine predicted 100 to one in favour of Eisenhower. This produced some consternation on the part of the operators, since a close election was expected, and it was not understood how the machine could be so sure of itself when so many states had not reported in.

A quick check of the programming was made, but no error was found. It was then decided to make a slight change in the factor representing the unheard-of states, to show a closer election for this set of returns. Ten minutes later, however, when more complete results were in UNIVAC repeated its prediction of 100 to one, and it was realized that no mistake was made.

#### From War Priorities to Translation

Another tremendous problem being investigated by digital machinery is one of inter-industry economics, where the inter-dependence of one industry on others is studied and their effect on the output of each is determined. Such an undertaking is of great importance in time of war; for example, where production must be speeded up and priorities laid down. The old time requirement that military commitments be met at all costs is now giving way to a planned program, which can be achieved within the existing industrial structure.

Computors have also been applied to many other problems. They have been used to study the behaviour of underground oil pools, the United States census, beam vibrations, automatic control problems, and, most recently, language translation.

The successful demonstration of this last capability was given early this year, when the International Business Machines 701 computing installation in New York city was programmed to translate Russian sentences into English. More than 60 sentences, involving 250 different words were translated, the time for each sentence being about 8 seconds. The process was achieved by setting in the machine all English words which are required to describe the various meanings which the Russian word may denote, and a set of six rules for determining which English word is the proper one to use.

#### Many New Applications to Come

The use of computors in industry is not an entirely new development, of course. Card-programmed calculators have been used in accounting for many years. The idea of using punched cards was in fact first conceived over 100 years ago by Jacquard in France, for the control of patterns in weaving, and this technique is still being used today in that industry. The "Analytical Engine" which Babbage designed in 1833, contained many of the principles used in modern computors.

But it has really been only in the past 15 years or so that scientific know-how and manufacturing technique have advanced to the point where general purpose computors become a feasible proposition. Every day, new applications are being found for these machines, and office procedures and manufacturing processes are being converted to a form where they can be accurately and speedily handled by machine computation.

The future role of the computor, that of supervision and control in the automatic factory, is only beginning to be realized in such developments as the punched tape controlled automatic milling machine at M.I.T. When this capability of the computor is fully exploited, the impact of the computor on industry will really be felt.

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# Discussion

## G. Glinski[1]

Mr. Moore should be highly complimented for such a lucid presentation on the subject of the application of computors to industry.

In my short discussion of his paper, I would like to elaborate on one aspect of the problem which I feel should be of particular interest to the members of this Institute: How much Canadian engineers and scientists contributed to the developments in the computor field.

My own activity in this field goes back to 1946 when I prepared, as a consultant, a proposal for a large scale audio frequency network analyzer for a firm in Toronto.

The interest of our Armed Services goes back to 1948. The names of Lt. Cmdr. J. Belyea of R.C.N. and W/C J. G. Wright of R.C.A.F., should be particularly emphasized.

The National Research Council and Defence Research Board sponsored, since 1948, the activities of the Computation Center of the Toronto University. At the University, such people as Professor V. G. Smith, Dr. C. C. Gotleib, Dr. J. Kates and Dr. A. G. Ratz made many contributions to the techniques and art of computation.

In 1948, also, a first Canadian company specializing in electronic computation, was organized: Computing Devices of Canada, Limited, in Ottawa. I have been associated with this Company from its inception.

In 1949, Ferranti established a separate department, specializing in computing problems.

In 1951, Professor F. S. Howes of McGill University, decided to organize the postgraduate courses on digital and analog computation and I was asked to lecture at both McGill University in Montreal, and Carleton College in Ottawa. Since then, these courses became well established and, I think, we have now more than 100 people who have been initiated into the mysteries of computation.

I like to stress this problem of manpower particularly, since, on having a sufficient number of people who can build the computors, operate them and see their potentialities for particular applications, lies the future of computing in Canada.

A few years ago, even in my own Company, many colleagues considered me as an impractical fellow, whose computing obsession will ruin the business. These fears, of course, are things of the past.

Whereas in 1948, I could count on the fingers of my right hand the number of people in Ottawa who knew something about computors, now in 1954, even Deputy Postmaster General invents "built-in brains".

I have no time to dwell upon particular technical contributions to the art of computation which originated here in Canada, but I would like to mention a few. We developed many specialized computors for military applications. We built prototypes of a few general purpose computors. We invented several new computor components such as: matrix tubes, magnetic pulse elements, electro-mechanical devices, magneto-striction delay line memories, etc. We introduced first unitized construction of digital computing equipment.

In my short discussion of computing in Canada, I probably omitted some important names, dates or accomplishments. Of course, this is not intentional but simply because of the impromptu character of these remarks.

## Dr. J. Kates[2]

Much of the literature about computors, especially popular and semi-popular, places heavy emphasis on the large size of computors and large size of the problems computors can handle. In the very excellent paper we have just heard, large figures also played a prominent part. I recall statements as to: 23 significant figures—

$400,000
500,000
22,000 calls per day
13,000 items
1,000 square feet
15 tons

Now it is true that machines, particularly earlier models, are fairly large and costly and require staff possessing considerable qualifications. But in emphasizing these points, we tend to scare smaller

[1]Consulting Engineer, Director, Computing Devices of Canada Limited, Ottawa.

[2]Adalia Limited, Consulting Engineers, Toronto.

industry away from the very considerable and worthy applications for computors of a smaller and more limited scope, applications which exist at present. Let me here just give two examples:—

At Toronto about a year ago, we used our computor for calculations connected with the St. Lawrence Seaway. These calculations required 400 hours machine time and cost $60,000.

Now we are programming a design procedure for a company. One set of calculations will take only a few minutes and will cost between $10 and $20.

By a calculation such as the $60,000 Seaway calculation, millions of dollars can be saved by minimizing earth moving operations. By the $10 design calculations, a few thousands of dollars will be saved every year in engineering time. Also it will be possible to obtain immediate estimates instead of waiting a few weeks. The important point is that the digital computor is an economic tool for small jobs as well as for big ones. Too few people realize that short or lengthy sequences of operations and manipulations can be recorded on an ordinary teletype tape. This means that into this tape, or cards or other devices, an engineering or an accounting or a planning department may record those of their operating sequences which occur repetitively. Once such a master tape is entered into a general purpose computor, this computor assumes the characteristics of a machine specially built for the particular task. And yet this transformation is accomplished without changing one item of hardware on the machine. This master program which is on the large tape sets up the process. A separate tape, the data tape, is used so that the master program can deal with a great variety of problems of a similar nature.

I should like to underline Mr. Moore's point that it is not necessary to construct a new program every time a problem is handled. Rather, the same program can be used for a great number of applications.

Engineers, scientists, accountants and businessmen can now (and this is not five years from now, but at any time they choose), have a particular repetitive type of design operation, estimating procedure or other calculation, programmed, i.e. put on a tape. This tape represents an investment which does not deteriorate with time for there is no depreciation involved. Moreover, it is fairly easy to broaden such programmes later on.

By running such a tape together with the data of particular interest into a computor, you can then have the computor go through the sequence of steps far more cheaply, quickly and reliably than a human chain of either girl operators or highly skilled engineers could do. In order to avail yourself of such computors in a very large number of cases, you do not necessarily require to either own or build a computor nor do you require staff who are experienced with computors. Experienced programmers are available at a number of centres who can work with your company's own staff in order to adapt computors to your company's operations.

Computors are not expensive; they are really cheap. You can now buy computor time by the minute, i.e. by the dollar. And in one dollar's worth of time, a computor can do considerable work.

This means that industry can now relieve its staff, particularly highly trained engineers who are in short supply, from tedious and costly calculations and operations. It means that industry can make savings by reducing the cost of operations and at the same time increase revenue by employing their highly skilled staff more efficiently and more intensively. This is particularly important for Canada because here engineering departments tend to be small. In order to utilize our engineering manpower most effectively, we must relieve them of lengthy repetitive design routines.

Every executive knows that he should not do something that he can delegate to someone else; and that a human being should not be wasted on tasks which a machine can do so much better. And so it is important for Canadian industry to get acquainted—to "get its hands wet", so to speak, with the newest and most flexible tool that has been developed so far. This tool will become as important to technology as the assembly line, much sooner than you think. Industry should scan its operations everywhere—first, for smaller tasks, and then for the larger tasks which might be done by automatic machines.

Thus:

1. Industry can economize on these tasks;

and

2. Industry can better realize the potentialities of these new techniques. √

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## Future Power Developments, Northern B.C.

The future power developments and metallurgical projects planned for Northern British Columbia and the Yukon will rank among the major engineering developments of the world today. T. Lindsley, president of the Frobisher and Ventures group of companies recently met with Premier W. A. C. Bennett and Honorable Robert E. Sommers, B.C. Minister of Lands and Forests and Minister of Mines, to discuss the project.

The total watersheds to be developed extend 200 miles north-south from the south end of Atlin Lake to the mouth of Big Salmon River, and an east-west distance of 300 miles from Rancheria to Burwash.

The industrial phase of the project calls for the construction of smelters and refineries to treat ores and concentrates which will be shipped in from distant parts of the world as well as those from the Pacific area of Canada.

The hydro-electric project, officially known as the Yukon River-Atlin Lake-Taku River Power Project, plans to utilize the run-off from the upper drainage system of the Yukon Territory. Northern B.C. Water from other watersheds west and east of the Upper Yukon Valley will also be diverted. A group of large lakes forming the headwaters of the Yukon River will be used as storage reservoirs. The project will divert the flow of the Upper Yukon River and adjacent rivers and streams, to the valleys south of Atlin lake. Ultimately this will generate some 4,300,000 horsepower. The first stage of the project calls for the development of 880,000 horsepower by 1962.

The development is being undertaken by Northwest Power Industries Limited, a subsidiary of Quebec Metallurgical Industries Limited, and Frobisher Limited, a subsidiary of Ventures Limited.

Work will begin next year, assuming the necessary licences are obtained from the governments of Canada and British Columbia before the end of this year. √

*A paper presented to the 68th Annual Meeting of The Engineering Institute of Canada, Quebec, May, 1954.*

# Electronics in The Pulp and Paper Industry

*by*

W. A. Messervey

*Pulp and Paper Mill Application Engineer, Canadian General Electric Co., Ltd., Peterborough, Ont.*

Like many another process industry, paper making is becoming more and more automatic. Production and quality may now be kept up to standard, or improved, by means unkown only a few years ago. Much of this advance in technique is attributable to electronic instruments and devices, like those described in this paper. All such advances should be good news to Canadians, each of whom is to some extent, directly or indirectly, dependent on pulp and paper for a part of his daily bread.

The pulp and paper industry in Canada leads all others in value of production, in exports, in wages paid and in capital invested. It is the largest consumer of electric energy, purchasing some 17 per cent of all central station power developed, and also generates more water power than all other industries combined. It is the largest industrial buyer of goods, services and transportation. Canada's newsprint output is five times that of any other country and supplies one-half of the world's needs. Canada also is the world's greatest exporter of wood pulp and the world's second largest producer of pulp.*

This paper describes briefly electronic equipment applications which have assisted the industry to keep pace with our heavy industrial expansion, and also describes more recent applications which will further assist the industry.

### Paper Making Process

A brief description of the paper making process will be of assistance to those not too familiar with the industry. Figure 1 is a simplified flow sheet of a newsprint paper mill.

Pulpwood is brought in from the woodpile or log pond and the bark is removed by a barker. In eastern mills this is usually a cylindrical drum in which the logs are tumbled and the bark removed by friction. The hydraulic debarker is more common on the west coast where logs are much larger. In this type the bark is removed by high pressure water jets.

Some of the cleaned wood goes to the chippers where it is reduced to chips about ¾ inch thick. These chips are then cooked in an acid bath which produces almost pure cellulose. The resulting pulp is washed, screened and refined and goes to the sulphite stock chest.

The remainder of the debarked wood goes to the grinders where it is reduced to pulp. This groundwood pulp in turn is screened and refined and goes to the groundwood stock chest. The groundwood and chemical pulp are then mixed in the proper proportion, for newsprint roughly 80/20, and pumped into the head box. There it is mixed with more

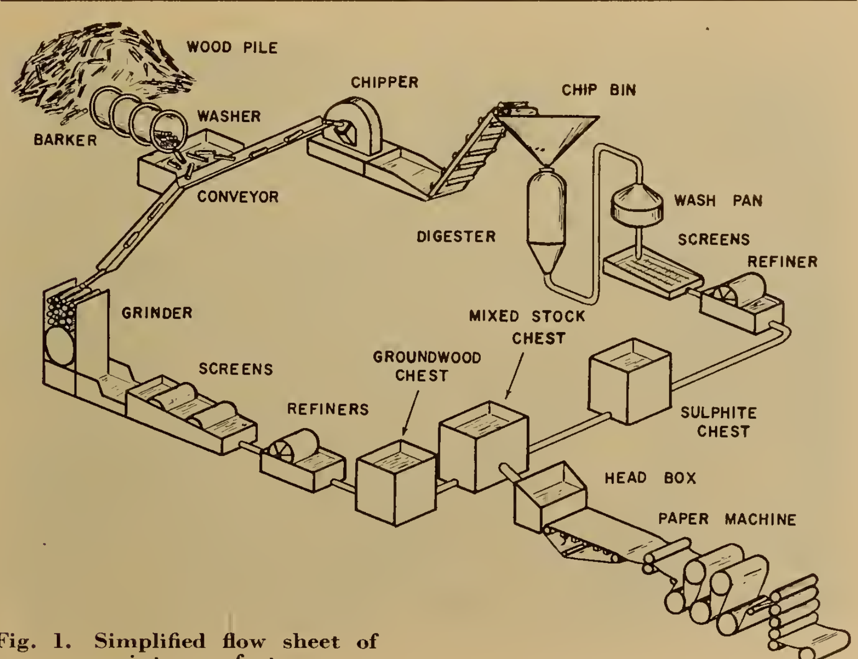


Fig. 1. Simplified flow sheet of newsprint manufacture.

* Based on data from Canada Year Book, 1952-53.

water and flows out on the paper machine, where it is formed into a continuous sheet of paper.

### Theory of Electronics

This paper is much too general to cover in detail the theory of electronics and of electronic tubes. A brief description of what electronics can do, however, is worthwhile, because making use of one or several of these abilities constitutes in part the art of application engineering for electronic equipment.

#### *Rectifying*

Electronic tubes can pass current in only one direction; thus they serve as a means of converting alternating current to direct current for generator and motor excitation. By using grid-controlled rectifiers the amount of current flow can be adjusted, permitting variable excitation.

#### *Amplifying*

Signals applied between the grid and the cathode of a tube produce corresponding changes in the current that it will conduct. By proper selection of the plate resistor, the change in plate current can be converted into a change in voltage many times greater than the original signal. The power requirements of the grid circuit are extremely small, so a very minute signal may be detected and, by placing several tubes in cascade, may be amplified as many times as desired to give a working signal to control a machine or process.

#### *Light Sensitive*

Light shining on the cathode of a phototube causes an increase in current flow and this may be amplified to provide enough power to operate the desired mechanism.

#### *Voltage Regulating*

In cold-cathode gas-filled tubes, commonly known as "glow tubes", the voltage drop across the tube remains practically constant regardless of changes in the amount of current flowing through it, within the rating of the tube. This constant voltage is used to provide for stable power supplies to electronic circuits and to act as a reference voltage in regulating circuits.

A combination of the above properties, together with proper circuit design, is usually necessary to meet the desired application requirements. For example, a voltage amplifier would require a power supply and one or more amplifying stages. The power supply would involve rectification and perhaps voltage regulation in order to supply a stable d-c. voltage to the amplifier from the a-c. lines.

### General Electronics Applications

#### *Metal Detector*

The application of electronics in the paper industry can be found at the very beginning of the process.

Spikes, pieces of wire rope and other metal can become embedded in logs during cutting and transporting, particularly if the logs are floated or towed in rafts. Stray metal can cause damage to chipper knives and grinder stones. Figure 2 shows a metal detecting installation in which the detecting coil is partly submerged and logs are floated through it. The detecting circuit employs an inductance bridge of which this coil forms a part. Metal introduced through the coil causes the bridge to become unbalanced electrically. This unbalance is amplified electronically and the output operates an alarm or can be arranged to operate a reject device.

**Fig. 2. A log passing through coil of metal detector.**

**Fig. 3. Adjustable speed control panel: "brain" unit at top; motor armature rectifier testers at bottom left; motor field rectifiers at bottom right.**

The coils are rugged, single-turn devices; the four-foot coil can detect magnetic materials equivalent in volume to a ½-inch sphere at the centre of the coil opening. This is a conservative figure; the sensitivity increases several-fold as the metal approaches the coil. This equipment will detect non-ferrous metal of about twice the diameter of magnetic material.

#### *Adjustable Speed Drives*

There is a growing need for inexpensive, yet high quality, adjustable speed drives in the smaller horsepower ranges for new processes and machines, or to provide adequate control to an older process made more critical by increased production.

The direct current motor and electronic control combination has proved well suited to meet these requirements, particularly where speed ranges are wide, load changes are frequent and large, and where automatic control, speed regulation, tension regulation, timed acceleration or current limit acceleration are indicated. These electronic d-c. drives are classed according to the nature of their power supply:

a. Figure 3 shows the panel for an adjustable speed drive with an all-electronic power supply. This drive is most economical in the smaller sizes and is accurate, versatile and fast acting. Because few paper mill applications require all its features, its cost in the larger sizes is sometimes not justifiable.

Both the field and the armature of the direct current motor are supplied with power from grid-controlled rectifiers connected to the a-c. lines. The rectifier grids are controlled in turn by an amplifying unit which is responsive to speed, voltage or current signals. A glow tube is sometimes used to act as a reference for the signal to be controlled. The amplifying part is often referred to as the "brain" unit.

b. Figure 4 illustrates another type of adjustable speed drive. It can be used with or without electronics. The unit consists of an induction motor driven d-c. generator which supplies armature power to the d-c. machine motor; a d-c. exciter for control power and motor field excitation; induction motor starting equipment; and the necessary d-c. magnetic control. The whole is housed in a sheet steel enclosure, complete with air filtering and ventilating equipment. With electronics, this drive is controlled by a unit similar to the brain already mentioned, which regulates small grid-controlled rectifiers. The latter supply excitation to the d-c. generator field in proportion to the control signal. These drives are available in package form up to 200 hp. and are used in such paper mill applications as for stock washers, for rewinders, for windups and unwinds of supercalenders, for small paper machines and for pulp drying machines. Their use is also indicated where only small control signals are available.

### *Grinder Load Regulators*

Newsprint consists of over 80 per cent groundwood. The grinding process uses more than 50 per cent of the total power requirements of a newsprint paper mill and it is desirable to keep the mill power load approximately constant. There is also a definite relation between grinder power and pulp quality and quantity, so it is common practice to regulate grinder motor input kilowatts. This is accomplished by changing the feed rate of the wood onto the stone, but is not by any means an easy regulating task. The sharpness of the stone, the species of wood, the quality of a given species, voids in the wood supply and power system changes all contribute to the wide variation in the feed rate required.

In continuous types of wood grinders, feed mechanisms are driven by d-c. motors through gears with ratios in the order of 30,000 to 1. Thus, while grinder loads may change suddenly, the time of response of the electrical system is partly nullified by this high ratio and by backlash. Rapid, jerky correction is not permissible because of its detrimental effect on groundwood quality. What is required is a sensitive high-gain regulator, having a minimum time lag consistent with smooth wood feed.

Numerous types of regulators have been installed in the past thirty years, the majority of them using some form of contact-making wattmeter as the sensing means. These usually perform adequately, but require considerable maintenance of contacts and relays. In addition, it is now difficult and expensive to obtain replacement parts. The operating range of these regulators is also somewhat limited and the on-off system tends to give choppy woodpulp. An attempt has been made in the past few years, therefore, to build some static form of regulator and, while some success has been attained, it is only recently that a static circuit has been developed which is truly responsive to watts, even under conditions of varying power factor, line voltage and frequency.

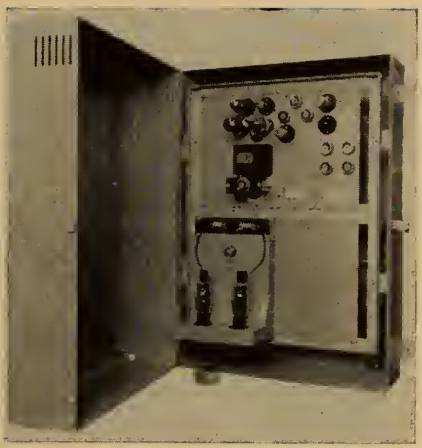

**Fig. 5. Electronic grinder load regulating panel; electronic watt meter at upper right.**

After several years of research and testing, regulating equipment as shown in Figure 5 has been built and installed; this appears to have all the requirements of a successful grinder load regulator. The circuit is shown in simplified form in Figure 6. The equipment is inexpensive, accurate, reliable, completely static and can be adapted to existing regulating systems if the rotating equipment is adequate.

The heart of the regulator is the electronic wattmeter which delivers a d-c. voltage directly proportional to watts over a wide range of time, voltage, power factor, frequency and ambient temperature. This voltage is compared to a precise glow tube reference, which is adjustable to set the kilowatt load. If any difference exists between the reference and the wattmeter signal, it is amplified in the next stage and this in turn controls the grids of the output rectifier tubes, thus controlling the excitation of the field of the feed-motor generator. This changes the

**Fig. 4. 40 hp. electronic speed control power unit; motor generator set at bottom; magnetic control at upper right; electronic control at upper left.**

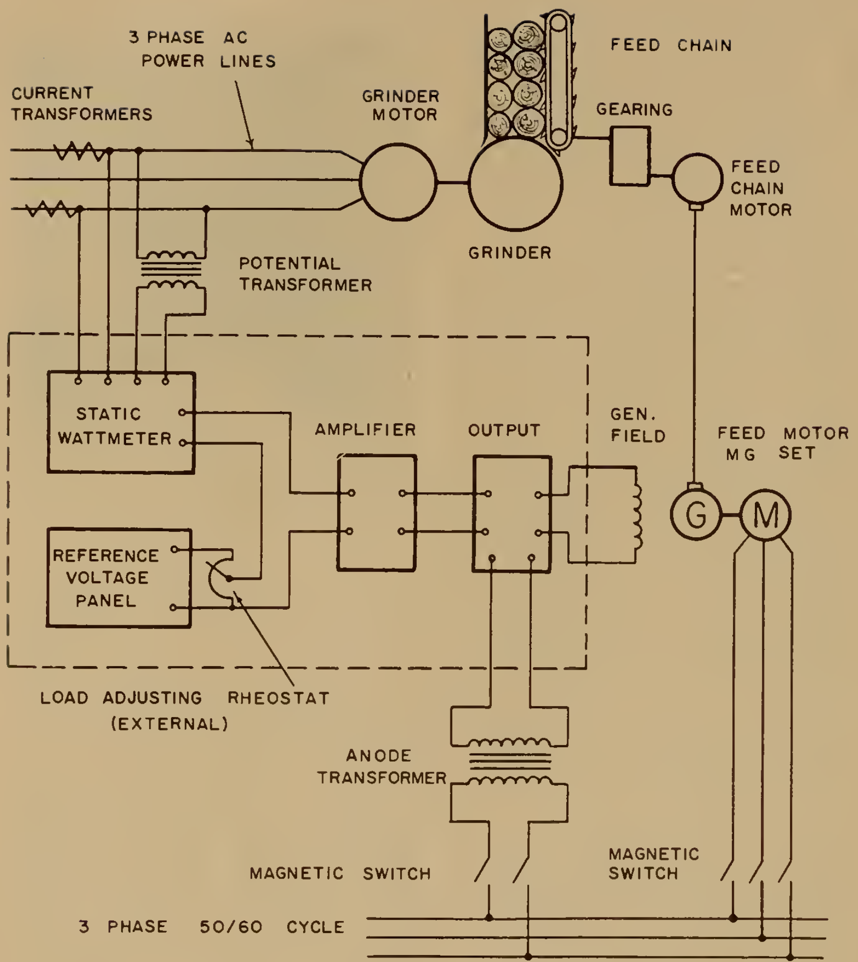


**Fig. 6. Simplified diagram of electronic grinder load regulator.**

voltage of the generator, which changes the speed of the feed chain motor, changing the rate at which the wood is fed onto the stone. This in turn restores the load on the grinder motor to the desired value. A drop in load would occasion an increase in feed motor speed and vice versa.

Operating experience with this equipment shows an accuracy well beyond that of any existing static device and superior to the contact-making wattmeter in all but exceptional cases.

### The Paper Machine

The whole output of a paper mill has to pass through its paper machines to obtain the required product. It will be realized, then, that utmost reliability is a criterion for any equipment associated with the machine, otherwise production will be lost or product quality will suffer.

A brief look at the paper making process will reveal some of the problems that can be met only by reliable and accurate control. Figure 7 shows in elevation a typical newsprint machine. Stock flows onto an endless wire screen belt from the head box in the proportion of 199 parts of water to 1 part of pulp. As the stock moves along with the travelling wire much of the water is removed by passing through the openings in the screen. The wet sheet then passes over a number of suction boxes and around a suction roll, called the "couch roll", where more water is removed. At this point the sheet looks much like waterlogged newspaper, having little mechanical strength and still containing a great deal of water. Then it passes through two or more press sections, which wring out more of the water. The sheet then passes into the dryer section which consists of a multiplicity of steam heated rolls. By the time the paper has reached the end of the dryer section it is completely dry. A controlled amount of moisture is then put back into the sheet by passing it over a sweat roll. From there it passes to a calender section, which polishes the paper to make it suitable for printing. The final product is wound into rolls on the reel section. Machines for other types of paper vary in makeup according to requirements, but in general the objective is the same.

These rolls of paper are then rewound and slit on a winder with the proper tension and desired width. Paper breaks are spliced on the winder and poor quality paper, if present, is removed.

#### *Sectional Drives*

Paper machines may be driven either by a mechanical lineshaft or by a sectional electric drive. In the former, a lineshaft extends the length of the machine. Each section of the machine is mechanically coupled to the shaft through a clutch and cone pulley drive.

In the sectional drive each section is driven by a direct current motor;

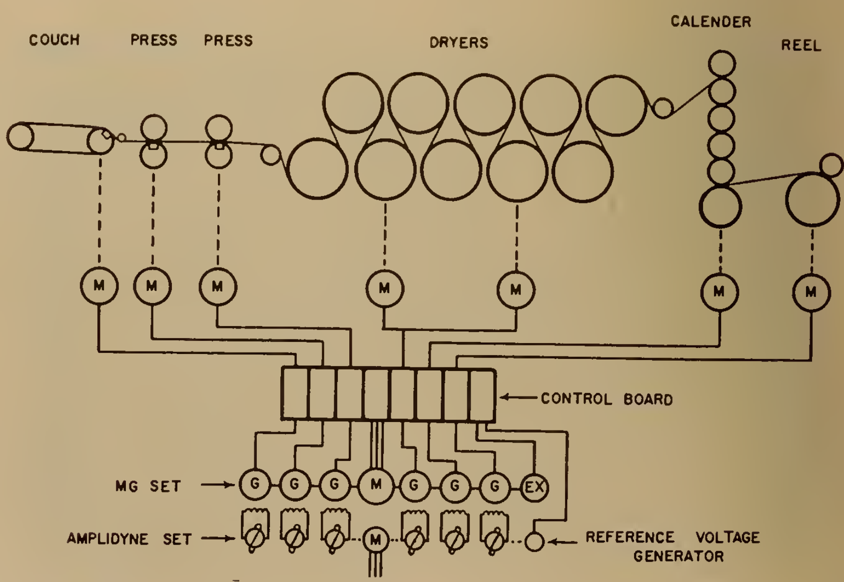


**Fig. 7. Diagram of paper machine showing section drive equipment and control.**

the majority of larger, higher-speed machines use this type of drive. Such a drive is called upon to perform satisfactorily under unusually stringent conditions with the utmost reliability and with extreme accuracy. The sections vary widely in horsepower and inertia; the speed of each section must be independently variable and, once set, must hold the difference in speed, commonly known as "draw", extremely closely. In addition, overall machine speed must also be held closely in order to produce a uniform product. Fig. 8 shows a sectional drive set-up.

As paper machine speeds have increased, the electronic-amplidyne drive has proved itself adequate to meet these stringent requirements. Some tissue machines are now in operation at speeds in excess of 2,500 f.p.m.; kraft and newsprint machines are consistently running above 1,600 f.p.m. and in some cases approaching 2,000 f.p.m. In Canada, almost 200 section-years of operation have proved this type of regulator to give quite satisfactory performance. It is interesting to note that the majority of these drives has been installed on old machines, many of which are now running at double their original designed speeds.

Usually each section of the machine is driven by an individual motor, except in the case of the dryer section, where two or more motors are used for mechanical reasons. As shown in Figure 9, each motor is supplied with armature voltage by its own generator. The motor field excitation is constant. Speed control is obtained by varying the armature voltage. Each generator is excited by its individual amplidyne generator, the latter being a very high-gain, high-speed d-c. exciter. The amplidyne requires only a few watts of excitation and this can be supplied quite adequately by the electronic amplifier.

Each section motor has a pilot generator connected to it. This pilot is a heavy duty, non-aging, temperature-compensated, alnico-magnet-field tachometer generator, which delivers a voltage directly proportional to motor speed. This voltage is compared in the electronic amplifier to a very precise d-c. voltage, called the "reference voltage", which is the master voltage for each paper machine; every section pilot generator voltage is compared to it and this master voltage therefore sets the overall speed of the drive. If any difference exists between the pilot generator voltage and the master voltage, it is amplified in the amplifier.

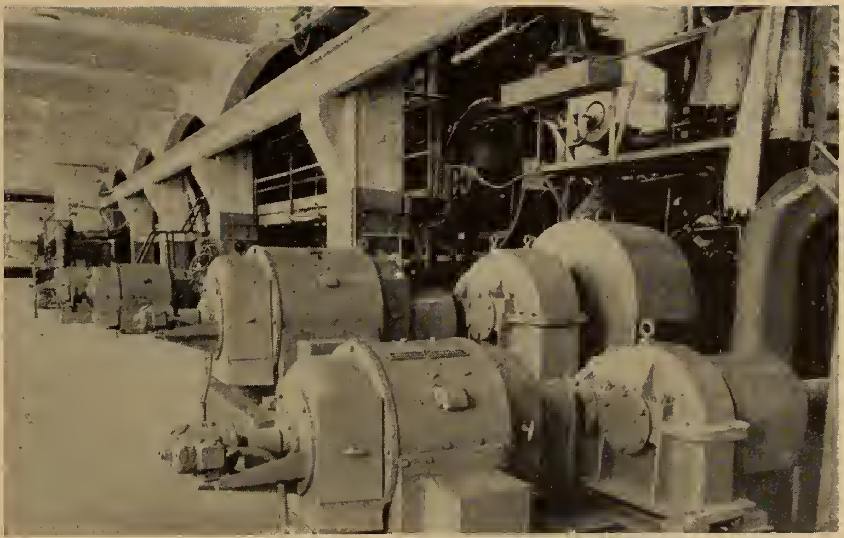

Fig. 8. Paper machine drive units each consisting of a d-c. motor, a gear unit, and speed regulating tachometer generator. Motors range from 40 to 500 horsepower.

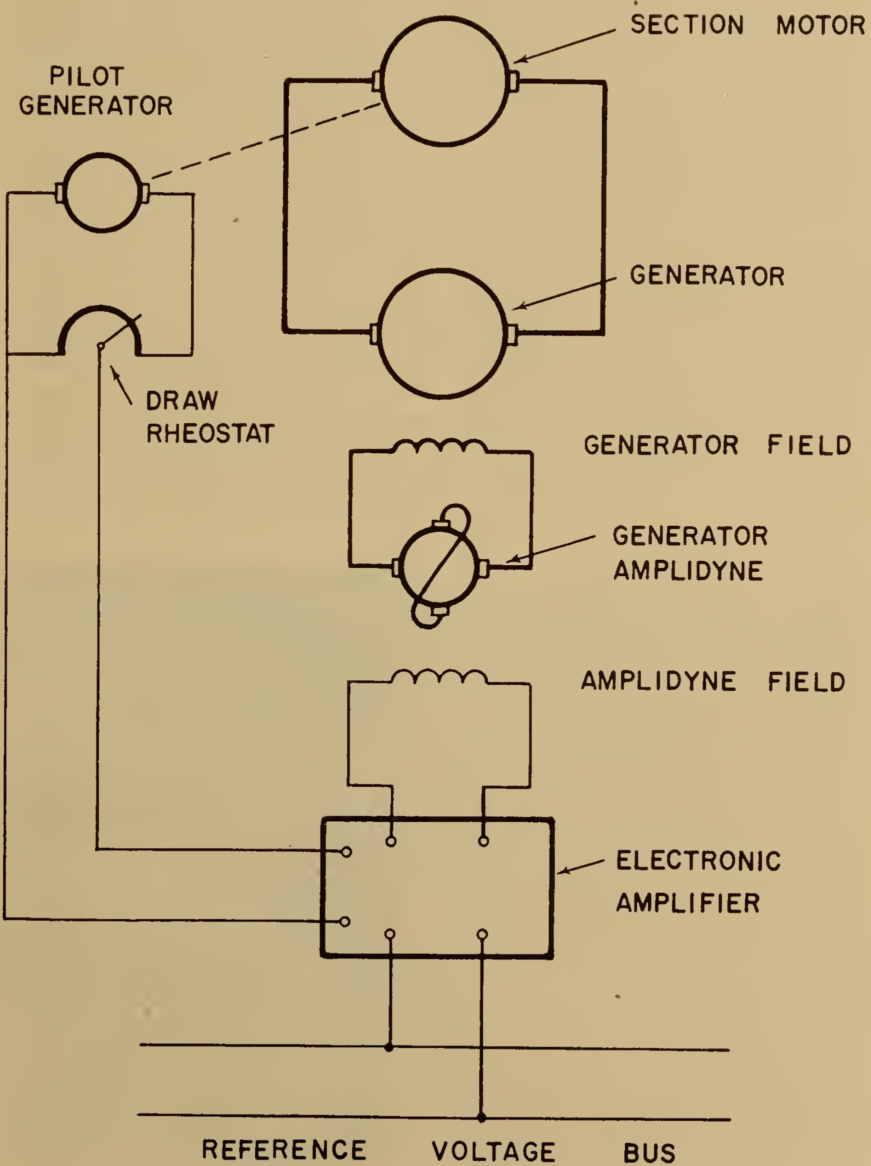


Fig. 9. Simplified diagram of one section of a multiple-generator electronic amplidyne sectional paper machine drive.

Suppose a sudden load were applied to a section. Its speed would temporarily drop and the pilot generator voltage would decrease slightly. This change in voltage would be amplified. The output of the amplifier would increase the excitation of the amplidyne generator, which would in turn increase the excitation of the section generator. This would increase the armature voltage of the section motor to speed it up and restore it to the original speed.

This system has phenomenally high gain and rapid speed of response, because of the electronic amplifier-amplidyne generator combination. Stabilizing and accelerating circuits are a part of the electronic equipment and adjustments are now refined to the point where a field engineer can set up a section in half a day and know the drive will "make paper" with little or no further adjustment. The control and the system are flexible and can meet future machine changes and additions, as well as being adaptable to instrumentation and automatic control.

Performance investigations of the electronic amplidyne speed regulator have established that it will operate for long periods with an error of less than 0.1 per cent. From a maintenance standpoint these drives compare favourably with any. Extreme care in selection of components, in manufacture and in assembly go into all sectional drives. Gone are the days of the breadboard electronic amplifier. Instead, heavy duty industrial equipment, made with conservatively selected components is used, wired and cabled in industrial fashion with wire and device numbers marked. Actual downtime due to vacuum tube failure is considerably less than ½ minute per section per month.

### Paper Machine Instrumentation

Electronics has made it possible to measure with high accuracy and low first cost, functions or quantities heretofore impossible of measurement. Four of these electronic instruments are the basis weight gauge, the draw speed indicator, the tensiometer and the moisture monitor. All are of assistance in maintaining the production and the quality of paper.

#### *Basis Weight Gauge*

The paper sheet passes through the gauging head without touching it. (Figure 10). One jaw of the gauging head contains a radio-active source sending a beam of beta rays across the gap into the other jaw, which has an ionization chamber. If material is in the gap, some of the beta rays will be absorbed by that material. The unabsorbed rays which reach the chamber ionize the air within it and the ions and electrons so formed are collected by charged electrodes. The flow of charged particles to the electrodes constitutes a minute current, the strength of which is dependent on the amount of unabsorbed beta rays reaching the chamber. This current is bucked against a reference and any difference is amplified electronically to show up as a deviation from a set weight per unit area of absorbing material. Thus this device provides for continuous measurement of paper weight, without marking the sheet or interfering with production.

There are pioneer installations utilizing this type of gauge to control the stock flow or the paper machine speed so that basis weight will be maintained automatically. Installations to date have been on slow machines, but the future looks promising for use on higher speed installations.

#### *Differential Speed Indicator*

Paper machine section speeds progressively increase as the sheet proceeds from the wet end toward the dry end. The difference in speed between the couch and the first press might be as high as 5 per cent in a newsprint machine. This difference in speed, or "draw", is an important physical concept in paper making, and many mills are finding it to their advantage, both from a production and quality control viewpoint, to know what this draw is at all times. The draw meter can be inexpensively applied to any machine. This is all the more true when applied to a machine equipped with electronic amplidyne drive, because the draw meter can operate from the same tachometer generators as used for speed regulation.

Figure 11 indicates the simplicity of the circuit. A portion of the signal from say the couch tachometer generator ($V_1$) and a portion of the signal from that of the first press ($V_2$) are compared by an electronic self-balancing potentiometer. In essence this is a sensitive galvanometer with an extremely stable electronic amplifier follow-up, yet relatively simple in form and circuitry. The output of this potentiometer operates an indicating or recording instrument, or both. These can be calibrated in feet per minute if desired. The only adjustments are as shown. These are necessary to set up the equipment to account for differences in tachometer gearing, roll diameter changes, etc.

#### *Tensiometer*

While this is not an electronic device, its use as a tension regulator depends largely on its association with electronic equipment.

At the dry end of the paper machine, the sheet is relatively strong and small speed changes can cause large tension changes. The heavier the paper, the truer this is. Moisture or stock changes can also affect the tension, causing paper breaks from excess tension, or calender cuts and poor reeling from too slack a sheet.

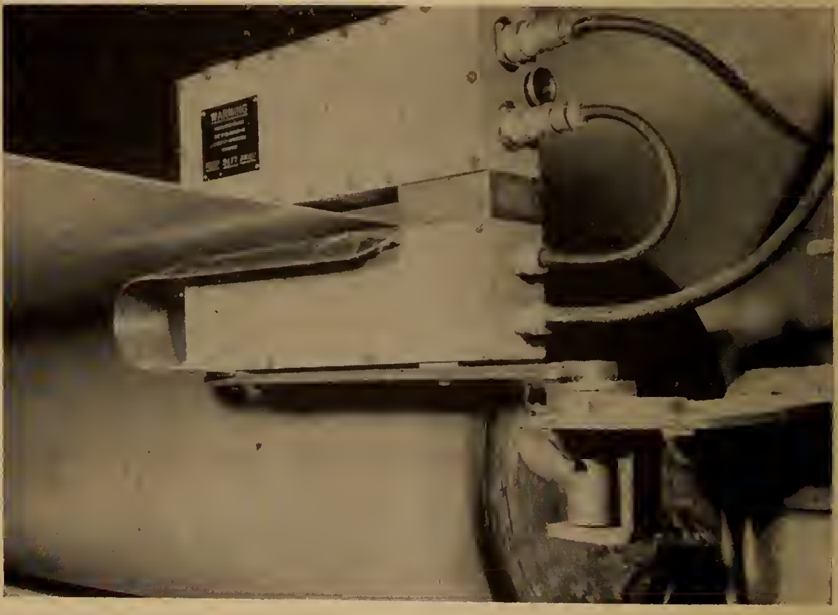

Fig. 10. Beta-ray basis weight head used to measure sheet thickness on a board machine.

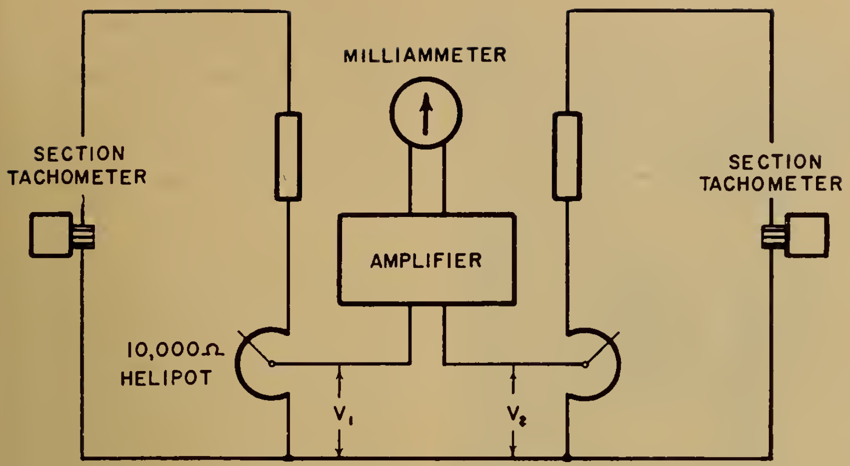


**Fig. 11. Line diagram of differential speed indicator circuit.**

Paper machines which operate over a range of speeds and paper weights can be particularly troublesome. During changeovers the drying function is temporarily upset and the moisture content will change. Relatively large tension changes will occur and, because of the inertia of the drying system, several minutes may be required before the system will settle down. During this time the operator must be continuously on the alert otherwise production will suffer.

The tensiometer head has a four-inch roller connected by a leaf spring to a variable gap magnetic structure. The tensiometer rides on top of the moving paper sheet so that the roller makes a slight dimple in the sheet (Figure 12). Variations in sheet tension change the spring deflection, which alters the air gap, thus changing the output voltage of the device. This voltage is compared to a reference voltage and the difference is fed into the input of the section amplifier, over-riding the speed signal. Thus paper tension can be maintained accurately under all conditions. The instrument eliminates inconsistencies of human judgement and frees the operator for other duties. It can also be used to indicate or record tension by means of a voltmeter and so can be applied to any machine.

*Moisture Monitor*

This device must be considered still in the development stage, although work has been in progress for several years and test data are promising.

The sheet of paper is passed over a capacitor made up of a number of interlaced metal plates. This capacitor forms part of a sensitive electronic measuring bridge. The moisture content in the sheet of paper is part of the dielectric in the capacitor. Any change in moisture content, therefore, represents a change in capacitance and this upsets the measuring bridge. This deviation is indicated or recorded on an appropriate measuring device.

**Light-Sensitive Electronics**

Numerous applications of the photoelectric electronic principle can be found throughout the industry; because they are similar in function they have been grouped under this one heading for easier comprehension.

Photoelectric installations require a light source, one or more photoelectric tubes, an electronic amplifier and the indicating or actuating device. The simplest applications employ the on-off principle in which the light beam is interrupted. One such application is log-counting, where the log passing the counting stand interrupts the light beam. The change in current in the phototube is amplified and the output actuates a counter.

Another on-off application is the detection of paper breaks on the paper machine. Here the light beam is normally interrupted by the paper travelling through the machine. If a paper break occurs, light will shine on the phototube and the output of the tube can be made to sound an alarm, or the system can be arranged to break down the paper sheet at the couch section by shutting down the first press.

*Pinhole Detector*

Certain of the finer papers for precise printing or blueprinting must be relatively free of small holes or slits. A photoelectric hole detector has been perfected for the quality inspection of these papers during production. If a hole is detected the equipment can be arranged to operate a counter, actuate a reject mechanism, shut down the drive or energize a marking device.

The device consists of a wide light source installed on one side of the paper sheet and a similar width photoelectric pickup, consisting of a multiplicity of phototubes, on the other side. Considering the speed of travel of the paper sheet the equipment is remarkably sensitive. Holes as small as 1/25 inch in diameter can be detected at speeds up to 1,000 f.p.m. and as small as 1/12 inch in diameter at 2,000 f.p.m. Intermediate speeds will permit detection of holes of proportionate size.

It is interesting to note that this equipment has been in use in the

**Fig. 12. Tensiometer installed between two calender sections and mounted on screw to adjust for different pass line to second calender.**

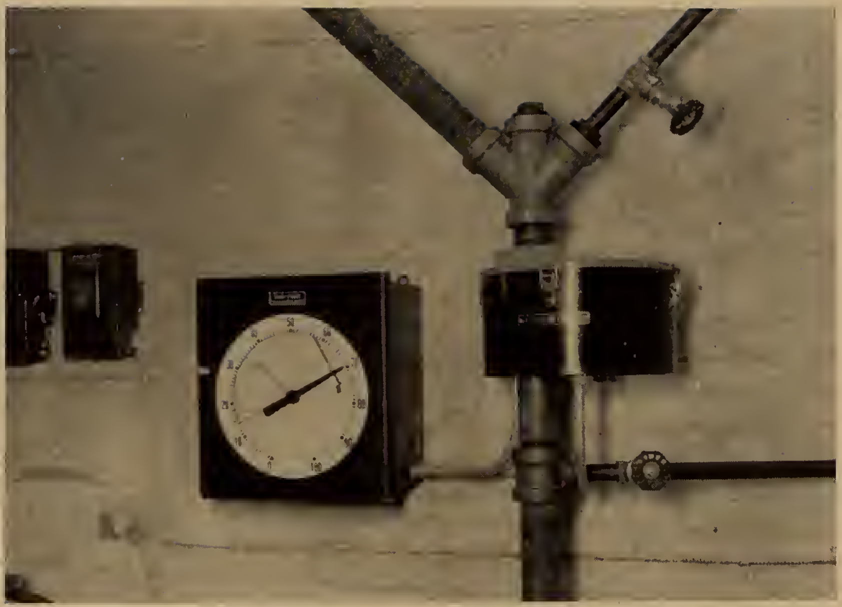

Fig. 13. Recording turbidimeter; sampling head on right, connected in pipe line.

steel industry for many years but has only recently been applied to the inspection of paper.

*Recording Turbidimeter*

While this equipment can be considered as just past the final development stage so far as its application in the pulp and paper industry is concerned, it has been used for a number of years in water and sewage plants and in the food, beverage and chemical industries.

The instrument is designed to measure and to record continuously the amount of material suspended in a liquid. Its use, therefore, is indicated in measuring pulp stock consistency, particularly just before it goes to the paper machine, and in monitoring the "white water", tailings or rejects that have drained out with the water on the paper machine. The present device can measure stock having a consistency of up to ½ per cent and a number of runs in an actual installation show good accuracy when checked with gravimetric measurements.

The liquid to be measured passes through a sampling head connected into the piping which carries the liquid (Figure 13). A glass chamber in the sampling head has a photocell on one side. A mirror and shutter arrangement pulses light through the liquid, first directly through the liquid onto the cell and then at right angles to the cell. In the latter case the light that reaches the cell is that reflected from the particles in suspension. Turbidity in equation form is a function of the ratio of the amount of scattered light to the amount of transmitted light. Thus the greater the turbidity the more the scattered light and the less the transmitted light.

The two signals thus obtained are "remembered" and compared in the recording device. The ratio is then indicated by the recording meter and is permanently marked on the chart.

This system is stable and inherently compensates for variations in sensitivity, line voltage, ambient temperature and color of the liquids.

**Conclusion**

This paper has by no means covered every present and possible application of electronics. Rather, specifically interesting applications have been selected to show the wide variety of uses. For instance, communication by radio between the mill, the woodland operations and the purchasing office have made the operation of remote mills both close-knit and economical. Instrumentation throughout the mill in the chemical, the steam and the hydraulic processes utilizes much electronic equipment. In laboratory operations there are also precise applications. The whole trend in paper making is toward a more scientific approach, with processes automatically controlled. Undoubtedly electronics will be one of the major contributors in this endeavor.

# Discussion

**J. G. Langley**[1]

The use of electronic equipment for industrial purposes has increased steadily since the last war and the pulp and paper industry is by no means unique in this regard. It is interesting to note that all the applications of electronics mentioned by Mr. Messervey, with the possible exception of the use of photo-electric cells, are postwar developments which have been introduced in the pulp and paper industry.

It has been said that the time will come when the paper making process will become a continuous process, controlled and operated by means of instrumentation. Electronics will undoubtedly perform the major role in any such form of automatic control. However, one of the few things which electronics cannot do is service itself. Some manufacturers have built duplicate apparatus which automatically monitors itself so that failure of one piece automatically cuts in the standby with no loss of operating time. Needless to say the part which failed must still be located and corrected by a service-man or maintenance electrician.

Speaking from the point of view of the user of electronic equipment in a paper mill, one of the chief requirements is that any such electronic equipment shall operate with a minimum of servicing and in the event of a breakdown, can be serviced and put back into operation in a matter of minutes.

Due to the absence of moving parts, electronic equipment generally speaking, requires very little attention. In the design of electronic equipment for industrial use, much can be done to facilitate servicing. Unitized construction and accessibility are most important in order that critical units may be speedily replaced by a spare unit in the event of failure. The use of more rugged and dependable components than are normally used in the average radio (or TV set if you like) are gradually coming on the market and being utilized by the makers of industrial electronic equipment.

One manufacturer of electronic tubes has brought out a few types

[1]Plant Engineer, Donnacona Paper Company, Donnacona, Que.

of tubes especially designed for industrial use. These tubes are more uniform and especially designed for industrial use. They have a minimum life expectancy of 10,000 hours or 16 months of operation on the basis of a 24-hour day, 6-day week. This is just an example of the sort of thing we are looking for in the pulp and paper industry where electronics are being applied to the manufacturing process.

The suppliers of electrical apparatus have, generally speaking, made remarkable improvements during the past few years with regards to providing a more reliable and serviceable type of electronic equipment to the pulp and paper industry. However, on the other hand we have the makers of instruments for stock preparation and control purposes still supplying a laboratory type of electronic instrument. Such equipment has yet to be widely accepted due to their unreliability and difficulty of servicing. The use of non-preferred tube types, closely rated components and needlessly compact construction are but a few of the troublesome features we find in electronic control instruments today.

It would appear that little or no thought has been given to the fact that such instruments in most cases will be subjected to corrosive fumes, high humidity, dirt, moisture and the day to day hard knocks of operating personnel and machinery.

Since the average paper mill of today may have only one or two service men qualified in electronics on its electrical staff, it is essential that first line servicing of electronic equipment be simple enough for the average shift electrician to deal with where production is on a 24-hour basis.

I was impressed by Mr. Messervey's figure of ½ minute lost time per section per month due to tube failure on an electronic paper machine drive. For a standard six section paper machine this would represent a total of 36 minutes per year lost time attributable to tube failures. Personally I feel that this is an optimum figure or something for the electrical servicemen to aim at. Careful pre-selection and periodic testing of tubes will certainly reduce lost time due to electronic tube failure but much depends on just when, where and how the failure occurs.

In closing I would like to compliment Mr. Messervey on his presentation of a most interesting, informative and timely paper.

**T. Foulkes, M.E.I.C.**[2]

Mr. Messervey is to be congratulated for having brought together for our edification a large number of electronic applications which have already been proved or may prove to be useful in the pulp and paper industry.

The first reaction to the use of vacuum tube devices on paper machines was one of extreme caution, but over the past few years especially with the introduction of the industrial or heavy duty tubes they have been used more extensively.

The electronic type speed regulator with its associated rotating equipment has given the paper maker greater precision in speed regulation which is essential to the good operation of the paper machine.

In the paper making process a machine twenty feet in width operating at a speed of 1400 f.p.m. is reducing a mixture of one half of one per cent fibre and 99.5 per cent of water to a sheet of the consistency of a rain soaked newspaper in 12 seconds. In transferring the sheet in this condition from one section of the machine to the following section the paper is stretched at the rate of sixty feet per minute. It must be recognized that speed variations even of a very small order create a real problem for the person responsible for the operation of the machine.

The Draw Speed Indicator which Mr. Messervey has described has proved to be a very useful tool in determining the sources of difficulties encountered at the aforementioned transfer point. It has also assisted materially in checking on changes in operation conditions caused not only by the drive equipment, but also due to variations in stock conditions, vacuums, etc.

The pinhole detector seems to offer possibilities for the inspection of high-grade papers during the winding or finishing process.

Such devices as the Tensiometer, Basis Weight Gauge, Moisture Meter and the Turbidimeter are interesting electronic applications which would appear to warrant, and are receiving study in our industry.

The Grinder Load Regulator has been applied to a continuous type of grinder and we understand it is operating successfully at a Canadian mill. Have you developed an application which can be used with the hydraulic type of grinder ?

[2]Chief Plant Engineer, E. B. Eddy Co., Hull, Que.

**W. A. Messervey**

Development work is now being carried out to adapt the Electronic Grinder Load Regulator for use with hydraulic type grinders. Basically this does not present any great technical problems.

In the hydraulic type of grinder the pulp wood is pressed on to the stone by pistons, usually under hydraulic pressure although any other means such as steam or air pressure could be used. The greater the pressure the faster the wood is ground. The pressure, therefore, is analagous to the speed of the feed chain motors in the continuous type of grinders.

Thus the problem is one of converting the signal from the electronic wattmeter into a means of varying the pressure rather than varying the voltage applied to the feed chain motors.

In keeping with our policy, however, a pioneer installation will be made to prove the theory and to obtain best possible results. √

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# The Development

of

# The Axial Flow

Although of particular interest for the aeronautical engineer, this paper also shows the reader some of the reasons why it takes so long to get a new type of aircraft into mass production. The author also calls attention to the fact that fans designed according to the methods used in the aircraft industry would show great advantages in industry.

The multi-stage axial flow compressor is now about as old as powered flight, but it was not until the last war and the advent of the jet engine that really intensive development for aircraft propulsion began.

Although the centrifugal compressor has made a very useful contribution to the progress of the aircraft gas-turbine engine, the axial compressor forms the basis for almost all new military aircraft engines today. It has won this position because of its high mass flow per unit frontal area, its high efficiency and the possibility of acceptable characteristics up to pressure ratios of 6 or 7.

As an example of the characteristics of such a compressor, Fig. 1 shows those of the original design of compressor of the Orenda engine. At design speed more than 13,000 hp. is required to drive the compressor under standard inlet conditions. Since the rig has only 6,000 hp. available it is necessary to test with throttled inlet, and for this purpose a drilled plate is inserted in the inlet duct.

The characteristics shown were measured at an equivalent pressure altitude of about 30,000 ft. at design speed, and have not been corrected for the effect of Reynold's number. A normal engine working line is shown across the characteristic. The distance between the working line and the compressor surge line has a very important effect on the acceleration time of the engine, as is illustrated by the broken line which represents a possible acceleration.

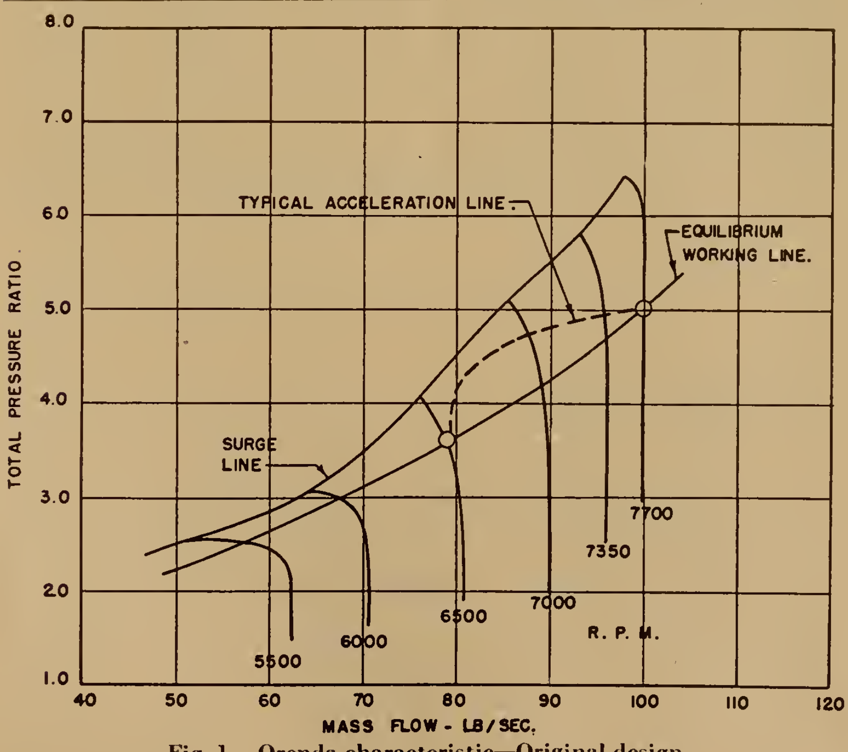


Fig. 1. Orenda characteristic—Original design.

In order to accelerate the engine, the fuel flow to the combustion chambers is increased. This forces the working point closer to the surge line. Considering acceleration, the desirable surge line should be so far from the equilibrium working line that the limit on fuel addition should be established by turbine inlet temperature before compressor surge occurs. The shapes of the characteristic and the equilibrium working line are usually such that this is true in the high speed range of operation; at lower speeds the surge line often approaches the equilibrium working line over a certain speed range, thereby imposing a limit on acceleration.

It is interesting to note here that all the centrifugal compressor engines of which the author has experience had an opposite tendency. Surge was always a high speed trouble, with the equilibrium working line sometimes meeting the surge line at high engine speed. Although the first build of an aircraft compressor may do all that

*A paper presented before the 68th Annual Meeting of The Engineering Institute of Canada at Quebec, May, 1954.*

# Compressor for The Orenda Engine

*by* F. H. Keast

*Assistant Chief Engineer, Gas Turbine Division, A. V. Roe Canada Limited, Toronto, Ont.*

the design called for, the aircraft industry can never remain static. Development aimed towards higher mass flow, pressure ratio, efficiency and improvement of surge characteristics is an essential part of the business of building better engines.

Although in no way complete, this paper attempts to indicate some of the methods of attack in the development problem. The scope of the paper has been largely restricted to aerodynamic development and such important considerations as blade vibration, a subject in itself, have of necessity been mentioned only where they affect the aerodynamic performance.

The compressor development can be divided into three groups of tests, (a) stationary blade or cascade tests (b) single stage tests and (c) full compressor tests. This paper concentrates on (b) and (c) since much has already been published on (a).

### Cascade Testing

Much has already been published on cascade testing, and the author has described the methods used by him (1). Compressor cascades of thirty different types have been tested in 173 configurations over a complete range of incidence and Mach number. Since this paper is largely concerned with stage matching, it is important from cascade tests to determine the air angles for optimum operation of the blades. Howell recommends designing compressor blading to operate at a nominal deflection defined as 0.8 of the stall deflection measured from cascade tests (2).

For this condition it is important to know the air angles associated with any given cascade for this nominal condition. He suggested a value of nominal deviation for blades of circular arc camber, i.e. the difference between the air and blade outlet angles, given by the equation.

$$\delta^* = 0.26\,\theta\sqrt{s/c}$$

In a later report, (3), this equation was modified to

$$\delta^* = m\theta\sqrt{s/c}$$

where, for C4 base aerofoils

$$m = 0.23\left(\frac{2a}{c}\right)^2 + 0.002\,a_2^*$$

Our tests to date on C7 base aerofoil sections (5) on circular arc camber lines (i.e. $2a=c$) have confirmed that this equation is valid within $\pm\,0.04\,\theta\sqrt{s/c}$. The equation for the C7 section is given in the appendix. Associated with this nominal deviation is the nominal incidence, for which our tests have indicated the value given below.

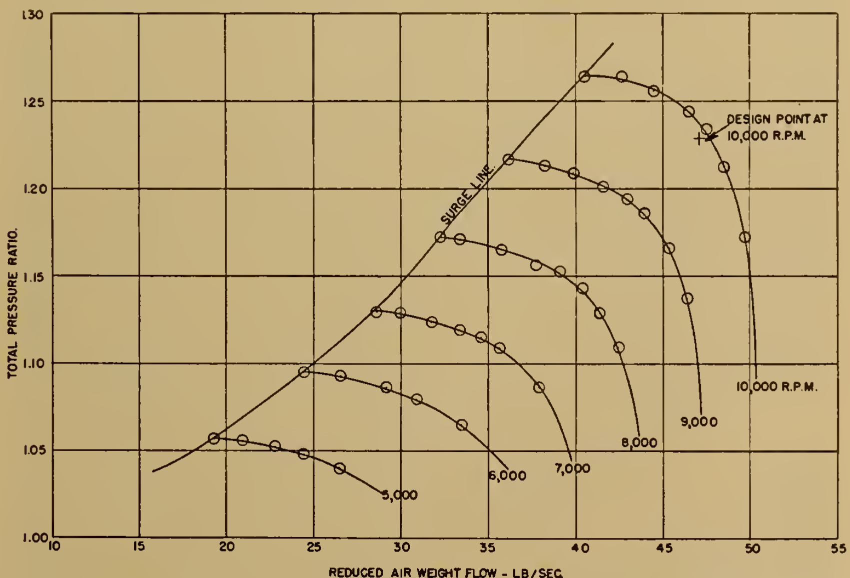


**Fig. 2. Single stage characteristic measured by instrumentation at mean blade height.**

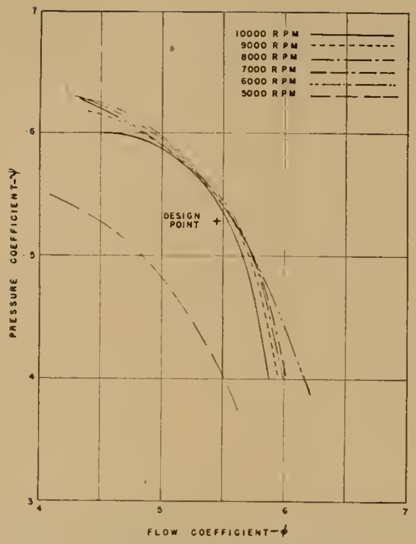


**Fig. 3.** Single stage characteristic of fig. 2 in dimensionless form.

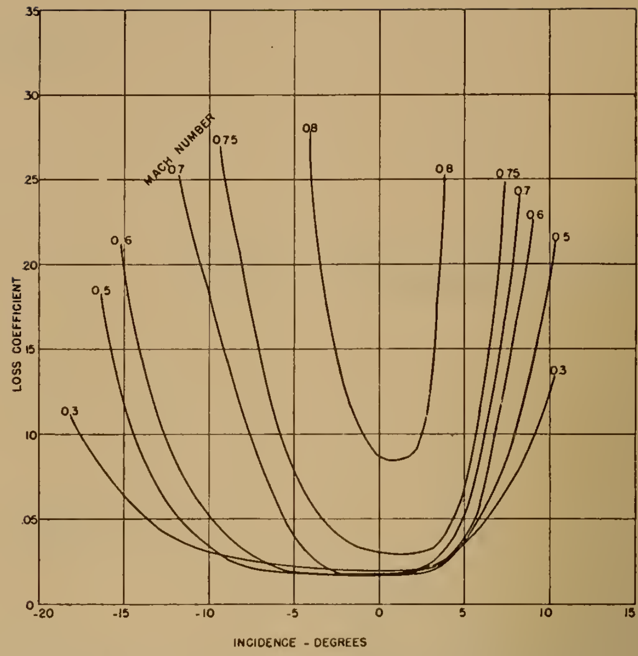


**Fig. 4.** Typical cascade performance 10C730C50.

$$i^* = \frac{11.7}{(s/c)^{0.75}} - 0.4\theta - 1.2$$

This equation has proved reasonably accurate over a range of inlet angle ($\alpha_1$) from 30° to 60° for ten percent thick aerofoils. The value is about one degree lower for five percent thickness.

### Characteristics of a Single Stage

Figure 2 shows a typical set of characteristics of a single stage, measured at mid-blade height behind the outlet stator using a manifolded pitot rake. It is interesting to plot these characteristics in the form shown in Fig. 3. The abcissa $\phi$ is the flow function defined as the ratio of axial velocity to blade speed. In the absence of secondary effects a given value of $\phi$ defines the shape of the velocity triangles and, for a given velocity triangle the work done as well as the losses should be proportional to the square of the blade speed.

The ordinate, the pressure coefficient, is a function of pressure ratio and blade speed. It is actually the ratio of isentropic temperature rise to the temperature equivalent of the mean blade speed.

$$\phi = Va/u$$

$$\psi = \eta \Delta T/\theta_u$$

where $\theta_u = \frac{u_m^2}{2gJC_p}$ (°C.)

$$\eta \Delta T = T_1 \left[R^{(\gamma/\gamma-1)} - 1\right] (°C)$$

Figure 3 shows that the five higher speeds fall closely together, but that the low speed curve is quite different. It is clear that as the speed increases from 6,000 r.p.m. to 10,000 r.p.m. the stall values of $\phi$ increases and of $\psi$ decreases. At the other end of the characteristic the value of $\phi$ is gradually reduced as the speed increases. Both of these effects are due to the increase of blade Mach number. This effect is qualitatively shown in Fig. 4, which shows the variation of loss coefficient in a two-dimensional cascade at different inlet Mach numbers.

The reduction of incidence range is clearly shown in this figure, which represents a cascade section very similar to that at the mid blade height of the rotor of the test compressor. Quantitative correlation of the cascade performance to the single stage performance is difficult because of three-dimensional effects. With the single stage the effects of high Mach number will, for this particular stage, occur first at the rotor tip.

Figure 5 shows the variation of the values of $\phi$ and $\psi$ at stall, plotted against r.p.m. The very marked drop in both functions between 6,000 and 5,000 r.p.m. is due to the effects of Reynold's number. Figure 6 plots the values of the rotor mid-blade height Reynold's number and relative Mach number at stall versus compressor speed, and also includes the estimated stall incidence. Critical Reynold's number effects appear to occur at a value of about 220,000.

Figure 7 shows the characteristics of the same stage, estimated from measurements of wall static pressure at inlet and outlet, and the measured total temperature at inlet and outlet. It will be seen that, although as one might expect, the actual values of the ratios are different, the general shape is very similar. Thus it might be expected that in a multi-stage machine, where it is difficult to make mid-blade height measurements, useful information on matching might be obtained from the provision of wall statics.

As pointed out later, this can be misleading if strong three-dimensional effects are present but, on the whole, considerable success has been achieved in studying matching by this method and benefits have been realized, particularly in the control of the surge line. Methods of deriving the characteristic curves

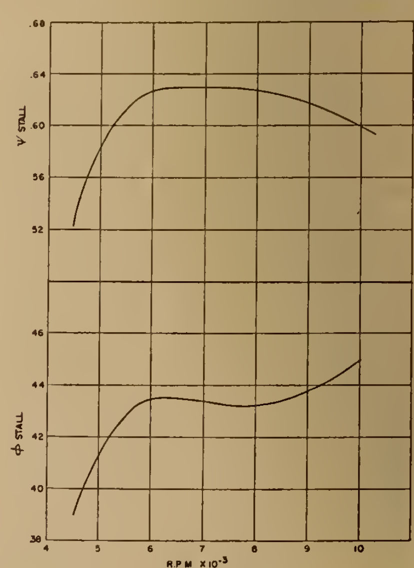


**Fig. 5.** Pressure and flow coefficients at stall.

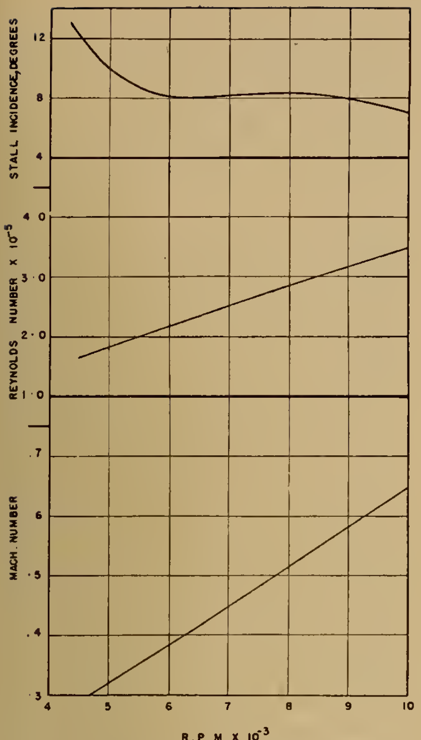


Fig. 6. **Incidence, Reynold's No. and Mach. No. at stall.**

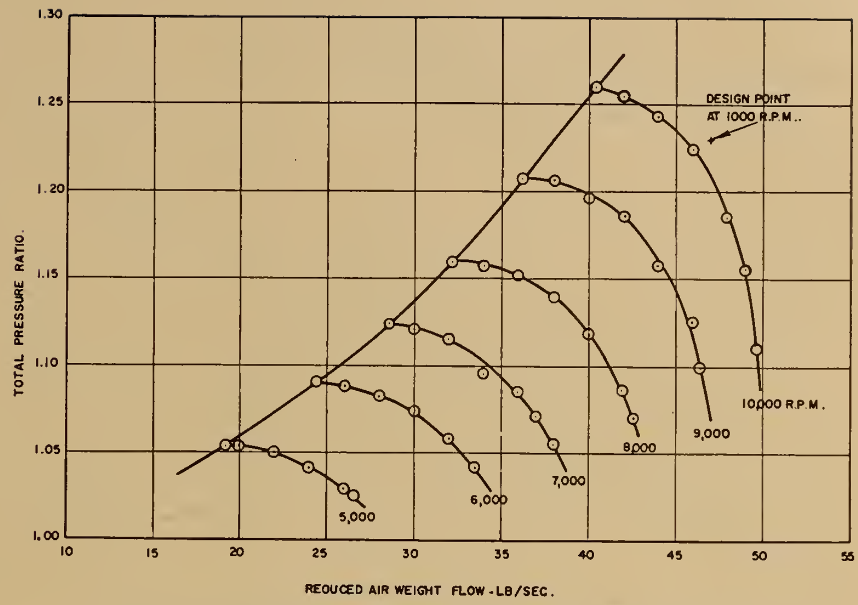


Fig. 7. **Characteristics estimated from wall static pressure.**

from wall statics can be used varying in complexity.

For instance, attempts can be made to allow for the radial static pressure variation in order to estimate the mid-blade height value. In practice it is found that, as long as the pressures are measured at equivalent points, e.g. at outlet from the stator preceding and the stator following, it is reasonably accurate to assume that the ratio of wall static pressures is equal to the ratio of mid-blade height static pressures.

In order to estimate the flow coefficient $\phi = Va/u$, it is found reasonably accurate to assume the design stator outlet air angle and use the mass flow measured at inlet to the compressor, wall static pressures and a total temperature estimated by taking a fixed ratio of the measured overall temperature rise to the inlet of the stage in question. If there are no indications to the contrary this is normally assumed to be the design ratio.

The effect of error in the temperature assumption is not too great but, in order to check this, tests on a full compressor were made with stagnation type thermocouples buried in the leading edge of a few stator blades in each row, as shown in Fig. 8. For the long blades at the front of the compressor some blades had three thermocouples as shown; others had two, placed at stations between those shown, so that temperature was measured at five radii. The shorter blades at the rear had only three measuring points.

Some of the results are shown in Fig. 9. These were found to confirm that, for practical purposes, the assumption of a fixed ratio gave results which were accurate enough for stage matching analysis.

Figure 10 is an illustration of the value of casing static pressure measurements for the analysis of matching. This is the first stage characteristic converted to non-dimensional form, points denoted by any given symbol being measured by holding the compressor speed constant and varying the outlet throttle setting.

This figure illustrates the way in which the working range on the first stage narrows as the speed increases, until at the high speed the working range degenerates into a single point except for a small range close to the overall compressor surge. This indicates that some stage further back, or possibly

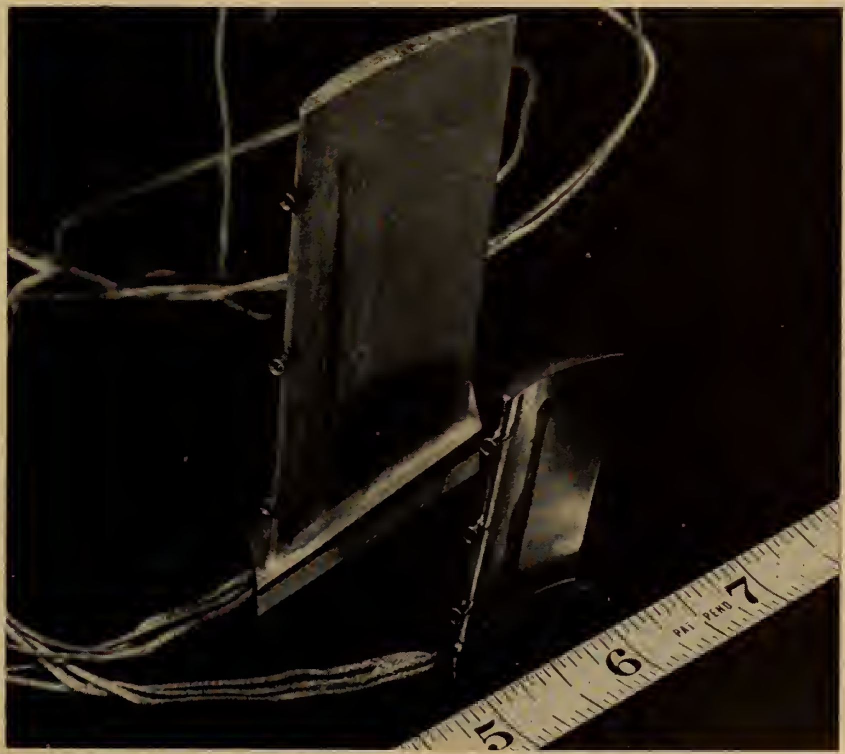

Fig. 8. **Temperature instrumented stators.**

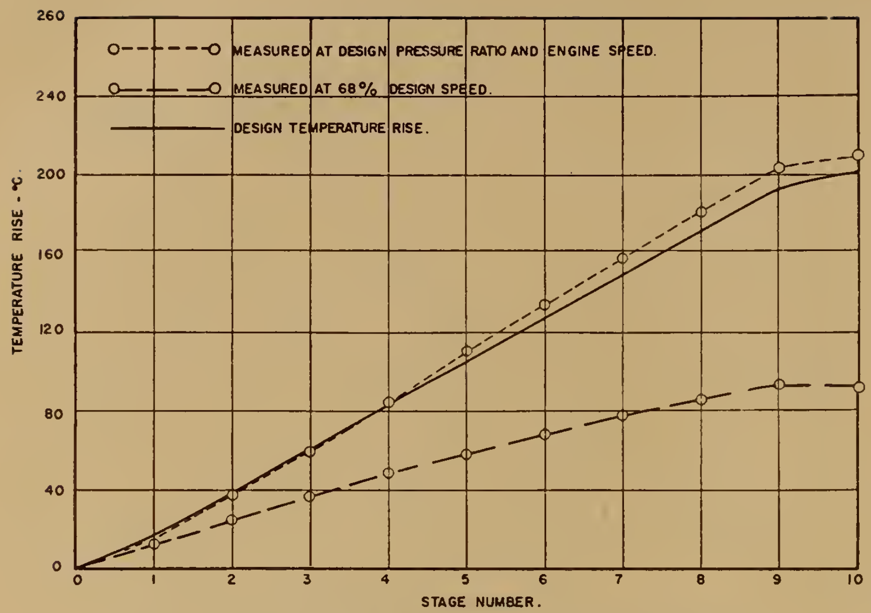


**Fig. 9. Orenda interstage temperatures—Original design.**

the outlet diffuser, has choked, so that adjustment of the outlet throttle cannot possibly affect the first stage except at high pressure ratios close to surge.

#### Finding Stage that Fixes Mass Flow

This is a very useful indication of which stage is responsible for fixing the high speed mass flow of the compressor. If we plot the characteristics of each stage, all of those ahead of the offending stage will have single working points. As soon as the choking stage is reached the working points will again expand to cover a range of the stage characteristic.

If the choking stage is early enough in the compressor, it is sometimes possible to increase the flow by opening up the critical area. It is usually possible, by examining the design of the blading, to deduce whether the rotor or the stator is applying the control. If wall statics are available at stator inlet as well as outlet, these can help in the evaluation. Area increase may be effected by reducing the number of blades, decreasing the blade camber, (by a change of curvature over the front sections of the blade) or by reducing the stagger angle of the blade.

The first and last of these methods are simpler to perform, as they merely entail different broaching of the disc and possibly a minor reworking of the blade platform. This means that they are easily introduced into production engines. These measures are not without their dangers, as they may substitute for the choke some other undesirable factor, such as stall. In certain cases the desired improvement is achieved at high speed, but an unacceptable kink may be introduced in the surge line at lower speeds.

Another approach to the problem is to leave the restricting area unchanged, and attempt to increase the pressure ratio of the stages ahead of it so that the increased pressure at the restriction allows a greater mass flow. In all such attempts to increase mass flow and pressure ratio a careful check must of course be made to ensure that all blades have enough strength margin to take the increased loading.

As an example, let us consider reduction of stagger of the first stage rotor. This will in general displace its characteristic towards high flow coefficients, and may or may not increase the peak pressure coefficient depending on the changed stalling incidence. The rest of the compressor in practice operates with the same non-dimensional characteristic, based on values at inlet to the second stage.

It has been seen that at high speed in the normal operating range there is only one working point on the first stage. Reducing stagger of the first stage gives a small increase in temperature to the second stage, reduces the value of non-dimensional speed of this stage and therefore reduces its non-dimensional mass flow.

The increase in temperature also results in a slight further decrease of the value of $W/P$ but the increase in $P$ overrides these reductions, so that a net increase in mass flow results roughly proportional

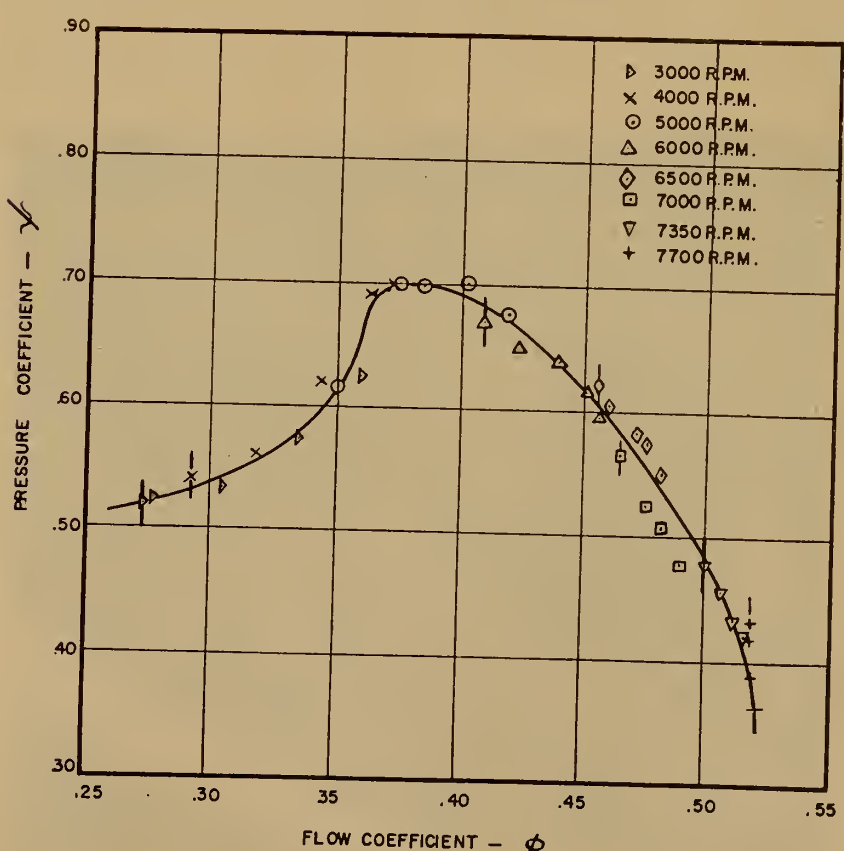


**Fig. 10. Orenda first stage characteristic from wall static pressures.**

to about the 2/3 power of the increase of pressure at the second stage inlet, so that a curve of $\frac{W}{P^{2/3}}$ drawn from the operating point on the old characteristic cuts the new characteristic near the new operating point.

The two-thirds power rule assumes that the changes are small, the polytropic efficiency of the first stage remains unchanged at a value of 6/7, and that the non-dimensional mass flow for the rest of the compressor is proportional to its non-dimensional speed, i.e.

$$Q_2 \propto N/\sqrt{T_2}$$

All of these assumptions are accurate enough to be useful as a rough check on the effects of possible changes. Figure 10 shows that the first stage is never stalled even at surge at high speed. At 5,000 r.p.m. stall is first encountered near surge and at lower speeds (below 4,000 r.p.m.) the stage is fully stalled over the complete range measured.

It is interesting to observe that the Orenda compressor in its original form exhibited a rasping or buzzing noise at low speeds, which changed abruptly to a high pitched scream above about 5,400 r.p.m. This coincided with the unstalling point for the first stage blades. At exactly the same speed the first stator vibration amplitude, as measured by strain gauges, dropped sharply to about one third of the value it had below the "change speed".

### Discussion of Single Stage Characteristic

If we take a characteristic measured by the wall static method as in Fig. 10, it is of interest to plot this on a base of non-dimensional mass flow at outlet, as in Figs. 11 and 12. If the stage is now removed from the multi-stage compressor, from which the complete characteristic has been derived, we may see how it might be expected to operate if tested on a single stage test rig with a simple outlet throttle.

The non-dimensional outlet flow from the stage is the same as the non-dimensional inlet flow to the throttle. Thus, if the rig discharges back to ambient pressure we may draw the throttle characteristic on the same diagram, one line for each throttle setting. Two stage characteristics are shown, a low speed and high speed one. Both demonstrate that, if the compressor is maintained at constant speed and the throttle closed, a value is reached where there is a sudden drop in mass flow and pressure ratio, the

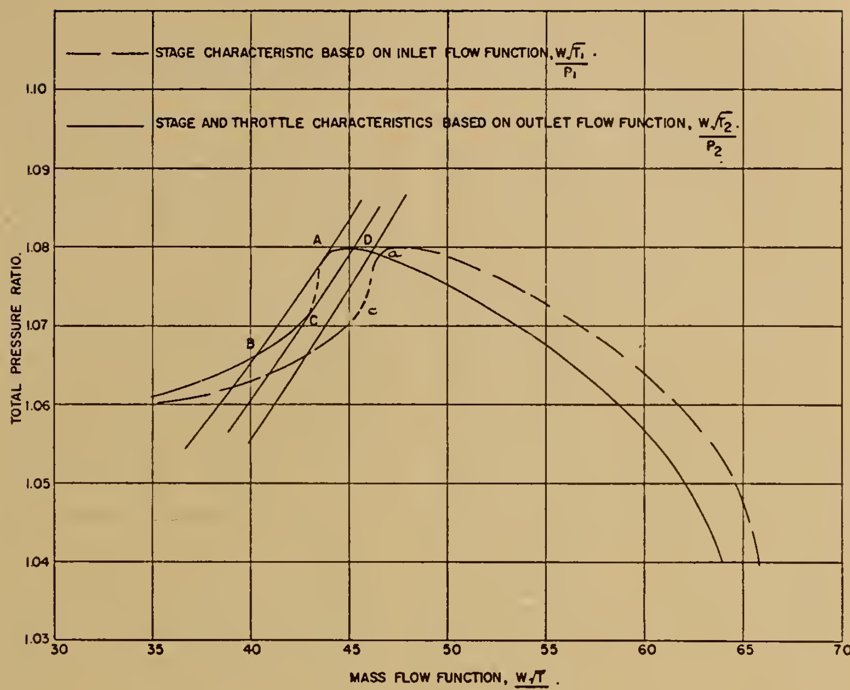


Fig. 11. Derived characteristics at low speed.

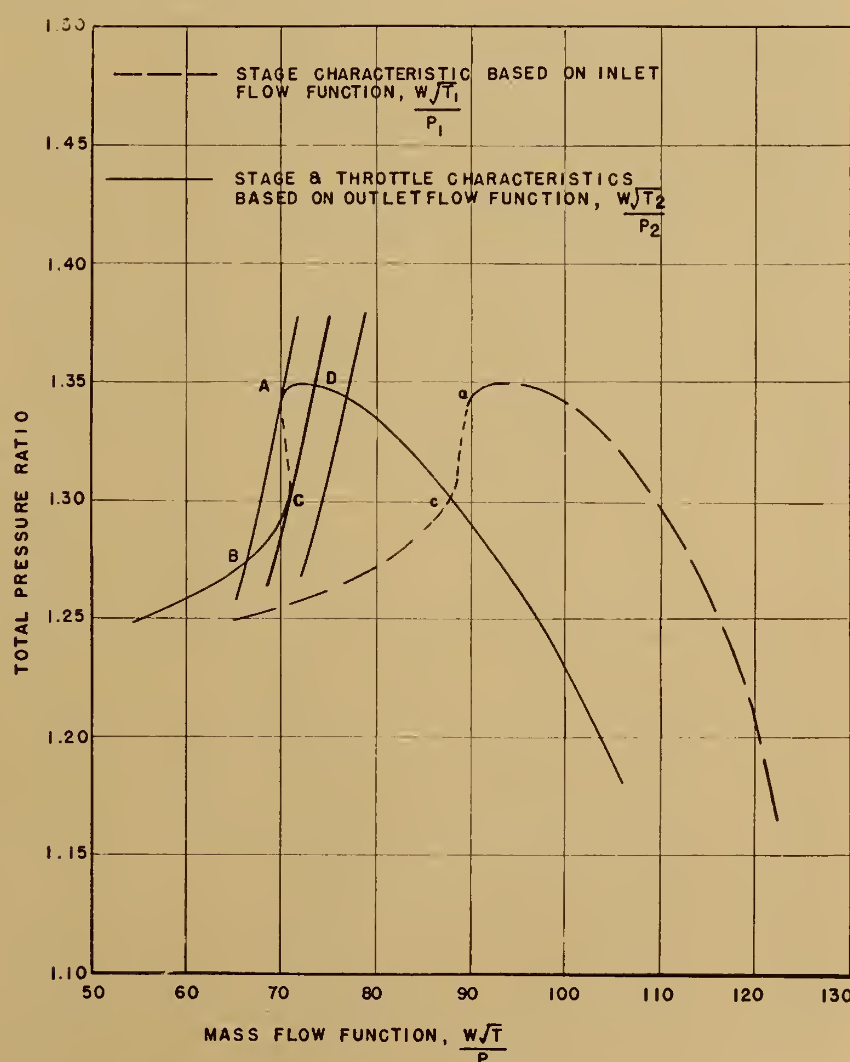


Fig. 12. Derived characteristics at high speed.

corresponding points being labelled A and B. This indicates stalling of the stage.

On opening the throttle again, the stage will remain stalled until point C is reached, when a sudden jump to the unstalled state at point D occurs. Thus there is a marked hysteresis in the stalling and unstalling. The dotted part of the characteristic cannot be measured on such a test rig. It is interesting to note, however, that if the outlet throttle discharged constantly into a receiver maintained at a sufficiently low pressure to ensure choking of the throttle, the throttle characteristics for each value of throttle area would be vertical. Under these conditions the whole characteristic at low speed could be measured whereas at high speed a sudden stall would still be encountered with a drop in pressure ratio.

Tests show on a low speed compressor that this transition characteristic between unstalled and fully stalled operation can be a region where local stalling of some of the blades can occur over part of the blade height (8). This gives rise to the so-called rotating stall where a usually symmetrical pattern of perhaps two, three or four stalled areas rotates with the rotor blades, but at a smaller rate than the blades. This can give rise to severe vibrations and possibly blade failure.

Huppert and Benser (8) distinguish between a progressive stall, which they have found to be a stall occurring in discrete areas progressing inward from the tip, and a so-called "root-to-tip" stall which might, with less ambiguity, be called a full span stall. The progressive stall is more likely to occur with low hub-tip ratio, i.e. at the front, where blade section characteristics can vary widely from root to tip. The full-span stall is likely to be found at the rear where hub-tip ratios are high and section characteristics are very similar over the full blade height.

The authors indicate that the latter type of stall may exhibit a hysteresis of a different character from that mentioned earlier. They give examples that indicate a stall which, on opening the throttle, persists beyond the point designated C in Fig. 11, so that even the characteristic based on inlet conditions can give a pressure ratio which is a two-valued function of mass flow.

As with the fully choked throttle, it is possible in a multi-stage compressor for a stage to operate in the partially stalled condition. This occurs at lower speeds, where the stage characteristic plotted on outlet flow has not yet exhibited a vertical transition curve. Referring to Fig. 12, it is evident that no matter what the characteristic of the back of the compressor, the stage illustrated will exhibit a sharp stall at high speed.

For the low speed characteristic, however, if the matching is such that the steep positive slope of the first stage during the partial stall combines with a high negative slope of the following stages, the overall characteristic can exhibit a quite favorable slope. The combination of characteristics of individual stages does not always give a complete description of a multistage compressor performance.

If the stage characteristics derived by the method described are compounded analytically, an extension of the characteristic well beyond the practical surge point can be estimated. The stalling of one stage often gives what would appear to be completely insignificant local kink in the characteristic.

### Stage Stall Can Cause Surge

The drop in mass flow and overall pressure ratio and efficiency may appear incapable of causing more than a minor embarrassment to the engine, yet a violent surge may be initiated with severe drop in flow and disastrous rise in jet pipe temperature. It seems, then, that the apparently insignificant nature of a stage stall can nevertheless act as a trigger for the surge, although in a different area of operation the same stage may stall with no trouble.

Two possible explanations can be considered. Firstly, a stage stall may, under certain conditions, so change the flow at inlet to following stages that their characteristics are materially changed, and combine to cause a complete disruption of flow. When two or more stages stall simultaneously, surge can usually be expected. Secondly, the cause may be a dynamic instability, depending on whether pulsations in flow caused by a stage entering stall experience positive or negative damping from the rest of the compressor.

Various analyses have been made on the latter possibility (7) (8). Some have indicated that the dimensions of the inlet and outlet ducting to the compressor can have an appreciable effect on the phenomena. This, however, can offer little hope towards solution of troublesome surge conditions, since the outlet volume, i.e. the combustion and exhaust system, is fixed for reasons beyond the control of the compressor designer.

Moreover, the inlet is either a ram type with an effective volume of infinity, or is a duct which is inevitably one of the most unchangeable and inflexible parts of the aircraft. Space in an aircraft is always at a premium, and the engine inlet ducts are so determined by the requirements of external aerodynamics, aircraft structure, fuel tanks, wheel bays, cockpit and all the equipment that must be packed in somewhere, that any changes to the shape or size of the ducts leads to a major redesign of the aircraft.

We must therefore concentrate on the compressor itself for the answer. The approaches available are:

1. Soften the stall by redesign of blading,
2. Change the blade angles of the stalling stage to move the stall in relation to the other stages, so that it occurs at a lower mass flow,
3. Change some other blade row in the compressor to steepen the stable slope of the rest of the compressor at the stall of the offending stage.

Method (3) was used on the Orenda when surge due to first stage stall was greatly improved by redesign of the last stage, some tests of which will be described later.

### Description of Orenda Compressor

The original design of the Orenda compressor was completed in 1946. It was a ten stage half vortex design, to give a mass flow of 100 lb./sec. at a pressure ratio of 5:1 at 7,350 r.p.m., to give 5,500 lb. thrust with the possibility of developing the engine by overspeeding to 7,800 r.p.m. up to a rating of 6,500 lb. thrust.

The choice of half vortex whirl distribution was made with the following thoughts in mind. Free vortex theoretically satisfies radial equilibrium with a constant axial velocity from root to tip. It has the disadvantage of leading to high Mach numbers at rotor and stator tips. (Here the stator tip refers to the section at the inside diameter.) Constant reaction blading gives lower Mach numbers at these stations but, if constant axial velocity is used, departs from radial equilibrium. Also the Mach number distribution is such that all sections of the blade tend to reach critical almost simultaneously.

Considering overspeed combined with the high effective speeds encountered at altitude, it was feared that a rapid fall in efficiency might result under these conditions. Half vortex whirl distribution is the average of that of free vortex and constant reaction, and so avoids the extremes of each. Use of constant $V_a$ made possible the use of various factors empirically determined to allow for 3 dimensional effects, e.g. work-done factor. Use of radial equilibrium design would at that time have been a departure which would possibly invalidate past experience available.

In addition to these thoughts it is rather amusing to reflect, almost eight years after the event, that, with the limited computing facilities available at that time, the incorporation of radial equilibrium would have added a couple of weeks to the time required to design the blading. This would have caused the drawing release of blade co-ordinates to have fallen behind schedule.

The second to ninth stages were made aerodynamically identical, in that they were designed so that at any given radius the design air angles were identical, so each would give the same stage temperature rise, as long as velocity profile deterioration was not too serious. This had the mechanical advantage of reducing the number of blade masters required, but, more important, was chosen to give the greatest possibility of achieving proper stage matching.

Bad matching is the most powerful means of reducing efficiency. By having eight out of ten stages identical gives the best chance of matching, since if mass flow is under- or over-estimated for one stage, this will apply to all as long as the stage pressure ratios are achieved, so that they will still be matched at the new flow.

The last stage design was different from the rest, in that the work was substantially reduced to limit the absolute exit angle from the stage to a value that was felt could be handled by a single stator row with axial exit into the diffuser. The last stage also was used to give a moderate amount of diffusion from 480 fps to 450 fps before entering the exit diffuser.

As is usual on such a project, the engine parts received priority over test rigs, so the engine was on the bed and considerable running had been accomplished before a test compressor was available. From engine running it was determined that the compressor more than met its design performance, but left something to be desired in acceleration characteristics, acceleration time from idling being of the order of 15 to 18 seconds.

Blow off valves had been incorporated in the original design at the eighth stage as a possible aid to acceleration. It was found that, when they were opened, the jet pipe temperature increased considerably. Although they might possibly have helped the surge line, the acceleration was then limited by the amount of overfuelling which could be used without exceeding the jet pipe temperature limit which, was arbitrarily fixed at a value which, in review, would now be regarded as very safe indeed. Following the first runs therefore, these valves were locked and later omitted completely. The collector manifold which had fed them became useful as a source of air, for aircraft uses such as cabin pressurisation.

### Stage Matching

In order to study the stage matching, casing static pressure orifices were installed wherever possible. Some stations had to be omitted, as the casing was provided with air take-off passages at the second and fifth stage outlets, and also the blow-off valves at the eighth stage.

It is impossible to completely define the compressor characteristic from engine test. Changing the final propelling nozzle of the engine only moves the compressor working line slightly before jet pipe temperature limits are reached, so that only a thin band on either side of normal working line is possible. From the limited information available it was evident that the first stage was improperly matched to the rest of the compressor, since at high r.p.m. the first stage pressure rise was much lower than design.

With the limited information available from these tests, it was decided to be necessary to move the first stage characteristic towards higher mass flow to bring it into match and, in an attempt to do this, disc slots which held the first stage rotor blades were rebroached to reduce stagger, i.e. to turn the blade chord closer to the axial direction.

On engine test, the engine performance was worse and high jet pipe temperatures were encountered. No accelerations were attempted during these tests, which were terminated when the first stage rotor blades broke off close to the root and removed the rest of the blading. This, then, was not the answer.

The next step was to rebuild an engine with the original disc broaching, and to introduce probes between the first stage stator blades to find what the first rotor blades were doing. This had not been done earlier because of the danger of introducing a heavy wake from the probe, with the attendant risk of exciting excessive vibration into the rotor blades behind it, or of an upstream pressure field doing the same thing to the rotor blades ahead of the probe.

Fortunately it was decided to use a temperature probe as well as a pressure probe, as the results of the pressure probe alone would have been very misleading. They showed a remarkably constant total head pressure behind the rotor. The temperature probe, however, explained the trouble by showing that the temperature rise at the tip was very high, falling rapidly to a value slightly below design at the mid-blade height, and indicated heavy stalling over the outer 20 percent of the blade.

### Redesign Necessary

It was therefore evident that the centrifugal pressure gradients could not be ignored, and that there existed a radial flow through the inlet guide vanes, such that the axial flow velocity was considerably reduced at the outer sections and increased near the hub. This caused high positive incidence at the tip and reduced the incidence, and therefore the temperature rise, at the inner sections. On the strength of this the first stage was redesigned, retaining the original whirl velocity distribution, but calculating an axial velocity profile to satisfy the simplified radial equilibrium equation.

$$\frac{144}{\rho}\frac{dp}{dr} - \frac{Vw^2}{rg} = 0$$

Redesign of the second stage was necessary to blend the new design into the remainder of the compressor. The effect of the new blades was to take out the kink in the surge line, so that engine accelerations of 12 seconds could be guaranteed. In flight tests at altitude the effect of the new blading was even more marked. Acceleration time at 20,000 ft. was of the order of 40 seconds, if surge was to be avoided. With the new blades acceleration times of less than 12 seconds were measured at 30,000 ft.

There was a slight drop in mass flow at high speed with these new blades of the order of one to two per cent. This was restored by reducing the inlet guide vane stagger by five degrees. Blading manufacture at the time was a very critical supply problem and, unfortunately, after over 2,000 total hours of engine running, the seventh stage rotor blades began to exhibit a vibration problem.

This and the subsequent vibration troubles pushed acceleration into the position of a second priority problem. This was especially so since the manufacture of new blades to cure the vibration problem conflicted strongly with the supply of the revised front stages. At the same time, there was a strong desire not to change the blades that were free from vibration troubles.

The accumulated running time on the new front stages was not judged adequate to justify release for initial production so that the first production engines were delivered with the original compressor design only modified by the various schemes introduced to cure the vibration problem on the later stages. These included thicker rotor blades on the seventh, eighth and ninth stages to raise the natural frequency of the blades and an increase in the number of blades per row in the sixth, seventh, eighth and ninth stator rows, to raise the exciting frequencies out of the engine speed range.

The result of these changes made little difference to the compressor mass flow, but reduced the compressor efficiency by 2 to 3 per cent at take-off rating, which was accompanied by a drop in pressure ratio (Fig. 1). The new front stages were found to be the limiting ones for mass flow at high speeds, so a compressor test rig program was begun to increase mass flow, by reducing stagger on both the inlet guide vanes and on the first rotor blades.

It was demonstrated that the mass flow and pressure ratio could be substantially increased by this means, but that a deterioration in the low-speed surge line accompanied the change. This was diagnosed from wall static pressures as first stage stall. Analysis of the rear stages indicated that there was a possibility of increasing the work on the last stage, at the same time steepening the stable slope of rear stages.

A new tenth stage was therefore designed, and when tested proved that all the benefits of increased mass flow and pressure ratio could be achieved with a surge line that was even better than that with the radial equilibrium stage at its design stagger. The resultant characteristics with the engine equilibrium working line is shown in Fig. 13. It can be seen that mass flow and pressure ratio have been increased appreciably, and that the relative positions of the surge and working lines are greatly improved from those shown in Fig. 1.

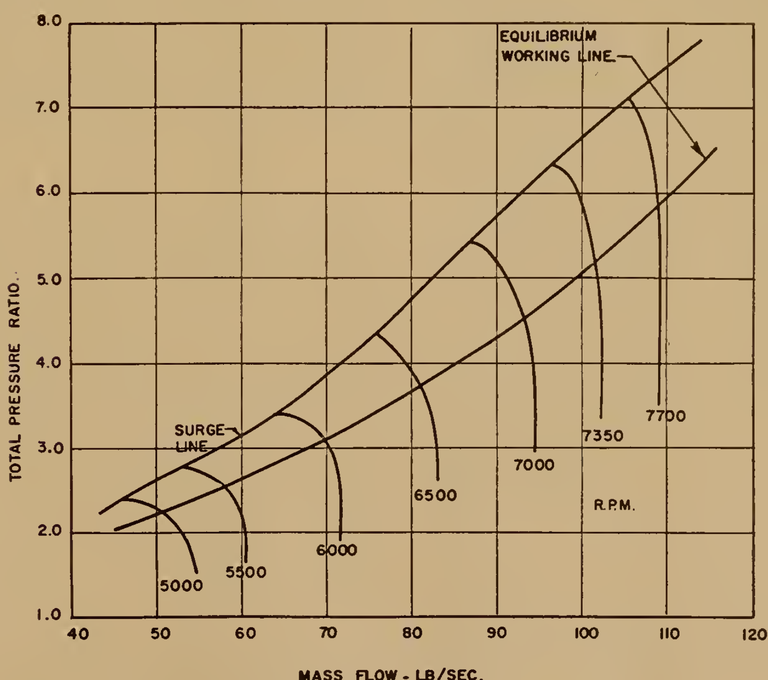


Fig. 13. Improved Orenda characteristics.

### Conclusions

In conclusion attention should be drawn to the implications which this work of the aircraft industry can have upon other industry. A recent article describes a mine ventilation scheme which pumped 300,000 cubic feet per minute, employing a fan with variable-pitch rotor weighing 20 tons. Presumably this must have included the driving motor and all of the external structure, which stood 42 ft. high.

The drawing of the installation was an artist's impression and only an outside view, but scaling what appeared to be the fan section gave a diameter of about eighteen feet. The Orenda first stage passes 90,000 cu. ft. per minute, so that an increase in diameter to about 58 in. would handle this air requirement, and result in a compact high-efficiency unit.

One factor which has probably hampered the design of ventilating equipment is that of noise level. It cannot be denied that with blades operating at tip speeds of the order of 1,000 fps the decibel level is almost painful. It seems however that improved technique in silencing has been neglected. A few feet of accoustic material arranged in the inlet and outlet ducts would cure this problem, as the sound is of very high frequency and readily absorbed.

The fan efficiency for the relatively low pressure-ratio required would be of the order of 90 per cent. The use of variable pitch inlet guide vanes can give a substantial working range, without the complication of variable pitch rotors. It is felt that the great disparity in size which this example shows cannot be justified on the grounds of economy, reliability or durability.

### Appendix

Coordinates of the base aerofoil C7 section are given in Ref. (5). Equations of a type which are useful for fitting aerofoil sections are described in Ref. (6). Using these basic equations the constants were determined to fit the C7 section as closely as possible. The resulting equations are as follows:

For $o < x \leqslant 0.4$

$$y = \sqrt{x}\,(0.13368 - 0.25545x + 0.50014x^2 - 0.50726x^3)$$

For $0.4 \leqslant x < 1$

$$y = 0.018842 + 0.16707x - 0.2511x^2 + 0.070459x^3$$

At $x=1$ this gives a finite thickness which is in practice replaced by the trailing edge radius.

**Symbols**

$a$ Position of maximum camber from leading edge. (inches)
$c$ Chord (inches)
$c_p$ Specific heat at constant pressure.
$g$ Acceleration of gravity (ft./sec.$^2$).
$i$ Incidence = $\alpha_1 - \beta_1 (°)$
$J$ Mechanical equivalent of heat (ft.lb./C.H.U.)
$m$ Deviation coefficient.
$N$ Rotational speed (r.p.m.)
$p$ Static pressure (psi).
$P$ Total pressure (psi).
$Q$ Mass flow function $= \frac{W\sqrt{T}}{P}$
$r$ Radius (ft.)
$R$ Pressure ratio.
$s$ Blade Pitch (inches).
$T$ Total temperature (°K).
$\Delta T$ Temperature rise (°C).
$u$ Blade speed (fps).
$V$ Air Velocity (fps).
$W$ Mass flow (lb.sec.).
$\alpha$ = Air angle from axial direction (°).
$\beta$ = Blade angle from axial direction (°).
$\gamma$ = Ratio of specific heats.
$\delta$ = Deviation $= \alpha_2 - \beta_2$ (°).
$\eta$ = Adiabatic efficiency.
$\theta$ = Blade camber $= \beta_1 - \beta_2$ (°).
$\theta_u = u^2/2gJc_p$ (°C).
$\rho$ = Air density (lb./ft.$^3$).
$\phi$ = Flow coefficient $= Va/u_m$
$\psi$ = Pressure coefficient $= \frac{\eta \Delta T}{\theta_u}$

***Subscripts***

$m$ = mean.
$1$ = inlet.
$2$ = outlet.
$a$ = axial.
$w$ = whirl.

***Superscript***

* Denotes nominal condition.

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# "Here is How to Reduce Costs"


**Reprinted from "Business Newsletter" of George H. Elliott & Company, December 8, 1953.**


About a year ago, a small company in New York (sales of approximately $1,000,000) figured that business wasn't always going to be so easy to get . . . that things might get a little rough in '53. So they decided to try reducing costs through a wage incentive plan based on time study. Like many other companies, they weren't certain that this might be the way to achieve their objective. Their union was "officially" opposed to such plans, too. But they decided to experiment anyway. They called in outside help. Here's what happened:

After a work simplification program, foreman training in how to make methods improvements —standards were set and the wage incentive plan went into effect. *Production increased by 50%. Labor's take-home pay increased by 20%.* Management said, "Let's reduce our selling prices, really get competitive!" They did . . . and something else happened. *Sales increased 50%. (Incidentally, we are using round figures to disguise the company itself . . . but the figures are correct within one to three percent.)*

The most important point of all. Because of the wage incentive plan—and its total effect—*profits increased 380%!*

The "before and after" balance sheets of the company, again using only round figures, are shown at the bottom of this page.

*This is no isolated case.* In our files we have such records from a significant number of companies in a wide variety of industries. Of course . . . sometimes incentive programs backfire, won't work out as planned . . . but the ONLY reasons for this are: (1) the wrong initial approach by either management or the consultant, (2) improper administration of the plan once it has been installed . . . and to be brutal about it, (3) foolish mistakes, and (4) prejudices.

This is putting it pretty strongly . . . but it is fact nonetheless. And don't blame wage incentive plan failures on labor unions! If the plan is fair and sound, and the unions are allowed to participate in the planning, they will almost invariably go along, even though "officially" the national headquarters of many unions frown on the principles of incentives. And, frankly, you can't blame them. They have been used all too often for "speed-up" purposes by unwise managements. And if this is the objective of management, then wage incentives are wrong. But the objective is to *increase production, reduce costs, increase labor take-home pay* —AND *increase profits* so that *selling prices can be reduced* . . . then there can be no failure . . . anywhere . . . if the people who set up the program know their business. And there are a goodly number of consulting firms who do.

*Final word.* To deny the great benefits of wage incentives is to deny Frederick W. Taylor, the first man to try to put "science" into management, to make it the *profession* that it is . . . just as surely as are the professions of law and medicine. And it is to deny Frank Gilbreth, and so many other pioneers in management research, whose work has made the middle of 20th Century U.S., the mass-production miracle . . . the undisputed leader of Western civilization.

Somebody should say some of these things more often. We've said it. We will stand on it. And we will say it again and again. Our advice: *if you don't have a wage incentive payment plan in effect, then get one (or stop complaining about narrowing profit margins.) And if you have one, then check it immediately for looseness.* You will find it is one *sure* way to reduce costs. There are others, but here you can't miss!

| | SALES (Before Incentives) $1,000,000 | SALES (After Incentives) $1,500,000 | DIFFERENCE 50% |
|---|---|---|---|
| Labor | $260,000 | $312,000 | +20% |
| Material | 380,000 | 570,000 | +50% |
| Factory Overhead | 180,000 | 180,000 | -0- |
| General and Administrative | 120,000 | 150,000 | +25% |
| Profit (before Taxes) | 60,000 | 288,000 | +380% |

# Safe Conduct for Salmon

by

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One of the most successful examples of fishway construction to date in Canada is the one recently completed at the Tobique Narrows hydro electric development for the New Brunswick Electric Power Commission. During its first operating season in 1953, it has passed just short of 4,700 salmon during their migration upstream.

The Tobique River, though small compared with many other salmon rivers entering the Atlantic, has long been a favourite stream for anglers. It passes through unsettled woodlands, contains many rapids, falls and pools, yet is readily accessible by excellent logging roads. A number of fishing clubs maintain lodges on its upper reaches and tributaries.

### Many Interested in Salmon Preservation

Many groups of Canadians are interested in the preservation of salmon. On the Pacific Coast, salmon canning is a major industry of British Columbia, and both the canneries and their employees are directly affected by any event or action which improves or lessens the yearly migration of salmon up the rivers to the spawning grounds in fresh water on their upper reaches.

On the Atlantic Coast, salmon fishing is a sport as well as an industry, but none the less a matter of wide interest. The Maritime Provinces derive handsome revenue from fishing licences and from leases to fishing clubs, many of them supported by wealthy American sportsmen. Many Maritimers find employment as guides.

On both coasts, power companies or commissions, and logging and pulp and paper interests are also much concerned with the problem of fish preservation, because the Federal Department of Fisheries is charged with assuring that for any structure built on a Canadian river, or changes in the natural flow of the river, adequate provision is made for unimpeded passage of fish both up and down stream.

### Life History of the Salmon

Salmon are found in both the North Atlantic and North Pacific, and differ from one another in these areas in at least one important respect. Although both fish migrate to their birthplace in fresh water to spawn, the Pacific salmon die after the breeding season and "never return to the sea". (Encyc. Brit.). The Atlantic salmon returns to the sea after spawning and may return to spawn again. They grow to 4 or 5 feet in length.

Beginning with their birth the life cycle of the salmon is briefly as follows:— The young fish are hatched in the spring and remain in the river two or three years, growing to "Fry" then to "Parr", then to "Smolt". These Smolt, averaging about 8 inches long, generally descend to the sea the third year in the late summer. If they remain in the sea for only one year and then return to spawn at a weight of 3 to 7 or 8 pounds, they are known as "Grilse". If they remain at sea for a year or more they return as full grown salmon weighing up to 40 pounds.

Spawning takes place during October. The female salmon scoops out a hollow in the riverbed on which her eggs are laid. After fertilization the eggs are covered by the male, and hatch out the following spring. The parents return to the sea in the fall or spring as "Slinks" or "Black salmon" after spawning. Opinion is that few salmon return a second time, though this belief has not been completely accepted by anglers. On this basis, if the Smolt get down to the sea safely without injury, little concern need be felt for the larger downbound fish or "Slinks", since these will not likely spawn again.

### Fishways on the Pacific Coast

The past history of fishways is somewhat disappointing. Perhaps many of these were built merely to fulfill the legal requirements. It has been only in this century that better results have been obtained. During this era fish facilities have increased in size and consequently in cost, with most recent designs indicating good efficiency.

The largest fishways system in operation in the Pacific Coast region is at Bonneville Dam on the Columbia River, at which fish ladders and fish locks were installed. The fish ladders are working satisfactorily and the locks on an experimental basis. Collection systems, downstream migrant passes and auxiliary water supplies have been considered as a part of the dam.

This system based upon 1930 prices cost seven and one-half million dollars. At McNary Dam on the Columbia River the same basic facilities, with modifications based upon Bonneville operations, will cost some seventeen and one-half million dollars. This means that the fishways represent an estimated 8 to 12 per cent of the total cost of the projects, with of course an annual cost for operations. The use of

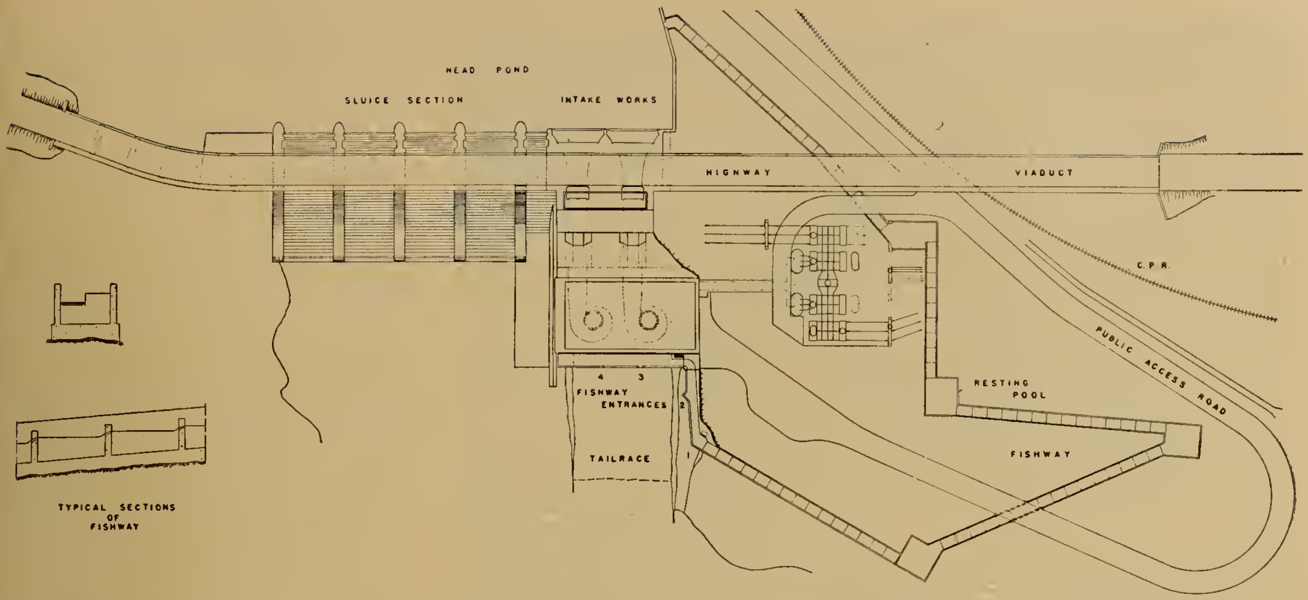


**Fig. 1. Outline plan of Tobique Narrows power development showing general layout of fishway.**

temporary facilities during construction has cost hundreds of thousands of dollars because it is equally essential to maintain fish runs during the construction period, which incidentally presents many difficult problems.

A further complication in fisheries stream management has arisen in the Pacific Coast regions where there is a growing tendency to use water instead of steam for standby or peaking power. It can readily be appreciated what it means to the stability of stream flow and fisheries, when such plants are sharply cut off during periods of minimum power loads. This is mentioned to indicate that operational changes can upset existing stream balances, and interfere with salmon runs.

### Atlantic Coast Fishways

A considerable number of fishways or fish ladders have been built at power sites in Canada's Maritime Provinces and in Quebec. In most cases they have been small, inexpensive and of cheap temporary construction. Some were built on the Mersey River by the Nova Scotia Power Commission. Though records are lacking on the number of fish migrating upstream in the Mersey, if the smolts were coming down presumably the adult fish were also passing upstream for spawning.

### Requirements for Fishways

In designing a power development on a river used by salmon and other fish that spawn in fresh water, efficient fishways must be provided to permit migration up and downstream. The essentials for a fishway are:—

(a) The entrances, especially downstream, must be attractive and easily located by the fish.

(b) The flow through the fishway must be such that passage upstream does not overtax any but the weakest fish.

(c) Fish should be able to swim through without risk of injury, and unhampered in their swimming movements.

(d) There should be sufficient resting pools.

(e) There should be no sharp projections.

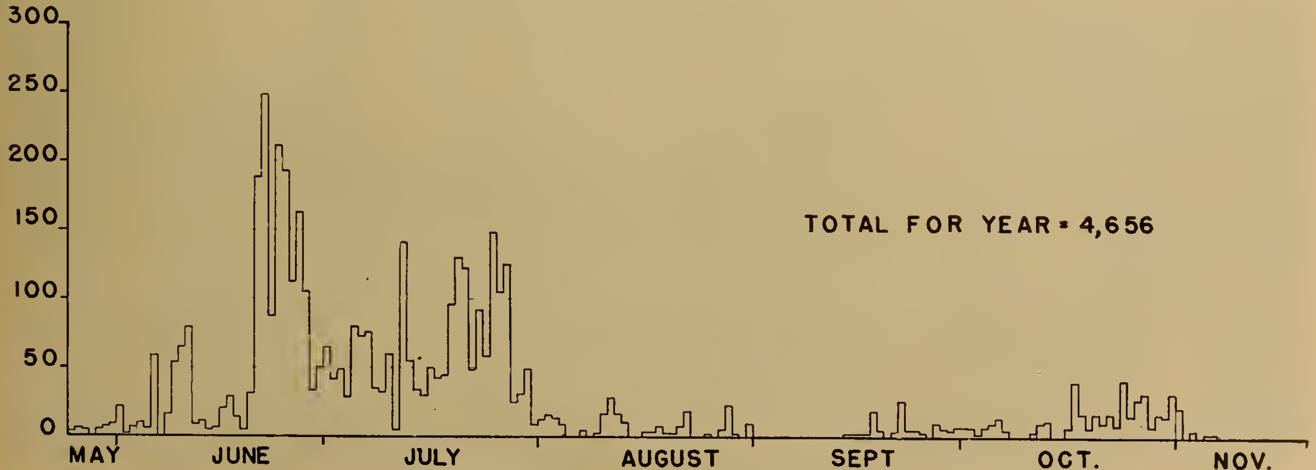


**Fig. 2. Daily count of salmon migration up Tobique Fishway during the year 1953.**

Salmon can, as a last resort, surmount some obstacles by leaping, if they have sufficient length of take-off in deep water. It is recorded that salmon can surmount a rise of over 11 feet, but this may be regarded as quite exceptional. Six feet is generally accepted as a maximum.

There are two kinds of fishways, the channel or "Denil" type and the jet type. The former consists of a sloped box-like flume with baffles; the latter may take the form of a series of weirs or overfalls, or with a submerged opening, or a combination of the two. In the latter case the difference in level between the pools should not exceed 18 inches.

### Location and Dimensions

The New Brunswick Electric Power Commission decided in 1950 to develop 27,000 hp., by building a 75-foot dam and powerhouse at Tobique Narrows, a mile above where the Tobique Flows into the Saint John River. Advice was sought from the Federal Department of Fisheries at Ottawa, regarding the type of fish ladder required. A small scale model of the dam was built in the N.R.C. Laboratory at Ottawa, on which the behaviour of the discharge was observed with turbines operating and closed, and with various combinations of sluice gates opened.

It was decided the most favorable location would be on the left bank of the river (Fig. 1), with an entrance gallery containing two entrances built along the downstream face of the power house. Later, it was considered advisable to provide two additional entrances along the first or lower leg of the fishway which runs roughly parallel to the tailrace, which might be preferred by the fish during times when the river was in flood and the tailrace level was higher.

The design provides for an operating flow of 9½ c.f.s. which can be varied by manipulating the orifices on the upstream exit. An auxiliary pipeline from the intake to the gallery entrances, with valve control, provides an additional flow of some 5 to 10 additional c.f.s. for flushing at high velocity. This creates additional current to attract the fish.

The Department of Fisheries was principally concerned with location of the entrances, the upstream exit, the inside dimensions of the channel, height and spacing of the lifts or jumps, and the provision of resting pools at suitable intervals along its length. The decision to build it of concrete, rather than of timbers, was made by the commission.

Owing to the rugged topography at the site, and the limited amount of room for access roads to the plant and for a switching structure with its banks of circuit breakers and transformers, the location of the ladder presented a difficult problem.

As built, the ladder has 78 steps or jumps a foot each in height. Between the steps are pools 8 feet wide, 11 feet long and 3 feet six inches in depth. Four resting pools, each with a surface area of 700 sq. feet, and with minimum depth of 5 feet, are placed at intervals along its total length of close to 1,000 feet.

### Migration Upstream

From the commencement of the summer upstream migration which generally occurs between mid-May to mid-October, Department of Fisheries game wardens directed the operation of the fishway. Figure 2 shows the daily count of the number of fish ascending, from late in May to the middle of November 1953.

It was found that early in the season the salmon preferred the two entrances provided along the lower leg of the fishway, probably because of the higher tailrace levels. Later in the season when the flow decreased, they favored the entrances built into the gallery along the downstream face of the powerhouse. With sudden changes in tailrace levels, mostly on weekends when the wheels were shut down, it was usually necessary to change from one entrance to another to find which ones the fish preferred.

In May a large number of eels and suckers entered the openings and crowded some of the resting pools. Many of these were killed. The jump immediately above the fourth resting pool was 18 inches in place of the 12 inches for the others, and appeared to be too high for the eels and suckers to negotiate, otherwise they would have continued on up into the headpond.

A total of 4,656 salmon passed up the fishway between May 24 and November 8. The largest monthly total was 1,979 during July, while the largest daily run was on June 22 when 248 passed through the trap. Early in the season all salmon passed up during the daylight hours. Later they started to run at night and at the end of the season runs were about equally divided between daylight and darkness.

From records of weather conditions and temperatures it appeared

Fig. 3. Tobique Narrows power house, showing four entrances to fishway from the tailrace.

that sunny or dull cloudy days made little difference in the number of fish entering. Nor did it appear that the presence of many anglers and spectators during weekends had the effect of frightening the fish so that they did not enter.

#### Migration Downstream

No accurate count could be made of the smolts migrating downstream, since these do not use the fishway but come down when the sluice gates are opened, or at other times through the turbines. The turbines are equipped with Kaplan type runners of five blades, similar to the ordinary ship's propeller, rather than with the Francis type runner, commonly used with medium-and-low-heads. The minimum clearance between blades is nine inches.

This is doubtless the reason that a constant watch did not verify that any downbound fish had been cut or killed by the blades, though dead eels floating in the tailrace attracted gulls and fish hawks in October. These evidently had entered the turbines while they were shut down.

In November large numbers of salmon were seen in the head pond, but after the gates were opened on November 15 they disappeared. No dead smolt were found below the dam and powerhouse at the time the smolt run left the river.

Fig. 4. Tobique Fishway. Lower leg from No. 1 entrance looking upstream.

#### Operation Satisfactory

The results of the first year's operation of the fishway is proof that it is adequate. Fishing clubs and sportsmen, who had been skeptical regarding the results, are now satisfied that salmon fishing on the Tobique is as good as ever. A number of fish and game associations, power producers and government wildlife services have addressed inquiries as to its design and operation.

One possible improvement might be to diminish the width of the openings at the baffles and so reduce the turbulence in the small pools. Whether the width of the channel could have been reduced below 8 feet, and so reduce the cost of construction, is open to conjecture. If the presence of suckers is a menace to the salmon eggs during the spawning and hatching period, one or more 18 inch jumps just above the entrances would appear to be useful in preventing these fish from entering the fishway.

Fig. 5. Tobique Fishway. Looking downstream to first resting pool.

#### Acknowledgement

The fishway was designed and built by Power Corporation of Canada, Limited, as part of the Tobique Narrows Power Development. Advice on fisheries requirements was obtained from officials of the conservation and development service, Department of Fisheries, at Ottawa. √

Discussion of

# Technical Papers

### Marginal Cost in Engineering Design

By D. F. Coates, M.E.I.C., Department of Civil Engineering, McGill University, Montreal.
*The Engineering Journal*, March 1954 issue, Page 246.

**J. W. Forster, M.E.I.C.** [1]

Mr. Coates has developed mathematically the economic principle that net revenue from an engineering project reaches a maximum at that stage of development where marginal cost equals marginal benefit. As an example, the principle has been applied to determine what is termed the economic or optimum height of a simple hydro electric storage dam.

The writer wishes to discuss two aspects of the subject: first, by illustrating how the method may be applied to a project having several inter-related features; and second, by demonstrating that the marginal cost criterion defines the "optimum" height only under certain conditions or assumptions, and that under other conditions a lesser extent of development may be economically preferable.

#### Pumped Water for Hydroelectric Plant

As an example of a project with several inter-related features, consider a system studied by the writer in Brazil and shown schematically in Fig. 1. Water is diverted from an existing reservoir to a high head plant. To increase the water supply, a dam is proposed further downstream to back water up to the existing dam where it will be pumped into the existing reservoir. A waterway from the upper end of the new reservoir to the pumping plant intake can be provided by rock excavation. The problem is to determine the upper and lower pool levels yielding maximum net revenue; i.e. the economic amount of storage, and the water levels between which it is to be provided. Total cost and gross revenue will be considered in turn.

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#### *Total Costs*

In this case, for any given storage within the range considered, the combination of the several inter-related features which results in the minimum combined or overall cost must be determined before marginal cost analysis can proceed.

It will be seen that as the upper pool level or dam height increases, costs of dam and reservoir, including land, buildings, and relocation of highways, railroads, transmission lines etc., increase, as indicated by the Curve *A* in Fig. 2. On the other hand, for any given amount of storage, as the upper pool level increases, costs of canal excavation, pumping plant and pumping decrease, as shown by the *B*-curves. Addition of curves *A* and *B* results in total cost curves *C*, which indicate the upper pool level resulting in minimum total cost for storage capacities from 10,000 to 100,000 ac. ft. Minimum points on the *C* curves are connected by a dotted line.

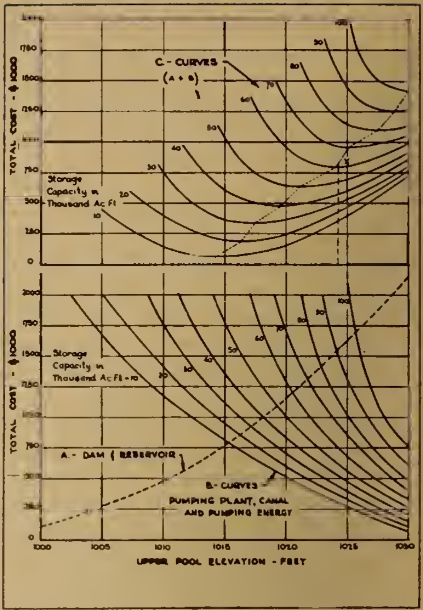


Fig. 2. Costs of dam and reservoir.

It is this minimum cost value for each given amount of storage that enters into the marginal cost analysis. Using these minimum values, the marginal or incremental cost of each increment of storage can then be plotted as Curve *D* in Fig. 3.

As the author showed, in the first step of the marginal cost analysis, it is unnecessary to determine actual *total* project costs; it is necessary to determine only increments in total costs corresponding to increments in project size, in this case measured by storage volume.

#### *Gross Revenue*

Provision of storage capacity permits holding and later use of

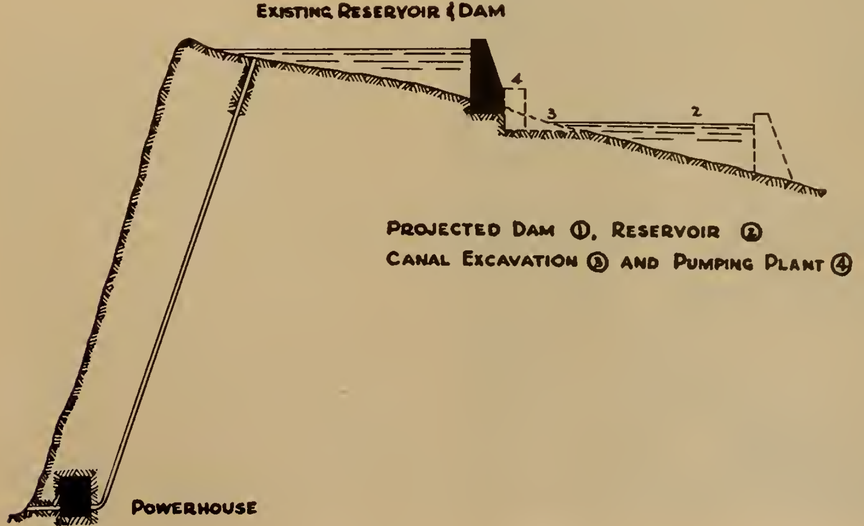


Fig. 1. System studied in Brazil.

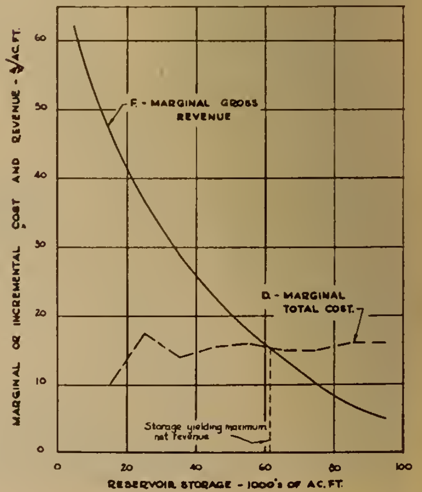


Fig. 3. Marginal cost and revenue.

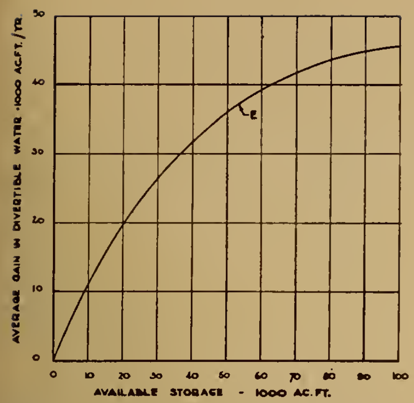


Fig. 4. Increase in divertable water.

freshet and flood flows which exceed diversion capacity and would otherwise be lost downstream. By analysis of flow records, the increase in divertable water resulting from any given storage capacity can be determined, as plotted as curve *E* of Fig. 4, and the corresponding increase in revenue computed over a range of storage. This yields the marginal gross revenue curve *F* of Fig. 3.

### *Results*

Storage capacity resulting in maximum net revenue is indicated in Fig. 3 as 61,000 ac. ft. by the intersection of marginal total cost and marginal gross revenue curve *D* and *F*. Then, by referring back to curve *C* in Fig. 2, upper pool elevation giving minimum cost for this storage is determined at point *X* as 1,024 ft., the corresponding lower level subsequently being obtained from the reservoir water level vs. storage curve.

### *Economic Analysis of Projects*

Considering a hydroelectric storage development as the author did, fixed or investment costs normally comprise by far the major portion of total costs, which increase rapidly as the structure outgrows the natural limitations of the site. On the other hand, gross revenue resulting from provision of each additional unit of storage diminishes after the capacity exceeds the volume of the minimum annual flood. Typical total cost and gross revenue curves for this type of development can be represented by curves 1 and 2 in Fig. 5.[2]

Whenever development is economically feasible, the total cost and gross revenue curves will intersect at two dam heights, *a* and *d*. Between these limits, net revenue, or gross revenue less total cost, is represented by curve 3, which reaches a maximum at dam height *c*. This height affording maximum net revenue is that at which the marginal gross revenue and marginal total cost curves, 5 and 6 respectively, intersect, as the author showed mathematically. Marginal curves 5 and 6 also illustrate that any increase in dam height beyond *c* is made at a net loss, and hence is not economically justified.

However, decision as to the desirable or optimum extent of development may well be governed not so much by the absolute amount of net revenue as by the per cent return on invested capital. The latter is indicated by curve 4, representing the ratio of gross revenue to total costs, and reaching a maximum at dam height *b*. (It will be found that as long as gross revenue exceeds total cost over some range of dam height, then point *b* lies to the left of *c*. If, however, total cost exceeds gross revenue for all dam heights, that is, if curves 1 and 2 have no points of intersection, then point *b* moves to the right of *c*. For the borderline case where curves 1 and 2 touch only at one point, then *a*, *b*, *c* and *d* are coincident).

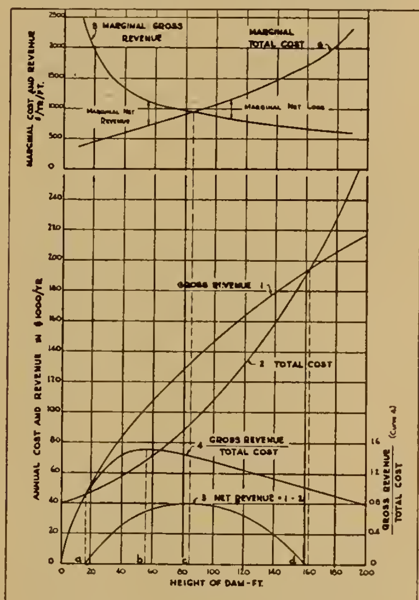


Fig. 5. Cost and revenue.

The basic limitation of the marginal cost criterion is that the extent of development which it indicates is independent of the net return on the investment. To illustrate, consider the cost curve 1 being simply shifted upwards (due for example to increased cost of access roads or foundation treatment) until it lies entirely above the gross revenue curve 2, so that any dam height would entail a net loss. Marginal cost and revenue curves would be unchanged, still indicating the optimum height at *c*, which would then represent the, height of minimum loss. In this case however, the truly optimum development, economically speaking, would be no dam at all.

### Optimum Height Definition Reconsidered

A logical economic criterion to govern the extent of development is that the rate of return on the investment should be not less than that considered commensurate with the risk involved. Of course, this rate is somewhat arbitrary and subject to experienced judgement in any particular case. However, once it has been decided, curves 3 and 4 then indicate the optimum extent of development. Three cases are possible, as reference to Fig. 6 will show.

First, if the minimum desired rate of return (indicated by ratio of gross revenue to total cost) is above the maximum value on curve 4, then at no point will the project yield an attractive return, so that no development is economically justified.

Second, if the required rate of return is lower, the length of dam must lie between *e* and *f* which are both less than *c*. In this case the height selected would be at *f*, since curve 3 indicates this point to yield the maximum net revenue within this range.

Third, if the required minimum rate of return is still lower, the height of dam must lie between *e'* and *f'*. In this case, the height selected would be at *c*, which yields the maximum net revenue within these limits.

In the first two of these three ranges the height indicated by the marginal cost analysis cannot be considered the optimum.

### Advantages and Limitations of Marginal Cost of Analysis

In any proposed hydroelectric project, regardless of the size of the structure within a reasonable range, cost of certain items such as pro-

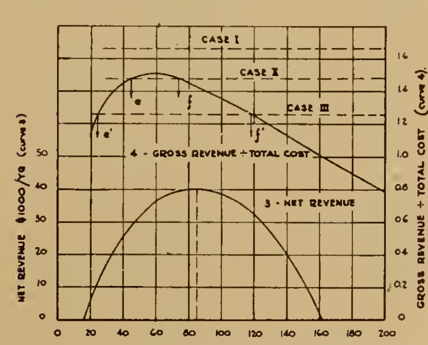


Fig. 6. Rate of return possibilities.

[2]See "Symposium on Multiple-Purpose Reservoirs", A.S.C.E. Transactions, Vol. 115, p. 789.

viding access to site, preparation of site and establishment of construction plant are more or less fixed. It is usually more difficult to make accurate estimates of these fixed costs than of incremental costs resulting from increasing size of structures within the feasible range considered. Since marginal cost analysis is independent of the less easily predictable fixed construction costs and is governed only by incremental costs, it lends itself to a quick determination of the maximum net revenue point without having to make detailed estimates of total project costs.

Also, since the optimum extent of development is never more than this maximum net revenue point, marginal cost analysis serves in preliminary studies to indicate the approximate upper limit of the range to be investigated in detail.

However, marginal cost analysis does not indicate whether or not the project is economically feasible on the basis of net return on investment, nor does the maximum revenue point which it indicates necessarily comprise the optimum extent of development, as shown above. To determine this it is still necessary to compute total costs.

There may be a tendency to carry economic studies to a degree of refinement not warranted by the accuracy of cost and revenue data on which they depend. Probably few hydroelectric projects construct- in the last 15 years have come within ten or even twenty per cent of their estimated costs. Until more accurate cost estimates are possible, refinements in the economic analysis appear to be of more academic than practical interest.

**D. F. Coates, M.E.I.C.**

Mr. Forster has presented a very good example of the application of the marginal cost analysis in engineering design. I should think that it would be interesting to most engineers to see a series of articles showing how this technique can be applied in different fields, e.g., in determining the optimum height of a hotel or office building, the optimum diameter of a pipe, the optimum depth for an open pit mining operation, the optimum chemical concentration in an industrial process involving a mass action reaction, etc.

At the same time, Mr. Forster's discussion contains some misconceptions that should be understood.

1. Mr. Forster has not shown the conditions under which "a lesser extent of development may be economically preferable." He has suggested that another criterion other than making net revenue a maximum might be used, but has not shown how or when this would be preferable to equating marginal cost and revenue. This is a large subject.
2. The alternate criterion suggested for designing an engineering project is to make the rate of return a maximum. As a theoretical point, this is certainly possible. But, first of all, it is not represented by the $R_g/C_t$ ratio. Secondly, to determine the point at which the maximum rate of return is obtained is quite difficult. This can be readily seen by examining the equation incorporating the rate of return:

$$R_n' = I_c \frac{i}{1-(1+i)^{-n}}$$

where $R_n'$ is the revenue net of operating costs (all costs except depreciation and interest on capital) in \$/yr;
$I$ is the capital invested in the project in \$;
$i$ is the rate of return represented by $R_n'$ on $I_c$ in % or \$/\$/yr.;
$n$ is the economic life of the project in years.

Thus no simple expression can be obtained for the rate of return. Moreover, the theoretical solution to the problem of obtaining the size for the maximum rate of return would require the differentiating of $i$ with respect to size and equating to zero. This would be difficult to do even by a trial and error procedure.

3. The "Symposium on Multiple-Purpose Reservoirs", that Mr. Forster refers to, suggests that the maximum Benefit/Cost ratio (Mr. Forster described this correctly as the $R_g/C_t$ ratio) may be an alternate criterion for design purposes. There are thus three alternate objectives that may be achieved by an engineering project:
   i) the maximization of net revenue,
   ii) the maximization of the Benefit/Cost ratio,
   iii) the maximization of the rate of return.

The correct criterion to use is actually a question of the intention of businessmen or government officials when investing in industrial plant. Recent surveys[3] have shown that not only are executives seldom explicit to the degree of following one of these three objectives, but that they are often irrationally influenced by non-economic factors in making investment decisions. At the same time it seems likely that of the three, businessmen, in increasing numbers, are most likely to base these decisions on the objective of maximizing net revenue.[4] In this case, it would behoove the engineer to direct his efforts to the ends of the executive, i.e., use the marginal cost analysis.

On the other hand government agencies seem to favour the use of the Benefit/Cost ratio. Engineers working for these bodies should thus use this alternate criterion. It is to be emphasized that the objectives of government bodies or businesses is sufficiently controversial that the superior officers must make the decisions on these questions; the engineers' role is to assist in obtaining it.

4. It is not correct to say that the marginal cost method of design "is independent of the net return on the investment." To determine the annual cost of amortization of plant, which is one component of the total annual cost, some rate of return or interest rate must be used. The appropriate figure may be close to the rate of interest on the borrowed capital for a non-profit making government organization incurring little risk. For a business organization, it may be what is judged to be the minimum attractive rate of return, or it may be some higher rate, which would be in the nature of a cut-off. rate for the purpose of budgeting capital. In any event, the higher the rate selected the higher would be the amortization cost with its influence on the design study.
5. In Mr. Forster's second to last paragraph it is not correct to say "marginal cost analysis does not indicate whether or not the project is economically feasible." In step 5 of the example in my paper, I pointed out that an essential step in the design study is to determine the actual rate of return at the point where the marginal cost equals the marginal revenue, for this point with an uneconomic project would be "Simply where losses are the least."

[3] See Dean, J. "Measuring the Productivity of Capital" Hvd Bus Rev. Jan-Feb. 54.
Heller, W. "The Anatomy of Investment Decisions", Hvd. Bus Rev. Mar. 51.

[4] See Dean, ibid.

# Abstracts of Current Literature

Abstracts of articles appearing in current technical periodicals

## CPR RECEIVES FIRST OF 173 NEW PASSENGER CARS

*Railway Age*, v. 137, n. 1, July 5, 1954, p. 10.

The first unit of its 1953 order for 173 streamline, all-stainless-steel passenger cars for transcontinental service was delivered to the Canadian Pacific by the Budd Company on June 29. The rest of the cars, which will go into service as delivered, will be completed at the rate of about three a week over approximately the next year.

The full order, which includes Canada's first dome cars, will be distributed in 15 train sets for service between Montreal-Toronto and Vancouver.

The first car, which was personally inspected and received from Budd by N. R. Crump, executive vice-president of the CPR, was a sleeper, containing eight roomettes, one drawing room, two double bedrooms and four sections.

Representing an investment by the CPR of some $40 million, the order includes regular and dome-lounge sleepers, standard and dome coaches, diners and baggage-dormitory cars.

## USE DOCK-BARGE IN GULF DRILLING

*The Iron Age*, v. 174, n. 1, July 1, 1954, p. 65.

Mobility plus stability in offshore drilling are the major advantages claimed for a new unit which recently went into service for a major oil company in the Gulf of Mexico. Unit is a DeLong dock-barge specially rigged for oil drilling.

Basically, it's a 203 x 70 ft. steel barge 8½ ft. deep mounting a series of special jacks on the deck. By means of the jacks, the 2500-ton barge pulls itself up 40-ft. out of the water on ten 160-ft, long steel caissons, converting itself into a stable drilling platform.

Fabricated by Consolidated Western Steel Division of United States Steel Corp., unit is leased by DeLong-McDermott Co. to the oil firm.

Forward deck provides a helicopter landing space as well as crew quarters. Drilling equipment is aft on the port side and functions through a 12-ft. slot in the unit's side. Slot permits the barge to be swung away from the drilling well when it has been completed. Internally, the hull is honeycombed with steel ribs for strength. Storage space is provided in the interior for fuel, oil and water.

Each half of the unusual air jacks is lined with rubber tubes. Similar tire-like tubes circle the caisson between sections. Tubes 6 in. above the deck are inflated, gripping the caisson. Air is pumped into the tubes between the sections which forces the caisson downward. Inflating the top tubes then clamps the caisson with the barge at its higher level and the bottom grip is released. Retraction here climbs the barge still higher. Centre tubes are next deflated and the operation starts anew. Reversing this cycle lowers the dock.

## DIRECTIONALITY OF MECHANICAL PROPERTIES IN HOT WORKED STEELS

A. R. Troiano and L. J. Klingler,
*Welding Journal* — v. 33, n. 5, May, 1954, pp. 209.

Steel that has been rolled or forged does not have the same mechanical properties in all directions. This directionality is called anisotropy and occurs in both cold-worked and hot-worked steel. In pressure vessel steels the greatest interest is in the properties parallel to and transverse to the rolling or forging direction.

In rolled, forged or otherwise hot-worked steel, the tensile and yield strength exhibit little or no directional properties over a wide range of testing temperatures including subzero temperatures. However, other related tensile properties usually show anisotropy. Both elongation and reduction of areas, for instance, decrease markedly as the angle between the test specimen axis and the rolling direction increases and approaches 90 degrees.

All notch properties exhibit directionality and invariably are inferior in the transverse direction, although the magnitude of the difference will, in some cases, depend upon the test employed and the criteria selected for comparison. This applies to the transition temperature, which may be considerably higher for specimens in which the notch is parallel to the direction of rolling than for specimens notched transverse or perpendicular to the direction of rolling. There is some indication that fatigue properties also are effected.

The extent to which hot-worked steels exhibit anisotropy depends upon many variables. One of these is the amount of reduction in working. It has been demonstrated repeatedly that reductions by forging up to 3:1 or 4:1 improves both longitudinal and transverse properties (tensile and yield strength excepted.) With continued reduction beyond this ratio the longitudinal properties improve only slightly but the transverse properties deteriorate markedly. Cross rolling tends to reduce the amount of directionality in plates.

Steel quality, as evidenced by non-metallic inclusions, banding, segregates, porosity and voids, is probably the single most important variable which influences the amount of directionality found in hot-worked material. Evidence indicates that the number of discontinuous stringers of oxides and other brittle inclusions fragmented in rolling, as well as continuous stringers such as silicates and sulfides; correlates quite well with transverse ductility. As the inclusion count increases, transverse ductility decreases while the longitudinal ductibility is not affected appreciably. There is agreement that nonmetallic inclusions account for only a part of the anisotropy, and that segregation, such as carbide stringers, as well as heterogeneous distribution of elements in solid solution accounts for most of the remainder.

Heat treatment *per se* appears to have little effect in reducing anisotropy. Homogenizing treatments have, in some instances, improved transverse properties by eliminating, banding and segregation but, as the nonmetallics are unaffected, such treatments cannot be relied upon to reduce directionality to any important degree. However, the amount of anisotropy may vary appreciably with changes in strength level produced by heat treatment and, in general, anisotropy increases as the strength level of the steel is increased by heat treatment.

Some forms of heat treatment may embrittle steel even at low-strength levels. An example of this is temper embrittlement, a phenomenon which occurs more or less in all steels if treated at appropriate subcritical temperatures for sufficient time, such as may be encountered in postweld stress-relief treatments. There is a greater susceptibility to temper embrittlement in the transverse than in the longitudinal direction.

Rolled plate used in construction of pressure vessels usually will exhibit lower ductility in the transverse direction than in the longitudinal direction. This difference, which is a function largely of steelmaking and rolling practice, tends to be relatively low in cross-rolled plate. Since this directionality in properties is most recognized by any of the applicable Codes except in limiting the maximum thickness of structural quality plate, and since no failures of pressure vessels have been attributed to it, it is not always rated as a significant factor in pressure vessel design or fabrication. However, in view of the fact that directionality in mechanical properties is known to exist in hot-rolled steel plate, additional work seems warranted to determine the magnitude of this effect in typical commercial plate of different thicknesses and under various conditions of manufacture and treatment.

## SALARIES AND ENGINEERS

*Chemical Engineering Progress*, v. 50, n. 5, May, 1954, p. 215.

Nothing interests us like ourselves, especially a comparison of our salary to the salaries of other engineers. Salary surveys continue to appear, ranging from the personal search of the want-ad columns and rough comparisons of the amounts offered clerks, deep sea divers, barbers and laborers with the current salaries offered engineers, to the complicated investigations of the professional engineering organizations. The newspaper search often causes deep concern. Engineers seem to be in no more favourable position than drivers of garbage trucks, and based on such quick surveys, premonitions of disaster for the whole profession are easy to come by.

For chemical engineers the A.I.Ch.E has, in the past, relied on its own studies. The most recent survey of the whole membership was published last July, and, in summary, in January of this year. The results were not at all discouraging. As a matter of fact the curves showed on the whole steady increases, and the picture for A.I.Ch.E members was promising.

But now the Engineers Joint Council has published a study of engineers' salaries which requires explanation to Institute members, and caution must be used if the figures are to mean anything. Titled "Professional Income of Engineers", it is the work of a Special Surveys Committee and is an adjunct to a survey on demand of engineers in industry. Data were collected from companies employing engineers, not from individual engineers, and in the report no differentiation is made in the kind of engineers on whom the company supplied data.

Direct comparison of the A.I.Ch.E. and E.J.C. data is difficult; nevertheless in the early professional period, up to ten years out of school, the E.J.C. study follows closely the experience of A.I Ch.E. members. But after the ten years are up, a peculiar thing happens. The salaries of the engineers in the E.J.C. survey, reported by the companies, begin to level off and soon hit a plateau, and in comparison with those of Institute members sink lower and lower, ending up below the A.I.Ch.E. third quartile. The E.J.C. survey shows that an engineer out of school since 1930 is earning $8,780. The A.I.Ch.E. shows him earning close to $14,000. The break seems to come at the ten-year experience level—graduates of 1942. Both surveys show them earning (in late 1952 and early 1953) a medium $7,200. From there on, however, Institute figures show a steadily increasing advantage. There are several explanations for this difference.

First and important is the fact that E.J.C. obtained data on all engineers employed by the chemical companies reporting. The companies were asked for information on any, many having an engineering degree. There was confusion as to the meaning of this requirement. Some companies interpreted the request to be for data on those still doing engineering work. Others gave the data on everyone (including executives) having an engineering degree. Second, the survey tapped only a limited sample. Out of the seventeen companies only one could be considered a major, in that it reported on 1,000 engineers. Finally the reporting sample of companies from the chemical field was not particularly representative.

Those who made the study for E.J.C. admit these short-comings and claim only that this survey is valuable in that it reports salaries of *ALL* engineers, and is not "limited by being restricted, for the most part, to members of professional societies". Therein is probably the answer for the vast difference in salary experience after the ten-year level.

Other surveys have revealed this same fact—members of a professional society command higher salaries. Many assumptions can be made as to why, but perhaps it is all summed up by saying that the man who joins a professional society is the man who looks upon engineering as a profession. The man who does not join his professional society looks upon engineering as a job, as a way of earning a living. As so often in life, devotion to a principle brings added things.

Professional membership must have its influence on the work, the mental attitude, the information quotient, the conversational interests, and the pride of everyone who joins. And over the years, this might just make the difference.

## THIN-SKINNED HOTEL

*Engineering News-Record*, v. 152, n. 23, June 10, 1954, pp. 31-33.

Exterior walls of the 16-story, $5.5 million Statler Hotel (approaching completion in Hartford, Conn.), are only 1¼ in. thick. This is only a small fraction of the thickness that would have been required if conventional masonry construction had been adopted.

The thin, lightweight walls, (they weigh only 4½ psf.) were made possible by treating the building exterior, from floor to ceiling in each story, as if made of glass. To eliminate a fire-resistant backup that the local building code otherwise would have required, the enclosure where not actually of glass had to have the same fire resistance as wire glass, sufficient strength to carry wind loads, excellent durability, good insulation qualities and ability to keep out rain. Metal-faced sandwich panels were devised to meet these requirements and then installed in aluminum sash, in the same manner as glass.

Development of these panels was not without problems, many of which had to be solved before erection started. Their successful solution made possible another step forward in the development of metal walls for tall buildings.

The trend toward metal exteriors for skyscrapers in this decade can be traced easily—beginning with the four renowned office buildings in Pittsburgh built in 1951 and 1952. The 525 Wm. Penn Place Building has a stainless steel facade backed up with 8 in. of brick. The two buildings in Gateway Center are enclosed with stainless steel panels into which a 4 in. lightweight concrete backup had been cast prior to erection. And the Aloca Building is faced with aluminum panels, which are backed up with 4-in. thick pneumatically placed, insulating concrete (ENR. April 3, 1952).

At the present time, several buildings under construction will have exterior curtain walls comparable in thickness with that of the Hartford Statler. One of the most noteworthy is the Republic National Bank Building in Dallas, with 1½ in. wall thickness—⅛ in. aluminum sheet plus vapor seal and insulation.

Wall panels for the Pittsburgh buildings were one story high. However, aluminum panels two stories high were adopted for the 99 Park Ave. Building in New York City last year, to speed construction. Following the pattern of the Pittsburgh buildings, though, these panels also have a backup—4 in. of brick. Local building codes require the backup for fire resistance, though none would be required if the whole space between floor and ceiling were enclosed with glass.

Designers of the Hartford Statler, taking cognizance of this, decided to treat the exterior wall as if made of glass. An exception was the spandrel facing, where the concrete spandrel beam itself provides ample fire resistance.

The designers called for large picture windows, which can be opened for cleaning from the inside by a key and hinge arrangement. Areas between and below the windows are occupied by wall panels that the city building department accepted as a substitute for glass. Aluminum sash for these panels and the windows were set as a single unit and the frame bolted to the building's concrete frame.

At first, an attempt was made to hold the 1¼ in. thick panels in place with the ordinary spring action of a glazing bead. However, this was found to be difficult in practice, because the bead tended to rotate. This troublesome movement was eliminated by anchoring the bead with screws.

Striated aluminum panels cover the reinforced concrete spandrel beams and columns. These panels also are clipped into the aluminum frame.

The wall panels are of sandwich construction, with a 1-in. thick glass-fiber insulation core and aluminum-foil vapor seal glued to two facing materials. The interior facing is a flat, ⅛ in. thick asbestos-cement board. The exterior is a laminate of ⅛ in. asbestos-cement board and a 20-ga. steel sheet with a blue-green porcelain-enameled outer surface. Purpose of this laminate is to eliminate "oil canning" or warping, of the facing.

In addition, the porcelainized metal was given a mottled, crinkly finish in an irregular texture, with some gloss. This color variation and texture are expected to make unnoticeable any minute irregularities in the shape of the surface, which the designers wished to appear as flat as window glass.

Edges of the panels are sealed with tape. However, small holes were punched in the tape to prevent building of pressure in the interior of the panels. Heat of the sun, the designers estimated, could set up a vapor pressure of 200 psi., if no relief were provided.

The panels vary in size, some of the largest being about 2½ x 7 ft. They have a heat-transmission coefficient of 0.20, compared with 0.16 for the walls of the Alcoa Building in Pittsburgh and 0.23 for the Gateway Center buildings. Cost in place is estimated to be $5 per sq. ft. A total of 1,640 panels (18,000 sq. ft.) was required to enclose the building.

## THE RAILROAD'S INHERENT ADVANTAGES

William J. Rae, *Railway Age*, v. 137, n. 1, July 5, 1954, pp. 22-26.

What are the inherent advantages of the railway? What are the characteristics of the railway structure and method of operation that give it advantages over its competitors? These must in some sense first be physical, but their final and most important manifestation may well be in pricing, or more simply in the setting of rates.

Although completely fundamental to the idea of a railroad, it is frequently overlooked that on a properly constructed railway the amount of power required per unit of transportation is small. It is only necessary to compare the horsepower of even the largest locomotive, designed to handle 5,000 or more trailing tons, with the horsepower of the large transport and passenger plane, or the combined horsepower of the trucks required to handle a like tonnage. Furthermore, it is relatively cheap power to build and maintain, in terms of the units of transportation provided.

Akin to this power advantage is the relatively small amount of labor required. One has only to visualize the five-or six-man crew of a railway train and compare it with the number of truck drivers and airplane crews required to move a like tonnage, to recognize the nature of the advantages inherent in the railway operation. Not so evident but just as real are the few men required to maintain equipment as compared to road and air competitors, relative to the tonnage handled.

Interchangeability of equipment is another advantage inherent in the modern railway, which frequently escapes comment and appreciation only because it is so commonplace.

Transportation is material handling, and the railway should, by background and interest, be the foremost exponent of its techniques, on the broadest scale. Few unit loads are as large as the normal freight carload, or travel so far without additional "handling".

There are a number of subsidiary physical advantages—such as freedom from weather interference, comparative freedom from extreme traffic conditions, and control of right of way—all quite inherent in the techniques of railroading.

These operating advantages are real, clearly witnessed by the fact that American railways can and do produce a ton-mile of freight transportation at a cost so much below the cost of the same unit by air or truck transport that the comparison is startling!

The inherent advantages so far are not fundamentally threatened or denied by anyone. Full crew and train-limit laws and other kindred restrictions may limit their ultimate development, but nothing more. The fact is that the advantages so far mentioned except the mechanical advantages of wheel on rail are all manifestations of the general principle that a railway of any size requires heavy capital investment, and a substantial supply of labor, including all management, sales, control and procurement groups as well as operating and maintenance personnel, whether a small tonnage or a large one is contemplated or immediately available. The railway is therefore most responsive to the economic pressures of overhead costs, and reaps the reward of decreasing unit costs in such dramatic fashion that it is a more imposing example of this characteristic type of American industry than the motor car or the packaged food industries.

The unit cost of railway transportation decreases as the number of units of transportation provided increases. Additional staff and facilities may be required as tonnage increases, and momentarily the cost per unit may increase until tonnage catches up with the capacity of the added units. The important fact is that, as the units of transportation provided increase, they do not call for like increases in total cost of the operation, and therefore the unit cost decreases.

Granted, this same influence is at work in other transportation agencies, but to a much restricted degree. A comparatively small increase in tonnage forces a transport operator to buy another truck, and take on another driver, but it takes a relatively large increase in traffic to require additional facilities on the railway. Relatively speaking, this is an advantage so inherent in the technique of railroad operation that it cannot be duplicated in all its manifestations by any other type of carrier.

It must be quickly recognized that unless the railway is permitted to obtain traffic in large volume, it will not produce transportation at low unit costs, but on the contrary, the so-called inherent advantage will become an inherent disadvantage and result in not low cost, but high cost transportation. This is the real "inherent advantage" that must be protected and which the railway must be free to exploit.

And how does the railway set about obtaining this large volume of traffic? Fundamentally by pricing its product in such a way as to attract the greatest tonnage. How to keep the price of the product as low as possible, while making an adequate, or more realistically the highest, profit concomitant with the fulfilment of service obligations to the public, is a proper statement of the problem.

Naturally the first reaction to this requirement is to decide that each transportation movement must be priced at least high enough to pay all the costs of producing it and as much more as can be obtained. But this is impossible, unless the railway chooses to give up that major inherent advantage of high overheads and decreasing unit costs, which it could not do even if it would remain in any modern sense a railway. Fortunately the real solution is even better, incorporating as it does another major "inherent advantage."

This second major inherent advantage is the fact that railway transportation is a classic example (in the terminology of the economist) of "joint product." The full cost of any particular movement of goods by railway is indeterminate. Not only is the total cost of any particular movement indeterminate, but only a small part of the known elements of cost can be directly attributed to the movement in question. Furthermore, most of the costs go on whether the individual movement takes place or not. The result is that the lowest price at which the railway can offer any particular service — and remain solvent — is one which just recovers the directly attributable "out-of-pocket" costs. The most important fact about this price is that it is usually very low. That is a real advantage and "inherent" in the fullest sense. Any price lower than the sum of the out-of-pocket costs would attract freight which it would be better to do without. Freight which pays more is advantageous for the railway to obtain —except to the extent that it may prevent the handling of some other freight which would pay an even higher rate relative to out-of-pocket costs.

That is not to say that this low "out-of-pocket cost" rate is that which should be charged. Very seldom would this be the case. The correct rate, once the out-of-pocket cost point has been surpassed, is that which results in the largest gross revenue, i.e., tonnage times the price or rate. The importance of this proposition is most clearly seen when considered along with another elementary economic observation: that generally, but with many modifications, the lower the price, the more goods will be purchased. The railway's inherent advantage is that it can, in pragmatic search for this price at which the maximum return will be obtained, lower rates further than most of its competitors.

It will have occurred to anyone familiar with the subject that all that has so far been written is no more than has been said in one form or another in even the most elementary texts on transportation economics. Nothing new has been said, nor was it intended to be otherwise. The basic facts have been known for many years, but has become obscured both by their simplicity and by the welter of social, as contrasted with economic objectives being sought by the many regional and political interests that combine to constitute the nation. They have diverted our attention from a purely economic phenomenon of great importance to our material welfare. Our purpose is to redirect attention to it, for even some railway managements seem to have overlooked the fundamental importance of this advantage.

What action then is indicated? First, would seem to be the direction of railway accounting talents to closer and more illuminating studies of out-of-pocket costs in connection with all important sources and types of traffic. Furthermore, it is not enough to make the studies—they must be presented to the sales management, or traffic departments in transportation parlance, in forms that will make the information informative. The fact that railway costing is perhaps the most difficult of all industrial costing is no reason for abandoning it. Rather it is an incentive to develop it in spite of its problems. Without appropriate cost information railway rates cannot be properly determined, in the sense that the resultant rate will supply service to the nation at the lowest possible cost per unit of transportation and at the same time provide a maximum of service, and as large a profit as possible. That is what railway management is supposed to be doing.

Detailed studies of the major sources of traffic should also be made to determine as closely as possible the rates that will bring about the greatest gross revenue. Skilful use of pricing is needed to capitalize on the railway's inherent advantages.

Secondly, the railways should work unremittingly to regain the right to price their own product. Restrictions, based primarily on monopoly conditions or the threat of such conditions, on the right of the railway to set its own prices, should be removed except where such conditions actually continue to exist.

The railways should therefore object most strenuously to the use of freight rates as a means of subsidizing geographic areas, political entities, industries or products. Railroading is a business, and tampering with prices always produces side effects and distortions of economic use, which finally increase the total cost of the national product and benefits other than those for whom the subsidy was originally conceived. Railway or other transportation rates should not be used as instruments of national policy, and the railway should reject all such proposals no matter what carrier is involved, and no matter how enticing the bait that is offered.

In this connection, the railways should strive to have removed the highly legalistic limitations on rate-making. In this day and age an "unreasonable" rate should be one that is clearly below out-of-pocket costs, or so high as to be extortionate in the absence of competition, and proof of absence of competition should be a required condition to support the charge. "Unjust discrimination" likewise should apply only where conditions are very similar, and where lack of competition suggests the possibility of quasi-monopolistic action on the part of the railway. The railways must keep in mind, however, that shippers will never let them attain the removal of these limitations until they are satisfied as to the railways' ability and intention to price their services efficiently and fairly.

The railways' inherent pricing advantage is only fully applicable when all competing carriers have charged against them the full cost of their operations. Therefore the railways should continue their fight to put their competition on a full-cost basis.

In implementing this program the railways should be careful to avoid vindicativeness and super-showmanship, not underestimating the essential intelligence and good taste of their public. Since much of what is proposed implies the need for a different social and political outlook on the part of the citizens of the country, the railways must engage in a broad program of economic education for the voting public, not the selling of a small number of "ideas" or slogans chosen for their ease of "recall" rather than factual context.

Many of the railway's problems are political in its most inclusive sense. It has been demonstrated many times that what the voter knows and understands the politician will soon learn and apply. The greater appreciation the public attains of the economic facts of life, the more certain that public policy will reflect that understanding.

Governments of course should review their approach to control of competitive business enterprises, and direct their attention to the maintenance of unsubsidized competition.

However, we must not expect governments to act with any strength unless the voting public understands and approves of such proposals, as there are too many short-term advantages to be gained from the present practices. The railways will have to create circumstances in which changes are possible, and they can do this only by taking their story to the people intelligently, moderately and persistently, and by practicing what they preach. They would do well to remember that their own employees as well as those of competing carriers are part of that public.

In summary it is held that the primary inherent advantages of the railway is its ability:

(1) To handle large volumes of heterogeneous traffic at low costs;
(2 To accept added volume at small additional cost of operation; and
(3) To price its service in such a way as to attract the larger volume required to reduce costs. The railway must exploit these advantages fully, and campaign intelligently and unremittingly to maintain conditions under which such exploitation is possible.

## THE ENGINEER'S TASK IN FUTURE WARS

Major-General G. N. Tuck, C.B., O.B.E.

*Chartered Civil Engineer,* November 1953, pp. 17-18.

The shape of any future war will be profoundly influenced by the advance of science and the engineer applications of new discoveries. If there is another major war it is likely to be very different from the last, and successful military planning will depend upon skill in adopting novel methods to fit the new conditions. New conceptions, those of "Mulberry" flavour stemming from an engineering approach to a strategic or tactical aim, may well govern the military solution. Two conclusions are drawn. Firstly, the importance of the close collaboration between the Royal Engineers and the civil engineers in engineer planning and engineer organization for a major war. Secondly, the Author suggests that civil engineers should contribute to military study with the aim of suggesting new solutions to strategic and tactical problems which become possible through technical progress; they will not be taking a full share in defence if they hesitate to express their views until a firm engineer requirement is specified by the Services.

In the land and tactical air force battle, greater effort may well be required on defensive and protective works. Machinery and prefabrication may help to solve defence problems. New types of obstacles to land forces which are cheaper, lighter and easier to handle, are required.

Equipment and assault bridging is of military rather than civil interest because the problems are special ones. The army's new designs to handle greater loads with simplicity of construction, light and handy components and ease of transportation, represent a great advance on last-war bridges. Modern military loads entail classification and strengthening of civilian bridges; many main road bridges even in the United Kingdom are not strong enough.

Airfields, and in particular hastily made airfields for the deployment of tactical air forces, present new problems due to wheel loading and jet resistance. Soil stabilization and new types of airfield surfacing are two lines of approach, but as yet no solution has been found to satisfy both the time factor and the operating requirements.

Among a long list of other tasks are fuel supply pipelines, "across the beach" delivery of commodities, rapid repair and construction of roads and railways, accommodation, field workshops, field tools, power supply, lighting and illumination including project illumination, and stores handling.

Military plant and equipment must be, where possible, the standard British made civilian product. Often the incorporation of some feature essential to military use can enhance the commercial value of a civilian machine, certainly for those designed for use in undeveloped countries. Collaboration between the Army and civilian makers is an important feature in defence preparations, and civil engineers are playing an active part in collaboration with the Royal Engineers, in the study of engineer tasks in war.

## TITANIUM:
### Tests on New Alloy Continue

*The Iron Age,* v. 174, n. 1, July 1, 1954, p. 72.

A titanium alloy that after proper heat treatment, has given tensile strength up to 192,000 psi in limited testing has been reported by Col. B. S. Mesick, commanding officer of Watertown Arsenal, Watertown, Mass. The alloy, a titanium-aluminum combination with beta stabilizing elements, was developed by Armour Research Foundation.

The material marks a major accomplishment in a 3 year titanium research program and the present announcement follows about 7 months of testing on alloys of this particular type. At least one 1000-lb. commercially produced ingot of the alloy has been shipped for further testing and other large ingots have been ordered. If test results confirm expectations, it is probable that general specifications for the material will be ready in 4 months.

# From Month To Month

**Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers**

## "Hands Across the Sea"

As a further development in the close and friendly relationship which has long subsisted between the two societies, the Council of The Institution of Electrical Engineers and the Council of the Engineering Institute of Canada recently have entered into arrangements whereby, in certain cases, no entrance fee will be payable when an applicant who is already a member of one is elected to membership of the other.

The following are the conditions under which the entrance fee will be waived:

1. On election to the Engineering Institute of Canada, if the applicant

> Is a Corporate Member or Graduate of The Institution in good standing, permanently resident in Canada, and
>
> Makes application within twelve months of his taking up residence in Canada or, if already resident there, within twelve months of the appearance of this notice.

2. On election to The Institution of Electrical Engineers if the applicant

> Is a Member or Junior Member of The Engineering Institute of Canada in good standing, permanently resident in Great Britain, including Northern Ireland, the Isle of Man and the Channel Islands, and
>
> Makes application within twelve months of his taking up residence in Great Britain or, if already resident there, within twelve months of the appearance of this notice.

The Councils of the two societies hope that the introduction of these arrangements will lead to a still further strengthening of the links which bind them.

## Institution of Electrical Engineers and Engineering Institute of Canada Reach New Agreement

The Institution of Electrical Engineers and the Engineering Institute of Canada have concluded negotiations whereby a member of one organization may become a member of the other, without payment of the entrance fee. (See official notice in this issue of the *Journal*).

These negotiations go back to 1952 when the president and secretary of the Institution were in Canada and visited with some of the members in cities such as Toronto, Ottawa and Montreal. At that time it became apparent that many members of The Institution of Electrical Engineers had come to Canada and that it was possible the Engineering Institute could be of service to them.

In accordance with the policy of the Conference of Commonwealth Engineering Institutions, all members of the affiliated institutions of the Commonwealth were given 12 months "guest" privileges when visiting or moving to another country represented on the membership of the Conference. Thus it is that the members of the Institution of Electrical Engineers in Canada have been welcomed by the Engineering Institute of Canada branches and invited to their technical meetings and the social events as well. The new agreement now provides membership beyond the 12 months period, on a preferred basis.

This agreement will be a matter of satisfaction to Institute members, and in particular to branch officers. It should result in many new members and increased activity in the field of technical meetings. Perhaps new members from the electrical branch of the profession will encourage more branches of the Institute to establish technical sections, and in particular electrical sections. The Institute and the branches are set up in such a way that any branch can have all the specialized technical meetings they wish. A transfusion of electricals from the British Institution should go a long way in extending the technical program of several branches.

## Cover Picture

The cover picture relates to the paper "Engineering Aspects of the Peribonka Developments" which starts on page 1051 of this issue. It is a view looking west along the downstream side of the intake at the Chute-à-la-Savane power house of the Aluminum Company of Canada Limited, showing 161-kv. transformers and buswork.

### Wide Co-operation

The Institute now has agreements for co-operation extending special privileges to the members of many organizations. Perhaps it will be interesting to list them here. First there are the agreements with the provincial professional organizations. With the exception of Quebec where it does not apply, the arrangement includes a joint fee and joint meetings. The organizations with whom such agreements apply are the provincial professional associations in Nova Scotia, New Brunswick, Manitoba, Saskatchewan, Alberta and the Corporation of Professional Engineers in Quebec.

The first written agreement made with an organization outside of Canada was with the American Society of Mechanical Engineers. This has been operative for 11 years. Right now the International Joint Council is considering an extension of this agreement whereby additional benefits may be available to members of both organizations.

Through the joint undertaking of the Conference of Commonwealth Engineering Institutions, the Institute has agreements with the national institutions in New Zealand, Australia, India, South Africa, Rhodesia and the United Kingdom. In the latter case, there are three institutions included, the institutions of civil, of electrical, and of mechanical engineers.

Another agreement is referred to elsewhere in this *Journal*. It relates to the recently formed Canadian Aeronautical Institute. The Council of the Institute has officially approved arrangements whereby the Engineering Institute of Canada members on joining the new organization are given certain special benefits, including a reduction in their fee.

Counting up all the organizations concerned, the Institute now has agreements with nineteen engineering societies.

## Ceremony at Government House

An occasion of unusual importance and interest to all engineers in Canada, was the presentation to His Royal Highness the Duke of Edinburgh, of a certificate of Honorary Membership in the Institute. This took place in Government House, Ottawa on Thursday, July 29.

It is not likely that any one of the seven members in the delegation, will ever forget the occasion. To have almost an hour of Prince Philip's undivided attention, in a delightfully informal atmosphere was an experience to remember.

The Institute is indebted deeply to His Excellency the Governor General Vincent Massey, for arranging the presentation at Government House and for being present with his aides throughout the ceremony.

**Presentation of a certificate of honorary membership to His Royal Highness the Duke of Edinburgh, Rideau Hall, Ottawa, July 29, 1954. Left to right: L. Austin Wright, general secretary, E.I.C.; B. G. Ballard, Ottawa, vice-president; G. R. Henderson, Sarnia, vice-president; C. J. Mackenzie, Ottawa, past-president and honorary member; His Royal Highness the Duke of Edinburgh; His Excellency the Governor General The Right Honorable Vincent Massey; Irving R. Tait, Montreal, vice-president; Donald M. Stephens, Winnipeg, president; J. O. Martineau, Quebec, vice-president.**

His Excellency's secretary, Mr. Lionel Massey, had much to do with the details that made the event so pleasant. The Institute's thanks are due also in great measure to Lieut. Commander Michael Parker, R.N., the Duke's private secretary. He was very helpful in the negotiations which led up to the acceptance of Honorary Membership by His Royal Highness, and that culminated in the certificate presentation.

The Institute party present for the presentation was made up of the president D. M. Stephens of Winnipeg, two vice-presidents from Ontario, Guy Ballard of Ottawa and Gordon Henderson from Sarnia, two vice-presidents from Quebec, J. O. Martineau from the City of Quebec and Irving Tait of Montreal, past-president and Honorary Member C. J. Mackenzie of Ottawa and the general secretary.

In making the presentation the president pointed out that in the Duke's tour of the northland, he would see for himself the work the engineers were doing in the gigantic task of nation building and that the engineers were proud that he had consented to be associated with them. (The full address follows).

The program and itinerary for the tour were in the hands of an engineer, a graduate of Saskatchewan in civil engineering, Group Capt. E. A. McNab, R.C.A.F. The Institute is indebted to him for the interest he took in making possible this presentation under such ideal conditions. Another interesting and interested member of the group of aides was Captain Adam Butler whose father is the Chancellor of the Exchequer of Great Britain.

Of all the brilliant events that make up the history of the Institute, it is doubtful if any exceed this, in significance, importance and in genuine satisfaction.

### The President's Address

Your Royal Highness, Your Excellency, Gentlemen,

To His Royal Highness I should like to say, on behalf of the Council and membership of The Engineering Institute of Canada, that we appreciate very much indeed, Sir, the fact that you have graciously consented to become associated with us through accepting Honorary Membership in our Institute.

To His Excellency the Governor General I should like to express my own appreciation and that of my colleagues for your kindness, Sir, in permitting us to meet for a few moments with your eminent guest, His Royal Highness the Duke of Edinburgh. We appreciate very deeply your further kindness, Sir, in having graced this occasion with your own distinguished presence.

Perhaps before presenting our Certificate of Honorary Membership I might be permitted to say to him that The Engineering Institute of Canada is an organization which embraces within its membership professional engineers from every one of the many specialties which are practised in the engineering fields today. In the Engineering Institute of Canada we are joined together not only by our common professional ties but through our Institute we seek to enhance the effectiveness of engineers and engineering in the development and strengthening of our country.

We know something of the interest which His Royal Highness is taking in the industrial and economic health of the United Kingdom; and we know something of the enthusiasm with which his interest and his leadership are being accepted by the engineers and industrialists of Great Britain. The members of our Institute, like all citizens of the Commonwealth, are proud of the great work which His Royal Highness is doing for the Commonwealth and the increasing strength and vigour and effectiveness which his influence and leadership are already gaining for our family of free nations.

As engineers of Canada we are gratified to know that in the course of the next few days His Royal Highness will visit so many of Canada's newest developments and that he will witness at first hand something of the tremendous strides that are being taken in our subarctic region.

How to give to Canada an economic breadth more nearly to conform with its geographic breadth —that has been the primary challenge to our generation of Canadians! As he visits our northland in the next few days His Royal Highness will see, and we know he will appreciate, how vital is the role of the engineer in establishing these new industrial frontiers well into the higher latitudes of Canada. At each and every point on your itinerary, Sir, you will find fellow members of our Institute and you will, I am sure, share our pride in the work that our engineers are doing in this gigantic task of nation building.

I am now going to ask you, Sir, to accept this Certificate of Honorary Membership in The Engineering Institute of Canada. The engineers of Canada are proud that you have consented to associate with us. We hope that you will find in this membership another instrument to your hand, and in our Institute yet another vehicle to aid you, Sir, in the work which you are doing for our family of nations and through them for all free men everywhere.

I am sure that my colleagues in the Council and all members of The Engineering Institute of Canada would feel particularly happy if you would be so kind as to convey to Her Most Gracious Majesty Queen Elizabeth a message of the warmest affection and loyalty from the entire membership of our Institute.

## It Took 250 Million Dollars

At 10 million tons a year it will take over 40 years to exhaust the supply of iron ore, already blocked out at Knob Lake. The attack on this huge mass of potential wealth was started officially on July 31st, through the medium of a ceremony held at the new town of Seven Islands in Quebec.

The *Engineering Journal* has published three papers on this project* so there is little technical material to repeat now. However, the president and general secretary of the Institute were guests of the company at the inaugural ceremony and an occasion of this kind is too significant to Canada, to be passed over without comment.

Preparations for the inauguration were very elaborate and far reaching. A cruise ship was chartered to transport the bulk of the guests from Montreal, but many came by air as well. A press party of over fifty were sent down by rail to Mont Joli, and then flown over to Seven Islands. Several C.P.R. passenger cars were shipped from Montreal so the guests could make a trip of 20 miles on the new railway to see the largest tunnel and the longest bridge on the line.

There was to be a great assembly outdoors to hear speeches and to see the Premier of Newfoundland and the Premier of Quebec push

*The Location and Construction of the Quebec North Shore and Labrador Railway, B. M. Monaghan, M.E.I.C., *Engineering Journal*, July, 1954.

Menihek Power Development, L. A. Carey, Jr.E.I.C., *Engineering Journal*, May, 1954.

Reconnaissance of the Labrador Railway, 1945, D. A. Livingston, M.E.I.C., *Engineering Journal*, April, 1954.

The first steamship taking iron ore from Seven Islands to Philadelphia.

two buttons that tipped two cars and started the ore towards the ore carrying steamer standing at the nearby pier. Unfortunately, the weatherman was not in the mood, and the assembly had to be transferred hastily to a large freight shed.

To one who had flown up to the ore field at Knob Lake previously, it seemed clear that no one who had gone only as far as Seven Islands, could ever get any conception of the gigantic work which had been accomplished. Of course, it was impossible to fly that huge crowd to the end of the line, but it did seem too bad that they would see only Seven Islands and go away with the idea that that was all.

This project of the Iron Ore Company of Canada staggers the imagination, not only because of the difficulties overcome in building the railway, but even more because of the economic impact it will have on Canada's economy. Think of what 10 million tons of ore a year can mean eventually to Canadian industry. Think of what it means to our national defence. Think of the colossal treasure house that is now open to man—and all under the control of this great country.

Great credit is due the hardy people who persisted in promoting and building this enterprise. The story of discovery, financing, design and construction is one of the thrilling tales of this country. This member of the Seven Islands audience was disappointed that none of the several speakers took much (or any) time to give credit to the people who had made it all possible. Here was a time for acknowledgement and tribute, but the opportunity was lost.

This little railway, 358 miles long will be a busy one for several months of the year. Although only single track, it has 22 passing tracks, and a theoretical capacity of 42 trains a day, each of over 100 cars. It will be able to handle easily 20,000,000 tons in a season, when the yard facilities are enlarged.

It is strange to contemplate that the port of Seven Islands may well become the busiest port in Canada. Montreal now handles about 15,000,000 tons of shipping a year. Seven Islands is certain to go beyond that figure with iron ore alone. When you consider the proposals there are for hauling grain to elevators to be built at Seven Islands, and of railway connection to Montreal, it becomes a bit staggering.

Coming back to the ceremony—the chairman for the day was Mr. Jules R. Timmins of Montreal, who certainly seems to be the one who most merited that honour. Hon. George M. Humphrey, secretary of the Treasury of the United States, and a former president of the Iron Ore Company, made an excellent speech as did also Mr. Joseph H. Thompson, president of the Company. The meeting finished up with two talks from the two premiers, and of course the pressing of the two buttons referred to earlier. Unfortunately, the altered location of the meeting, made it impossible to see the two cars that were supposed to tip at the press of the fingers, but it is assumed that everything went off as arranged.

The inaugural ceremony was a tremendous undertaking, as it should have been, to mark the start of another colossus in the business affairs of Canada.

## A New Institute Makes Its Bow

For some years there has been an interest, manifested through much correspondence and several meetings, in setting up in Canada, an organization devoted wholly to the technical matters associated with aeronautics and aircraft.

The Engineering Institute has been a party to the discussions and to the negotiations. The final proposal was approved by the Council of the Institute, and their support was demonstrated by a modest financial contribution to the funds of the new society.

The first president of the Canadian Aeronautical Institute is Dr. J. J. Green, immediate past chairman of the Ottawa Branch of the Engineering Institute. This is an early and splendid indication of the close collaboration of the two institutes. The inaugural meeting of the Aeronautical Institute and Dr. Green's induction took place at the Chateau Laurier in Ottawa on May 25. The Engineering Institute was represented officially by Guy Ballard, a vice-president of E.I.C.

The Canadian Aeronautical Institute starts out with the good wishes and the support of other organizations as well as the Engineering Institute. For instance the Royal Aeronautical Society is another of the sponsors. They were represented at the inauguration by Dr. Ballantyne, secretary of the society. Similarly the Institute of the Aeronautical Sciences (Headquarters in New York) is a backer of the Canadian Institute. They too were represented at the inauguration by their secretary, Robert Dexter. The I.A.S. have had branches in Canada but these have now been merged with the C.A.I.

For many years the Engineering Institute endeavoured to meet the needs of its members—and others—in the aeronautical field by the operation of an aeronautical section at Ottawa. A partner to the activity was the Royal Aeronautical Society. The Ottawa group functioned excellently but when war broke out, all activities ceased, for obvious reasons.

After the war, the Ottawa members of the Engineering Institute who were interested in the subject, started a study of the post-war position to see if a new co-operative agreement could be devised and made operative. The situation had changed considerably. The chief factor was that Canada was now in the aircraft business in a big way. It was no longer a matter of research, development and design. This meant that many people other than engineers were interested in a society.

As an indication of the change it should be noted that the Institute of the Aeronautical Science had come into Canada, with a strong branch at Toronto, and Montreal. This organization had grown to great strength in a remarkably few years, and was doing a fine work in the United States. They had definite advantages to the aeronautical people, as compared to the Ottawa activity. One of these of prime importance in these considerations was that their membership is not restricted to engineers. There are many people in the industry who are not engineers and therefore the Engineering Institute could not serve them.

A further factor that was influential in the creation of an all Canadian aeronautic institute, was that the situation was confused by the presence and activities of so many societies endeavouring to cater to the same people. Besides the I.A.S., the R.Ae.S. and the E.I.C., there was the Institute of Aircraft Technicians. In the midst of this overlapping it seemed only logical that a new, all-embracing organization should emerge. The Canadian Aeronautical Institute is the outcome.

By a feat of imagination, daring, and intelligence the organizers of the new group brought about a miracle . . . or at least a near miracle. They have obtained—in writing—the full support of all the organizations that previously competed within the Canadian field. This support is not just theoretical. It is real, as is shown very substantially by financial contribution from all organizations. In return the C.A.I. gives the members of these organizations special reductions in their fees. It looks like a fine arrangement, though a novel one.

The officers and the members of the Engineering Institute wish the best of everything for the new society and assures them that they are proud to be associated with them and at all times are willing and ready to co-operate, to collaborate and to help.

# A Qualifying Condition

For many years prior to the late war, the Civil Service Commission of Canada and the Department of National Defence used "qualifications for membership in the Engineering Institute of Canada" as a criterion of qualifications for employment by the government or for a commission in certain branches of the armed services. During the war the demand for technically qualified persons became so great that these standards had to be abandoned. There just were not enough with E.I.C. qualifications to fill the vacancies.

During the war and subsequent to it, the provincial professional associations suggested to the Civil Service Commission that qualifications for registration should be used as a standard. For several years no decision was made by the Commission, but recently a suggestion has been made that seems wise and statesmanlike. It should solve the problem to everyone's satisfaction.

The Engineering Institute has been asked to sanction the following wording for use by the Civil Service Commission in seeking engineers. One of the qualifications shall be "graduation from an accredited course in engineering and qualifications that would permit of membership in a provincial association or the Corporation of Professional Engineers and/or the Engineering Institute of Canada."

Recent advertisements for engineers, published by the Commission have been using this wording.

# Recognition

If we recall correctly, the Canadian Fairbanks-Morse Co., Ltd., were one of the advertisers in the very first issue of the *Journal* and have been with us ever since, so we regard them as quite of our family. Our latent feelings of kinship with them have been brought to the surface by the recent receipt of a collection of half a dozen proofs of advertisements they propose to run in various periodicals in the near future.

To receive advance copy of this kind is not unusual, but at the moment we cannot recall ever having seen any advertising just like this, built up as it is around the theme of paying tribute to the engineer. Perhaps its purpose can be best explained by quoting, though not verbatim, from the announcement accompanying the proofs:

> The skill and ability of the professional engineer are the cornerstones on which Canada was built. The roads and railways that brought settlers, the development of natural resources, the creation of modern cities and industrial plants, have been in the capable hands of the engineer. How well these tasks were accomplished is reflected today by our industrial and commercial might. The engineer's contribution to our way of life is found everywhere.
>
> To assist the engineering profession to obtain the recognition it so richly deserves, the Canadian Fairbanks-Morse Co. is pleased to present the series of advertisements you will find on the pages of this booklet. These will appear in magazines and newspapers in all major cities from coast to coast, so that millions of Canadians may see and more fully appreciate the meaning of the words "professional engineer".

No doubt many other firms feel as the Canadian Fairbanks-Morse Co. do toward the engineer, but so far, to the best of our knowledge, this is the first of our advertisers paying so great a tribute to him.

Our own readers do not need to be reminded of the importance of the engineer in modern life, so perhaps one might feel that the publication in the *Journal* of advertisements such as these would produce little impact. But note that these will appear "in magazines and newspapers . . . from coast to coast", which means that some, at least, will be read by those who are not engineers and so have a hazy conception, if any, of what engineering is all about.

These advertisements are an indication that hard-headed business believes the engineer is entitled to more recognition than he gets. These advertisements are a graceful gesture, a tribute, which will be appreciated by all engineers and we hope, by the public as well.

# Engineering Education

Education is not static; it changes with the needs and ideals of the times. Perhaps its process of continuous evolution is most evident in education for the medical and engineering professions, which must keep pace with new discoveries and changed concepts. Certain it is that today's engineering curriculum is far different from the one to which the writer was exposed fifty years ago. The emphasis is now on the fundamentals, where it belongs, and little attention is paid to turning out graduates who have acquired some little skill as draughtsmen, surveyors, pattern makers or machinists.

But most engineering educators are still not satisfied with things as they stand. They think that teachers, teaching and curricula can be improved and no doubt they are right. So in May, 1952, the American Society for Engineering Education appointed a Committee on Evaluation of Engineering Education, whose interim report of June 15, 1954 has just reached our desk. Too long to reprint or even to abstract satisfactorily here, it is certainly comprehensive, running, as it does to some 11,000 words, plus two short appendices, and based on opinions expressed by 122 engineering schools in the United States and in Canada. One suspects that most of the conclusions and recommendations represent the reactions of the United States schools; this writer does not believe that all of them reflect current Canadian opinion.

The objectives of engineering education are set forth at considerable length; a "set of specifications" for the ideal engineering faculty is proposed; the qualities desirable in an engineering curriculum are explored and a more or less "perfect" curriculum is outlined.

The ideal engineering teacher is pictured as such a paragon of perfection that it is hard to imagine that more than, say, 30 per cent of us—the writer has been *trying* to teach engineering subjects for most of his professional life—could even begin to qualify under the usual university pass mark. To our mind, too little emphasis is laid in this report on the personality of the teacher and too much on his professional attainments.

We think the discussion on curricula will be generally approved in Canada, and is less upsetting to us than it probably will be to some schools in the United States. Canadian schools have never been fond of bits-and-pieces curricula; they have managed to stick pretty well to the fundamentals and the changes in curricula they have made have been mainly in the direction of more training in the basic sciences.

Notwithstanding that, practically every reader of this report will disagree with parts of it, he will also agree with it in general. It is really remarkable that the 52 members of the Committee could produce a report which reflects so little difference in opinion.

A minor criticism, but a criticism from this writer's point of view, is that the report is hard to read. Though in impeccable English, it would be improved by the occasional use of a monosyllabic word with an Anglo-Saxon root, *vide* the Duncan report on coal mining in Nova Scotia.

For copies of the report write to the general secretary E.I.C. 2050 Mansfield St., Montreal 2.

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# C.T.A. Golden Jubilee Meeting

The Canadian Transit Association's 50th annual meeting was held at the Algonquin Hotel, St. Andrews, N.B., June 14—16, 1954, with some 200 delegates in attendance. They were welcomed to the Province by the Hon. D. L. MacLaren, P.C., the lieutenant governor of New Brunswick. M. T. Bancroft of Quebec City was elected president of the Association for the ensuing year.

President S. Sigmundson of Vancouver, in his presidential address, told the representatives of transit companies from coast to coast that their industry had failed to come to grips with its mammoth competitor, the private automobile. While the auto industry has glamorized its products and sold them at higher and higher prices, transit had not emphasized the services it sells and what these services mean to the public.

"The business which should be channelled to surface transit services", he said, "is going to the private automobile because the transit industry has been too poverty-conscious in its thinking and too unimaginative about what people are willing to pay for a product they want".

### Annual Report

In his annual report, the general secretary, H. E. King drew attention to the growth of the Association since receiving its charter fifty years ago. Membership had grown from 12 in 1904 to a total of 110 in 1954,

**Officers and guests of the Canadian Transit Association, at the recent annual meeting. Left to right: D. E. Blair, Montreal, a charter member; M. T. Bancroft, Quebec, president; and S. Sigmundson, past-president; back row, Stuart E. Preston, Kitchener, vice-president; and H. E. King, general secretary.**

made up of 35 active member companies, 71 associate member companies and 4 associate members.

Revenue passengers carried had risen from 18,200 in 1904 to 830 million in 1929 and to 1,223 million in 1953, while passenger revenue showed a rise from $8.93 million in 1904 to $126.6 million last year. "Over this fifty year period average wage rates had roughly tripled in each 25 year period", he stated, "though fares had by no means followed this trend".

Comparing operating expenses for 1953 with those of the previous year for 29 companies reporting, 15 of them had reported increases in revenue and 14 a reduction; 18 companies had shown increased operating expenses while 11 had reduced their cost of operation.

The basic adult fare structure for 35 comparable properties ranges from a high of 15c cash or 4 tickets for 50c, to a low of 10c cash or 3 tickets for 25c, he reported. The predominant fare combination which prevails in 17 of the 35 properties is 10c cash or 3 tickets for 25c.

#### Better Leadership Needed

Mayor D. H. MacKay of Calgary, in an address on "What is Required of Public Transit ?", declared the answer could be summed up in the words, "Wanted, Better Leadership". Speaking as a public official, he said, he was impressed with the need for the transit problem to be fully understood by the public at large.

Everything was being done today to encourage more and more vehicles to come into the downtown area, while nothing was being done to alleviate traffic congestion. Emphasis had been placed by those who hadn't the interest of the transit vehicle at heart, on the need for accelerating the movement of vehicles. We had listened to that voice too long and it had been too effective, he stated. Off street parking facilities, one way streets, traffic control, all these were designed to bring more vehicles downtown. Caught right in the middle of them was the transit vehicle.

Yet today at least 70 per cent of the purchasing public were travelling downtown by transit. This must be told more emphatically and effectively, and the time to tell it was now, before it was too late. "We need more leadership in the selling department of our transit industry to convince people that we must work in terms of the best interests of the majority. We must give the green light to the transit efforts of every community", he warned.

Transit officials, continued Mayor Mackay, had an important story to tell. No one else would do the sales job for them. A sound educational and promotional approach to the transit industry could accomplish the ideal of changing the whole plan of public thinking on the problem.

#### Strikes Reveal Importance of Transit

George Anderson, executive vice-president, American Transit Association, speaking of transits' achievements during the past year, told the meeting that in large American cities provision of express bus service and the adoption of zone price rates were devices now being used to attract fares. Many cities were currently installing "premier parking lots", where the car owner may park his automobile at the outskirts of the business area and ride on a bus to work. Greater amounts of transit revenue have melted into the air in the U.S.A. than in Canada, he said, because the Canadian organization had exerted more rigid control over its affiliates.

"Strike action by transit employes can be beneficial to the transportation industry as well as harmful", continued Mr. Anderson. "A mass-scale walkout has the tendency to reveal to the public the vital importance to a city of its transit service. While such strikes will have only a temporary effect on the industry, public apathy can often ruin a transportation concern".

#### Trolley Buses Losing Popularity

A symposium on the question: "Has the trolley coach lived up to expectations ?" was conducted on the final day of the meeting with five speakers, under the chairmanship of H. W. Tate of the Toronto Transportation Commission. George Anderson stated that trolley buses were backsliding in the United States and losing their appeal. Many American cities are finding installation of the overhead electric wiring systems used for trolley buses too inconvenient, he stated, due to continual changes in city planning.

Other speakers included L. Wingerter, president of ATA whose subject was "Signposts on the Road to Better Earnings"; Dennis O'Harrow, executive director, American Society of Planning Officials, who spoke on "Town Planning and Public Transit"; and C. E. DeLeuw of Chicago, who discussed "Transit Planning for the Future".

#### Charter Member Recalls Early Days

D. E. Blair of Montreal, only surviving charter member of the CTA was presented with a sterling silver cigar box in recognition of "his magnificent contribution to the transit industry in Canada". In his reply, he recalled some of the changes that had occurred over the fifty-year period. In the early days, he said, cars were equipped with hand brakes only. Contrary to some government regulations, he had proved by demonstration that cars could be stopped quicker with hand brakes.

Mr. Blair told of the early battles to maintain transit service during the winter months. In March 1901, Maple Avenue in Quebec City was blocked two weeks by snowdrifts, with no organization for snow removal as exists today. Drifts were so high that men had to be stationed to warn people not to touch the trolley wires. One year in Cartierville a rotary snow plow was kept in use 24 hours a day for a whole month without entering the shops for inspection.

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## ECPD Survey on Awarding Professional Degrees

The Recognition Committee of the Engineers' Council for Professional Development, under the chairmanship of R. H. Barclay, has completed a survey of the awarding of the professional degree by various engineering institutions. The survey, with its excellent response—of the 146 institutions sent questionnaires 142 responded—will serve as a basis for formulating recommendations concerning the practice of awarding the professional degree as a means of professional recognition.

Of the engineering schools surveyed, 86 award the professional degree while 62 do not. Of the 86 awarding the degree, 74 use professional experience as a basis for awarding the degree, 8 require resident graduate study and 4 include both professional experience and resident graduate study as prerequisites for awarding the professional degree.

In regard to their future plans concerning the professional degree, 69 colleges will continue awarding the degree, 2 will institute the professional degree, 13 will abandon it, 49 will continue not to award it, and 17 are uncertain as far as future plans are concerned. The survey shows that approximately 1/5 of the schools offering the professional degree have either dropped it or are making plans to do so.

The Committee also reported an increase of approximately 80 per cent in the awarding of professional degrees in the last five years as compared with the previous five-year period. In the last 10 years, 1387 to 1398 professional degrees have been awarded, and of these, 917 to 922 have been awarded during the last five years.

The Committee believes this survey to be the most comprehensive of its type ever undertaken and will use it in formulating recommendations on the practice which they believe should be followed in respect to awarding the professional degree as a means of professional recognition.

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# Chemical Institute Conference

The Chemical Institute of Canada held its 37th annual conference and exhibition at the Royal York Hotel, Toronto, June 21-23, 1954. E. R. Rowzee, F.C.I.C., vice-president and manager, Polymer Corporation, Ltd. of Sarnia, was elected president for 1954-55, with Dr. Roger Gaudry of Montreal as vice-president. Dr. Garnet T. Page, 18 Rideau St., Ottawa 2, continues as general manager and secretary. Forty prominent Canadian chemists and chemical engineers were elected as Fellows of the C.I.C. Dr. R. K. Stratford of Imperial Oil Ltd. was presented with the C.I.C. Medal for his outstanding contributions to Canadian chemistry and chemical engineering.

**L. E. Westman Memorial Address**

Dr. Linus Pauling, outstanding American research chemist of the California Institute of Technology, presented the annual L. E. Westman Memorial Lecture at the opening session, entitled "The Significance of Molecular Structure in Biology". Stating that recent research had shown some diseases are the result of the genetically-controlled manufacture of protein molecules with abnormal structure, he pointed out that four kinds of abnormal adult hemoglobin have been discovered so far.

In the case of sickle-cell anemia, discovered in 1945, the red blood cells are normal in the arteries but shaped like the blade of a sickle in the veins. Patients have a form of hemoglobin in their red blood cells that has different properties from normal hemoglobin. "These diseases", he stated, "are clearly molecular diseases, and while other diseases are likely caused by molecular structures, these anemias are the only ones that clearly show this factor".

**E. Ralph Rowzee, President, Chemical Institute.**

**Sound Principles of Past Must be Followed**

"It is much more difficult today for the research chemist to make a substantial contribution to scientific progress, than it was 30 years ago", observed Dr. R. K. Stratford in his C.I.C. Medal address. Noting a tendency on the part of the scientist in many fields today to neglect, under pressure of competition in manufacturing, the careful systematic work that had been the classical approach to all scientific progress, he emphasized that "little will be accomplished unless they continue to follow the sound principles of the past".

Industrial research groups must have sympathetic support and freedom of action, he added. The industrial scientist must collaborate widely with scientists in other fields so new ideas and discoveries, no matter where they originate, can be put into commercial practice. In particular, industry should be prepared to give unrestricted support to fundamental research at universities.

**Symposium on Management**

A symposium was conducted during the first day's afternoon session under the title "Molecules to Management". J. T. McCay of Montreal, speaking on "Communications and Human Relations", advised delegates to . . . "look to your words, learn what you can do with them and what they can do to you. By so doing you can develop ability to listen and observe, and these are important factors in obtaining co-operation from fellow workers."

"The success you have in getting people to work wholeheartedly with you towards a common goal" he continued, "depends on how much you know about them. The more you know, the better you can predict how they will react to what you do and say, and most of your information about them comes by listening and observing."

J. B. White, vice-president, Aluminum Co. of Canada, speaking of the training of personnel, stressed that "management, as distinct from technical work, is the job of enlisting, directing and co-ordinating human effort". There are two sides to management, he added, the technical and the administrative. Technical ability, knowing the techniques and knowledge that underlie processing, engineering, accounting, marketing, finance and sales, is a requirement for managerial work.

Besides this it is necessary to have administrative ability, which involves, among other things, the ability to get work done through and with others, to delegate, plan and organize the work of others, to be skilled in the art of conference and discussion and to develop and further the growth of subordinates. The ability to do all these things effectively is good management", he said.

Francis J. Curtis, vice-president of Monsanto Chemical Company, St. Louis, discussing "Developing Managerial Abilities of Employes", warned that "companies can no longer depend on haphazard methods of obtaining executives. It is now necessary to develop all possible candidates for executive positions. Only thus can the rapidly expanding chemical industry keep a supply of its scarcest component, top grade managers", he said.

The core of his company's system of management development was on-the-job coaching, Mr. Curtis pointed out. In his opinion this was the best way to teach a man to handle himself, to make his own judgments and to stand or fall on his actions. This plan calls for a limited amount of job rotation.

### Symposium on "The Chemical Engineer in Canada"

"The future of the Canadian chemical engineer is dependent on Canada's development in the future, and both look promising", stated Dr. J. R. Donald, president of J. T. Donald & Co., Montreal. He estimated that 9,000/10,000 engineers would be required in Canadian chemical industry by 1975, though at the present rate of graduation only 5,000 would be available by then. Thus, he urged, more students should be encouraged to study chemical engineering. Most of these graduates will be employed by the chemical industry, though a good number would go to other industries, as all industry, he noted, is becoming more and more chemical.

The greatest number will be required in plant operation and production, thus the greatest demand will be for those trained in these fields, he observed, adding that since the only answer to increased competition is lower production costs and refinement of operations, the demand for competent operators will always exceed supply.

While all Canadian manufacturing had doubled in size since 1939, the production of basic chemicals had tripled, the speaker stated. Chemical consumption in Canada would be doubled by 1975, he predicted, but the industry would only double in size if it was able to supply this increasing demand. Tariff policies would play an important role in helping the industry to meet these requirements, he said. Since prohibitive tariffs prevent the export of all important chemicals except fertilizer materials, the industry must look to Canadian markets for its future growth.

"The present trend in business is taking more engineers out of the plant and is placing them in managerial, executive, presidential and public positions of responsibility where technical competence alone is not sufficient and additional qualities are required." This was pointed out by R. R. McLaughlin, head of the Department of Chemical Engineering, University of Toronto, in discussing "Non-technical Aspects of the Training of Chemical Engineering Students".

"The rigorous student engineer is apt to regard time spent on non-technical subjects as wasted, in view of the vast amount of scientific knowledge that he should encompass," he observed. "On the other hand, the successful mature engineer is inclined to over-emphasize the importance of non-technical subjects. He realizes their importance in the later stages of his career, but forgets he has acquired them by his own efforts, and that actually his success is based primarily on his technical competence. "Technical competence", he concluded, "is paramount, although paradoxically, not at the expense of general knowledge and interests."

"The primary qualification of a chemical engineer should be a good basic understanding of the fundamentals of his branch of engineering", stated D. S. Simmons, assistant general manager, manufacturing, Imperial Oil Ltd., Toronto. "Without technical competence in your own chosen field", he continued, "you may never have the opportunity to demonstrate your other sterling qualities."

But while he must have a good grounding in basic fundamentals, his employer does not expect him to know the applications of this knowledge to industrial problems. This is something the employer expects to teach him. The value of post graduate training is that it certifies the man's intelligence, his knowledge, and his skill and imagination in applying these fundamentals. "Industry is beginning to appreciate this fact more and more", he said. "This is illustrated by the trend to an increased spread between starting salaries of those with bachelors, masters and doctors degrees."

Mr. Simmons expressed the view that it was better for the student to be put to work immediately, rather than to first have a training course. This gave the company a chance to spot the people not suited to the industry before they were there too long. Training courses, he said, seemed more profitable for men who had already proved they can handle a specific job.

### Symposium on Chemical Education

"The ultimate aim of the average scientific curriculum in high schools should be attainment of skills and logical processes of thought, with gaining of empirical knowledge only secondary". This was the view of Dr. M. R. Foran, professor of chemical engineering, Nova Scotia Technical College, Halifax.

Present day criticisms of the modern curriculum arise from too much emphasis on trying to meet the public's demands and from today's materialistic trend of thinking. This resulted in too much money being spent on modern schools and too little on teachers, he observed.

Differentiation should be made between students with greater and less ability, he believed, and while this might seem undemocratic it would lead to greater efficiency in teaching. There would be more time for thought and learning in the school if duplication of learning between the school, the home, and the community could be eliminated.

Speaking on "Occupational Guidance", H. R. Beattie of the Ontario Dept. of Education, outlined the three stages of vocational interest; romanticism, enlightenment and decision. These stages, he pointed out, lead to a period of decision when a choice must be made. These decisions are greatly influenced by the previous stages, and co-operation of the school and organizations of all kinds is necessary to ensure that romanticism is coupled with enlightenment so that the inevitable result is sound decisions. Our way of life depends on it.

Dr. W. Charles Cooper, chief chemist, Canadian Copper Refiners Ltd., advocated adequate instruction on instrumental methods of analysis in chemistry and allied sciences. Particularly important, he felt, was the need for short term courses in instrumentation for industrial chemists.

Dr. J. A. McCoubrey, of the Department of Research and Development, Canadian National Railways, outlined the problems associated with chemical plant location and the bearing some of these factors have on the final decision for a specific site. How some of these topics may be of interest to the chemical educator were outlined, with particular reference to Canada's chemical industry.

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### Technical Papers

Other technical papers were presented relating to chemical engineering, including those on the subjects of packed tower design; distillation columns; the heat pump; bubble cap tray design; cracking of ethane, cracking of hydrocarbons and pyrolysis of waste sulphite powder.

A wide range of technical papers was also presented relating to analytical, organic and physical chemistry, biochemistry, agricultural chemistry, and rubber chemistry. Many of them dealt with metallurgical subjects of specific interest to mining engineers and metallurgists. Others, such as those on biochemistry, were of particular interest to the medical profession or to pharmacists.

**Conservation**

The guest speaker addressing the luncheon meeting on the final day of the convention was F. H. Kortright, president, the Conservation Council of Ontario, Toronto, who told delegates that — "Here in North America we have broken all records in the rate of destruction of natural resources. Over one hundred million acres of fertile soil have already been rendered useless.

"Conservation is the concern of everyone", he pointed out; "there is no business that does not owe its prosperity, if not its very existence, to our natural resources. It is our responsibility to protect these renewable resources such as forests, soil, water and wildlife, for future generations, but so far we have largely ignored this obligation."

The destruction of our forest has proved most serious for it affects the rest of our resources, continued Mr. Kortright. Income loss from unwise deforestation is tremendous, and the folly of this practice is obvious when we realize that forestry products represent 30 per cent of the wealth created by our basic sources of production. Lumbering operations are conducted with little or no thought for the future.

In Ontario alone 85 per cent of once permanently flowing streams have become totally or temporarily dried up in part of the summer, thus lowering the ground water so vital to crops. Early farming methods resulted in wasteful exploitation of the soil. "We have been tragically slow to realize the vital importance of protecting our farmlands from erosion and loss of fertility", he added.

Plant tours were conducted to Victory Mills Limited; Canadian Breweries Limited; Canada Wire and Cable Company; Ford Motor Company of Canada Limited, Oakville; Canadian Industries Limited Works and Development Laboratories, and the British American Oil Company Limited refinery at Clarkson. Forty-five exhibits of chemicals and equipment were on display in the banquet hall during the convention.

# *Thirty-five Years Ago*

Comment on the *JOURNAL* of September 1919

The *Journal* for September, 1919, strikes this writer as rather dull. Excitement over the proposed model engineers' licensing act and over the bill to improve conditions in the Civil Service had receded from its peak. The two papers published were not outstanding. Council had little to report other than its routine activities. The personals referred mostly to members who were gradually returning to Canada after military service overseas. All in all, there seemed little to get excited about.

Returns from the letter ballot of June showed 475 votes in favour of the proposed model act, 138 against it and 3 spoiled ballots, a total of 616. As nearly as we can ascertain, there were then about 2,500 members entitled to vote, so those who exercised their franchise amounted to only about 25 per cent. This suggests that perhaps the issue had been receiving at least its full share of publicity. Quite apparently there were a good many members who weren't much interested, one way or the other, in trying to improve their status through legislation.

Council laid these returns on the table for future action "in view of the lengthy agenda." It also voted to buy 50 Institute badges in gold, 200 in silver and 250 in bronze and to sell them at $3.75, $2.25 and $1.50 each, respectively, "all complete and engraved with the member's name and badge number." It instructed the secretary to carry members' names on the rolls with their military titles. Council also ventured into the social field by "noting" a report on improving the education of Canadian children and by asking the Winnipeg Branch to appoint representatives to the "National Conference on Moral Education in the Schools in Relation to Canadian Citizenship". On the other hand, it refused to nominate a representative to the American Welding Society as "it was not feasible." Some load may have been lifted from Council's collective mind by the refusal of the American Association of Engineers to charter chapters in Canada.

The Civil Service bill was still somewhat in the limelight. The Toronto Branch thought the schedule of salaries suggested "not . . . adequate or reasonable" and urged "that . . . Council . . . take as energetic action as possible . . . to induce the Government to make such changes in this . . . reclassification as are necessary to provide a fair and proper remuneration to all engineers." But the Border Cities Branch wanted Council to support the proposed salary schedule as it stood.

On August 21, 1919, Montreal staged an uproarious welcome home to Gen. Sir Arthur Currie. In the course of an impromptu speech, Sir Arthur said, "I have always called a spade a spade. When a man was good, I promoted him if I could, and if he was not good, I fired him." Later in Sir Arthur's career, when he became principal of McGill University, he followed pretty much the same philosophy.

Lt. Col. Blair Ripley wrote on "Bomb-Proofing the Wimereux Viaduct." This three-span masonry bridge lay near Boulogne on the railway to Calais. Over it passed most of the supplies for the Allied front in Belgium, so its destruction would have been a calamity. More and more successful bombings by the Germans made it imperative to assure the safety of the viaduct so far as possible. This was accomplished by building timber arch centers for each of the three spans, similar to those used during construction, and by providing a "bomb bursting floor" on the deck. This floor was made of steel rails, laid parallel and alternately head up and base up. The efficacy of the scheme was never tested; the work was done in June, 1918, and the war ended the next November. In the intervening five months the Germans were too busy elsewhere to bother with the Wimereux viaduct.

The other paper in this *Journal* was "The Design and Construction of Reinforced Concrete Covered Reservoirs," by R. DeL. French. Filling 16 pages and with a number of charts and tables, it should have been of some help to the engineer of 1919 who was faced with the job of designing and building one of these structures. Changes in the basis of reinforced concrete design have made this paper obsolete, but it must have been some good, for it received a Gzowski medal.

Andrew Carnegie died on August 11, 1919, at Lenox, Massachusetts. The *Journal* devoted half a column to an appreciation of his interest in engineering; it will be remembered that he provided the funds for the United Engineering Societies building in New York, the home of the great engineering societies of the United States.

Woodstock, N.B., adopted the city-manager form of town government and made a contract with R. Fraser Armstrong, A.M.E.I.C., to act as its first manager. The *Journal* published the contract in full. It certainly gave Mr. Armstrong all the powers he could reasonably ask for.

A summary of questions asked by Civil Service employees and answered by the Commission in regard to classification was also given in this *Journal*. Some of them were from engineers; for example, one A.M.E.I.C. with six years of experience was told that his salary would be between $1,680 and $2,040. Most of the questions, however, came from clerks, accountants, etc.

# Correspondence

### More about Engineers in Government

In the June issue of the *Journal* I read in the Correspondence column the most thought-provoking letter I have read in years in our conservative organ. I am referring to the correspondent who asked for anonymity and who obtained it under the initials F.D.R., probably borrowed from one of the two great men known locally.

So "How would I like to be an M.P. ?" As you invited comments, either for or against, I shall supply you with both and leave to your discretion the question of anonymity. I share most of F.D.R.'s opinions, but I think some points might have been treated too superficially, which is quite understandable when one has to stay within the limits of a letter.

Let's pick some of these points. I quote: "It has been said many times that the qualities instilled into one by engineering training and experience are those that are needed badly by our legislators . . .".

### A Touch of Psychology

True, some legislators may learn from engineers to be more objective in their thinking. But, on the other hand, it cannot be generalized that the engineer's habit of thought can be applied directly to public problems. There are factors in life which cannot be put into equations. One can still be very objective in public affairs and add to the technical, the financial and the legislative, a touch of psychology. He must also take into account the past and the present and in doing so, he is so much more objective in his thinking. On this point, engineers can learn from other professions.

I quote again: "For example, engineers are impatient with delay . . . still less patient with cranks . . . their interest is generally limited to certain classes of people . . . co-workers . . . clients . . . Not many have great interest in the fisherman and the farmer . . . and the princes of the church . . ."

### Know Your Neighbour

F.D.R. must admit that a consulting engineer wanting to build up a clientele, does already practise those disagreeable tasks and for mercenary reasons. Why could this not be done for a much higher ideal ? I must concede that some politicians do it for mercenary reasons also, and very often far beyond the needs of their family. By the way, who invented baby kissing ? Certainly not the engineers.

Aside from the idea of meeting people only to get something out of, or from them, I think it is essential for any man in any profession to have a sincere interest in all classes of people . . . from the Prince of the Church to the fisherman. Wasn't He a fisherman ? And are we not supposed to practise what He preached ? At least, if we do not love our neighbour, we might try to know him.

I quote again: "In spite of valiant attempts on the part of the universities and on his own, to overcome the handicap, the engineer is still a rather dumb individual. He will talk to another engineer freely enough, or perhaps turn out a top-hole report . . ."

Some of our universities, according to engineers who made a success of their profession, have made valiant attempts to make engineers dumb and some have succeeded. In trying to cram very little of many subjects, the results may not be as good as the digesting of fewer subjects. As for the top-hole reports, maybe F.D.R. refers to top pigeon-hole reports. God knows how much effort some engineers will spend to undress their reports of any original idea or positive conclusion, thus following the training given by some of those valiant educators who have in mind success by the shortest and softest road.

### Praise of Being Dumb

By all means, being dumb may, in certain circumstances turn out to be an asset. Some statesmen have succeeded in staying in office for a whole generation without emitting any ideas lest they might have endangered their personal security or that of the party. I admit such a policy, if it is one, may have been preferable for the good of the country. Professional writers have been digging into the lives of some public men only to come out with the praise of being dumb when circumstances require such a course. Different times require different sorts of men. After all, F.D.R. should not despise the valiant attempts of some of our universities, whether those attempts are successful or not, insofar as engineers contemplate going into public life.

Here, I must introduce a rather incongruous parenthesis. At first sight, mathematics, or logics, seem universal; at least, we suppose they are in the physical world. But in the realm of human affairs, one should not contend too harshly that 2 and 2 make 4. That is all right between engineers, but in politics, it is preferable not to insist too much on such trivial conventions.

I quote again: "He seldom feels strongly enough on any non-technical matter to produce an article about it worth reading . . ."

I agree with F.D.R. that we should not boast about being ignorant of things not pertaining directly to our every-day technique. If that is the case for one of us, then it is a sign that he should take off his blinkers.

F.D.R. says: "Engineers are not familiar enough with what, for lack of a better term, are often called 'cultural subjects' . . ."

### Culture Is Universal

F.D.R. could have found the right term if only he had used the world "culture" instead of the periphrase "cultural subjects". Culture, by definition, is universal. It is not a matter of subjects. It is an atmosphere, a climate. It is something one breathes. It is a world to live in. It has quite remote relations with politics as understood today. Or, why such a fuss over Sir Winston who paints, writes and talks and puffs.

Though politics do not require a degree of any kind, it is commonly conceded that lawyers have been the most successful in the game, their training making them able to talk about anything at any time.

F.D.R. admits there are exceptions and he gives two names, Howe and Winters, to whom I bow, but not for the same reasons in each case. It is of public knowledge that even spelling is no obstacle in solving international affairs. Basic

English can save the world or blast it. As for one of the two ministers mentioned by F.D.R., I have read, written by him, one of the most enlightened papers on the national scale which no lawyer, nor doctor, nor financier could have brought forth. I take off my hat to that engineer-statesman, and I take off my hat twice to his ghost writer, if he has one. The world is full of ghosts anyhow.

#### Legislative and Executive

F.D.R. seems to confuse the legislative with the executive. The two engineers he mentions as having made a success in politics, are really serving the state in an administrative capacity, professional politicians putting up smoke screens to protect them from politicians of the other parties.

Ministers do not legislate, or at least they should not. Their job is to administer which, of course, implies much more direct responsibility than legislating. The members are only responsible towards the voters of their own constituencies. They usually judge of national affairs from a personal and local point of view. Very few up to now have been jailed for their mistakes. Ministers, on the contrary, are the responsible heads of workers in more or less specialized fields of state activity. They are responsible to the body of legislators for the way they handle the business entrusted to them, and they are also responsible to the nation at large, though they are shielded from the nation, more or less, by the M.P.'s who see that the decisions taken do not affect the rights of the majority, viz: the interests of the party.

#### Statesmen Are Scarce

To summarize, the qualities which make great statesmen are the same as those you will find in any great man in any field. As most discoveries, even in the technical field, have been made by men without training, or at least without degrees, statesmen have come from every walk of life, some with little learning, some with more, though learning certainly helps to compensate the other handicaps. Politicians are plentiful, statesmen are scarce. Politicians are the oysters, statesmen are the pearls.

Politics has been described as the art of looking for trouble, finding it everywhere, diagnosing it wrongly, and applying unsuitable remedies. And he who gets the votes is right.

An engineer would be quite naive if he should expect to apply to politics what he has been taught for years not to do. I guess this is the general idea of F.D.R.'s approach to the problem.

I trust, Mr. Editor, that I did not go beyond the physical limits of a letter, nor beyond the ethical limits of your *Journal*, but I think a good laugh once in a while cannot hurt. Politicians are the first to laugh even when the joke is on themselves. That is at least one lesson they can teach engineers.

Yours Politically,

JEAN ASSELIN, P. Eng., M.E.I.C.,
Montreal,
July 9, 1954

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## News of Other Societies

The annual meeting of the **Canadian Chamber of Commerce** for 1954, is scheduled for October 4, 5, 6, 7 at the Nova Scotian, The Lord Nelson and the Carlton Hotels in Halifax.

Information is available from General Manager D. L. Morell, Board of Trade Building, Montreal 1, Que.

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The newly formed **Canadian Institute of Timber Construction** reports activity in the preparation of design data and industry standards on timber construction, and work on building codes and standard specifications. Membership falls into three general divisions—timber fabricating companies, pressure treating companies, and trade extension organizations—with associate membership available to companies and individuals interested in structural timber. At the first annual meeting in March 1954, a broad plan of organization was made. The second annual meeting will take place in Montreal early in 1955.

R. F. DeGrace, of Ottawa, is executive vice-president and general manager of the Institute.

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Towards the end of September every member of the **Toronto Engineering Alumni** will personally receive news of the 1954 Triennial Re-Union, October 29, 30, 31, in Toronto.

The executive of the Triennial Re-Union reports that plans are progressing, and that they expect one of the most popular events will be the dinner and dance on Friday night, October 29. The Engineering Alumni medals will be presented after the dinner.

First awarded in 1939, and regarded as one of the highest honors attainable by S.P.S. graduates, the Alumni Medal has become a symbol of engineering achievement.

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The twenty-second annual meeting of the **Engineers' Council for Professional Development** (29-33 West 39th Street, New York 18) will be held on October 28-29, 1954, at the Hotel Alms, Cincinnati, Ohio.

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The **American Concrete Institute** (18263 West McNichols Road, Detroit 19, Mich.) lists: the seventh regional meeting, October 28-29, 1954, Statler Hotel, Los Angeles, Calif.; the 51st annual convention, February 21-24, 1955, Hotel Schroeder, Milwaukee, Wis.

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The **National Safety Council** (425 North Michigan Ave., Chicago 11, Ill.), will hold the National Safety Congress and Exposition in Chicago, October 18-22.

The Council, preparing the meeting for safety personnel in all fields —industrial, traffic, farm, school and home—expects an attendance of 12,000.

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The 61st annual meeting of the **American Society of Heating and Ventilating Engineers** (62 Worth St., New York 13, N.Y.) will be held in Philadelphia, Pa., January 24-27, 1955.

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A conference on "Plastics in Building", at the National Academy of Sciences in Washington, D.C., October 27 and 28, 1954, will be the seventh major conference to be conducted by the **Building Research Institute.**

Co-sponsors are the Society of the Plastics Industry (67 West 44th Street, New York 36); the Manufacturing Chemists Association, Washington, D.C.; and the Building Research Advisory Board.

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Dr. R. Harding Bliss will be the editor of a new publication to be issued by the **American Institute of Chemical Engineers** (120 East 41st St., New York 17, N.Y.) starting in January 1955.

Dr. Bliss will continue his teaching program at Yale University, where he is professor of chemical engineering and fellow of Jonathan Edwards College.

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The **Society of Automotive Engineers** (29 West 39th St., New York 18, N.Y.) announces meetings as follows: October 5-9, 1954, Hotel Statler, Los Angeles, Calif., national aeronautical meeting, aircraft production forum and aircraft engineering display; October 18-20, The Sheraton-Plaza, Boston, Mass., national transportation meeting and truck and bus engineering display; October 26-28, Hotel Statler, Cleveland, Ohio, national diesel engine meeting; November 4-5, The Mayo, Tulsa, Oklahoma, national fuels and lubricants meeting; January 10-14, 1955, golden anniversary annual meeting and engineering display, Sheraton-Cadillac Hotel and Hotel Statler, Detroit, Mich.

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The **American Society of Mechanical Engineers** (29 West 39th Street, New York 18) lists the following meetings for the fall session: October 28-29, 1954, ASME-AIME joint fuels conference, William Penn Hotel, Pittsburgh, Pa.; and the ASME annual meeting, Statler Hotel, New York, November 28 to December 3.

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The following conventions are scheduled by the **American Society of Civil Engineers** (33 West 39th St., New York 18): New York Convention, Hotel Statler, October 18-22, 1954; San Diego Convention, Hotel U.S. Grant, February 6-11, 1955; St. Louis Convention, Jefferson Hotel, June 13-17, 1955.

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# The ASME Boiler Code

### Interpretations

The Boiler Code Committee meets monthly to consider "Cases" where users have found difficulty in interpreting the Code. These pass through the following procedure (1) Inquiries are submitted by letter to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.; (2) Copies are distributed to Committee members for study; (3) At the next Committee meeting interpretations are formulated to be submitted to the ASME Board on Codes and Standards, authorized by the Council of the Society to pass upon them; (4) They are submitted to the Board for action; (5) Those which are approved are sent to the inquirers and are published in Mechanical Engineering.

The following Case Interpretations were formulated at the Committee meeting June 11, 1954.

#### Case No. 1190
Special Ruling

***Inquiry:*** Will the use in pressure vessels of bronze castings conforming to ASTM Specification B-143-52 meet the intent of Section VIII of the Codes. ?

***Reply:*** It is the opinion of the Committee that the use of castings conforming to ASTM Specification B-143-52 will meet the intent of Section VIII of the Code, provided no welding of this material is involved.

The maximum allowable design stresses given in Table UNF-23 for SB-61 will apply.

#### Case No. 1191
Special Ruling

***Inquiry:*** When alpha aluminum bronze alloy plates, sheets, pipes, tubes and shapes conforming to an approved specification are used for the construction of vessels to be used for external pressure, under what rules shall they be designed and fabricated. ?

***Reply:*** It is the opinion of the Committee that alpha aluminum bronze alloy plates, sheets, pipes, tubes and shapes that conform to an approved specification may be used for the construction of external pressure vessels and the vessels may be stamped with the Code symbol providing the following requirements are complied with:

(1) The applicable rules in the 1952 edition of Section VIII of the Code covering vessels under external pressure when constructed of nonferrous materials shall be adhered to.

(2) The thickness of shells and heads and the required moment of inertia for stiffening rings shall be determined from the charts in Fig. UNF-28.14 for alpha aluminum bronze and in Par. UNF-30.

The chart is available from the Committee.

#### Annulment of Cases

| *Case No.* | *Reason for Annulment* |
|---|---|
| 1053 | Seamless tubing is readily available. |
| 1074 | External pressure vessel charts are now available. |
| 879<br>1022<br>1165<br>1176 | The provisions of these Cases are now included in the 1953 edition of Section IX, Welding Qualifications. |
| 1146<br>1150 | These two Cases are no longer emergency alternate provisions. |
| 1136 | Government restriction on molybdenum has now been cancelled. |
| 1158 | The provisions of this Case are included in Section II, 1952 Edition. |

### Proposed Revisions and Addenda to Boiler and Pressure Vessel Code

As need arises, the Boiler Code Committee entertains suggestions for revising its Codes. Revisions approved by the Committee are published here as proposed addenda to the Code to invite criticism.

In the following the paragraph numbers indicate where the proposed revisions would apply in the various sections of the Code.

Comments should be addressed to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N.Y.

#### Power Boilers, 1952

***Par. P-111.*** Add the following as a third sentence —

Furnaces shall be rolled to practically a true circle with a maximum permissible deviation from the true circle of not more than ¼".

***Par. P-11.*** Add the following specification reference to the end of paragraph SA-369, Ferritic Alloy Steel Forged and Bored Pipe for High Temperature Service.

#### Ring Reinforced Furnaces

The original inquiry regarding Ring Reinforced Furnaces came from the Dominion Bridge Company, Ltd. of Canada on April 8, 1947. From that date on there were a number of inquiries involving similar construction. Although not providing for the construction proposed, these inquiries did result in Case No. 1101, (June 1949) which subsequently became a revision in Paragraph 242 (4) permitting the assembly of an Adamson Furnace by welding.

On November 10, 1950 we again received an inquiry on this same subject. Following this inquiry it was suggested that such a furnace be built and tested in service. After reporting the plan to the Boiler Code Committee on May 1, 1951 (Item 51-065), a number of interested manufacturers co-operated in raising funds for that purpose and the program was carried out. After careful consideration of the various design problems, the test furnace of the design shown on sketch No. A10-196-1 (available from the Committee) was built and installed in a boiler that was placed in operation at the Adelman Laundry in Milwaukee. The test in service began on May 6, 1953.

The boiler was operated 5½ full days per week during the test period, the total number of days the boiler was actually fired was 130. The burner was equipped with high-low controls, and in operation the burner was permitted to swing between the high and low fire in accordance with steam demand. The average number of reversals in a working day was about 125.

An inspection by the Fire Tube Sub-Group, and guests, was made after the boiler was shutdown on October 1, 1953. This inspection showed that there were no signs of overheating in any section of the furnace and no other signs of distress of any nature. The original roundness tolerance after construction of the furnace was ⅛". This was gauged and found to have remained unchanged.

The Sub-Group on Fire Tube Boilers then began the development of proposed rules for the construction of Ring Reinforced Furnaces. Steam from the boiler was not needed until approximately February 1, 1954. On that day the boiler was again put into operation with the same burner adjustments that were observed by the Sub-Group. On February 15 the boiler operator observed distortion in the front end of the furnace between the front head and the first and second supporting rings. The boiler was immediately taken out of service, drained and opened for inspection.

The distortions appeared between the head and the 1st ring and between the 1st and 2nd rings. Between the head and the 1st ring there was ¼" distortion at 1 o'clock, a ¼" distortion at 5:30 o'clock. It might be noted that the long seam of the furnace was located at 6 o'clock. In the section between the 1st and 2nd rings the distortions were as follows: two ¾" at 1 o'clock, one 9/16" at 3 o'clock with a continuous ⅝" distortion between them. There were two ¾" distortions located on either side of the long seam at 6 o'clock. The areas at the reinforcing rings were carefully checked with a templet accurately formed to the inside diameter of the furnace. At the rings and the furnace plate immediately adjacent to the rings there was no more deviation from a tube than when the furnace was originally formed.

An examination of the tubes showed that the first tubes in the 2nd, 3rd, 4th, 7th and 8th rows from the bottom on both sides of the furnace had been bowed outwardly toward the shell. Two tubes above the furnace at approximately 12 o'clock were bowed upward. The maximum distortion was in the tubes in the 2nd and 3rd rows from the bottom. This maximum distortion was estimated by sight to be approximately 2″. The other tubes in the rows mentioned were bowed to a lesser extent.

Hand hole plates were removed and a coating of oil was observed on all of the tubes accessible through the openings, being heaviest on the upper rows. Subsequently investigation showed that a serious deposit of oil covered the internal surfaces of the boiler. The oil entered the boiler from a reciprocating engine.

The fact that the damage was in the zone forward of the 2nd supporting ring may have been due to the location of a refractory collar just to the rear of the 2nd supporting ring. The collar extends into the furnace 7½″, is 9″ wide and is provided to improve combustion of the fuel.

While the accidental introduction of oil into the boiler with the results described above is regretted, this occurrence gave the ring reinforced furnace a more severe and conclusive test than any that could be devised by the Sub-Group, short of lowering the water level until the furnace was damaged.

The Cleaver-Brooks staff in its original calculations had shown that the heat transfer through a furnace wall supported by rings was greater underneath the rings. The inspection made on October 1st by the Committee revealed that, to all appearances, the furnace plate had remained cooler under the rings than between them. As a matter of fact the location of the rings could be determined from the inside of the furnace from the color of the plate. The inspection made on February 17, 1954 further substantiates these calculations in that all distortions occurred between the rings and feathered out to zero adjacent to the rings themselves. The additional heat transfer from the furnace wall to the surface of the reinforcing rings kept the furnace tube itself cooler in the areas adjacent to the rings. This prevented the serious deformation of the furnace tube.

This proposed construction is not new and untried. Ring reinforced furnaces have been built in this country and used in non-code jurisdictions. As far as is known, no unsatisfactory experience developed. Investigation developed furnaces of this type are also quite common in Great Britain. The British rules follow their formula for Adamson Ring Furnaces and place restrictions on the ring width and depth.

The Sub-Group on Fire Tube Boilers recommends the following revisions for the construction of Ring Reinforced Furnace be incorporated in Par. P-242 and in order to give members a chance to study this report that action on the proposal for adoption and publication be held over until its June Meeting.

***Par. P-242, Adamson Type.*** Revise present Par. P-242 to Par. P-242(a) and add the following as (b):

(b) ***Ring Reinforced Type.*** Horizontal circular flues or furnaces (Fig. P available from the Committee) may be constructed with completely circular reinforcing rings provided:

1. The reinforcing ring is rectangular in cross section and is fabricated from one piece of plate, or from plate sections or bars provided full penetration welds are used in assembling.

2. The reinforcing ring after fabrication has a thickness of not less than 5/16″ and not more than 13/16″ and in no case thicker than 1¼ times the furnace wall.

3. The ratio of the height of the reinforcing ring to its thickness ($H_r/T_r$) is not over 8 or less than 3.

4. The reinforcing ring is attached to the furnace by a full penetration weld on each side.

5. The thickness of the furnace wall or flue is a minimum of 5/16″ and a maximum of 13/16″.

6. The spacing of the rings on the furnace, $L$, is no greater than $60t$ or 36″ whichever is smaller.

7. In the use of chart, (Fig. P-), the temperature of the metal is taken as 100°F higher than the water temperature.

8. The furnace design permits replacement. A flared or welded OG ring would be an acceptable assembly.

9. The completed furnace assembly is stress relieved but radiographic examination is not required.

10. The thickness of the furnace wall and design of stiffening rings are determined by the use of Fig. P-. The notations defined below, and shown in Figs. P- and P- are used in the formulas of this paragraph:

= minimum required wall thickness of furnaces or flues, inches.

$L$ = design length of a furnace section, taken as the greatest center to center distance between any two adjacent stiffening rings; or the distance from the center of the first stiffening ring to the center of the furnace weld attachment, inches. In case a flared end assembly is used the distance shall be measured to the point of tangency between the flare and the furnace and the adjcent stiffening ring.

$D_o$ = outside diameter of furnace or flue, inches.

$P$ = design pressure, pounds per sq. inch.

The required wall thickness of a ring reinforced furnace or flue shall not be less than that determined by the following procedure:

1: Assume a value for $t$ and $L$. Determine the ratios $L/D_o$ and $D_o/t$.

2: Enter left-hand side of Fig. P- –. (This figure will be the same as Fig. UCS-28.2 in Section VIII) at value of $L/D_o$ determined in step 1.

3: Move horizontally to the line representing $D_o/t$ determined in step 1.

4: From this intersection move vertically to the material line of the proper temperature.

5: From this intersection move horizontally to the right and read the value of $B$.

6: Compute the allowable working pressure $P_a$ by the following formula:

$$P_a = \frac{B}{D_o/t}$$

7: Compare $P_a$ with $P$. If $P_a$ is less than $P$, a greater value of $t$ must be selected or a smaller value of $L$ or some combination of both to increase $P_a$ so that it is equal to or greater than $P$. (An example is shown in Appendix A-200).

The required moment of inertia of a circumferential stiffening ring shall not be less than that determined by the formula:

$$I_s = \frac{D_o 2\, L\, (t + \frac{A_s}{L})\, A}{14}$$

where: $I_s$ = required moment of inertia of the stiffening ring about its neutral axis parallel to the
4.
axis of the furnace, inches

$A_s$ = cross-sectional area of the stiffening ring, square inches.

$A$ = factor determined from Fig. P- –.

$P$, $D_o$, $L$, and $t$ are as defined above.

The moment of inertia for a stiffening ring shall be determined by the following procedure:

1: Assuming that the furnace has been designed and $D_o$, $L$, and $t$ are known, select a rectangular member to be used for a stiffening ring and determine its area, $A_s$, and its moment of inertia, I. Then calculate $B$ by the formula:

$$B = \frac{P D_o}{t + \frac{A_s}{L}}, \text{ where;}$$

$B$ = factor on the right-hand side of Fig. P- –.

$P$, $D_o$, $t$, $A_s$ and $L$ as defined above.

2: Enter the right-hand side of Fig. P- – at the value of $B$ determined in step 1.

3: Follow horizontally to the material line for the correct temperature.

4: Move down vertically to the bottom of the chart and read the value of $A$.

5: Compute the value of the required moment of inertia $I_s$, from the formula given above.

6: If the required $I_s$ is greater than the moment of inertia, $I$, for the section selected in step 1, a new section with a larger moment of inertia must be selected and a new $I_s$ determined. If the required $I_s$ is smaller than $I$ for the section selected in step 1, that section should be satisfactory. (An example is shown in Appendix A-201.)

The longitudinal and circumferential joints may be fusion welded of the double-welded butt type, the only requirements being that the welds are stress-relieved in accordance with Par. P-108 and a bend test of a sample of the welding for each furnace meets the requirements of Par. P-102, no radiographic examination being required.

### Heating Boilers, 1952

***Pars. H-31 and H-88.*** Revise to read:

It is recommended that dimensional requirements of bolted flange connections to external piping conform to:

Steel Pipe Flanges and Flanged Fittings ASA B16e 1953.

Such flanges may be used for pressure-temperature ratings in accordance with the Standard.

Steel flanges may also be designed in accordance with the rules in Appendix II of Section VIII for the design pressure and temperature conditions. The outside diameter and bolting shall conform to a recognized ASA Standard.

### Unfired Pressure Vessels, 1952

***Appendix Q, Pars. UA-601 (b) and UA-602 (b).*** Revised to read:

(1) 1/5 of the tensile strength as adjusted to minimum; and

(2) ¼ of the yield strength (as defined in the material specifications) as adjusted to minimum.

# NEWS OF THE ASSOCIATIONS & CORPORATION

**Information received through co-operation with the provincial organizations**

## Quebec

### Tournoi Provincial de Golf

Un tournoi de golf provincial pour les ingénieurs a été organisé pour la première fois cette année au Manoir Richelieu à La Malbaie.

Au delà de 100 joueurs ont participé au tournoi qui a été favorisé d'une température idéale.

Le champion golfeur de 1954 pour la province de Québec est M. Charles E. Rochette, qui a réussi un pointage brut de 88 dont 39 pour le premier neuf et 49 pour le second. Il a détaillé pour la première position avec MM. Guy Sicotte et René Dansereau qui avaient également enregistré un pointage de 88.

Chez les dames, Mme J. P. Drolet s'est classée première. M. Henri Savoie a mérité la première place parmi les invités.

### C.P.E.Q.'s 5,000th Member

The number of professional engineers registered in the Province of Quebec passed the 5,000th mark last spring. The 5,000th member was a lady, Mrs. Per Hall, wife of a vice-president of the Foundation of Canada Engineering Corporation Limited (FENCO).

At a brief ceremony during the annual meeting, president R. F. Shaw noted this as follows:

"I would now ask Mr. Per Hall, Professional Engineer, if he would be good enough to escort Mrs. Hall to the head table.

On any winter week-end this vigorous "Great Dane" can be seen skiing too fast down too big hills followed by this brave lady.

On any summer week-end they can be found sailing a too little boat over a too big wave.

At almost any time you will find engineering principles being applied by this charming hostess to the entertainment of what most of us would consider too many guests. But on week days, Nina Hall will be found in the home draughting room (for which it is rumoured she pays rent) designing and detailing structures.

Ask Per Hall to solve a knotty engineering problem and he will ask for time to "think it over". I hope he pays a fee.

Nina Hall—athlete, hostess, housewife, professional engineer — and the mother of three delightful children.

Mrs. Hall—Canada is most fortunate that you and your fine husband chose to become her citizens. Your profession is proud to welcome you as the five thousandth member of the Corporation."

### Third Permanent Officer At Headquarters

A larger membership plus overworked staff equals a requirement for additional help. The president and Council of the Corporation are pleased to announce the recent appointment of Mr. J. H. Legere, to the permanent office staff. This appointment will allow the Corporation to continue and to extend the many activities now being carried out for the protection of the public and the betterment of the engineering profession, and should do much to "balance" the above equation.

Mr. Legere began his career when he graduated from St. John Vocational School in 1940 with a certificate in Wireless Telegraphy and Radio Maintenance. During the following five years, until May, 1946, he was engaged in the maintenance and operation of heavy wireless stations in Canada and overseas, for the Canadian Army Signal Corps, first as a signalman, and later as an administrative officer.

Following demobilization, he registered in the Faculty of Engineering at McGill University, and graduated in 1950 with the degree of Bachelor of Engineering Physics. He became a member of the Corporation in the same year.

Mr. Legere's experience since graduation has been divided between the Bell Telephone Company of Canada, where he spent 2½ years on transmission engineering and traffic administration, and Canadian Aviation Electronics Ltd., where he acted as assistant to the chief

**C. E. Rochette, at right, receives from President G. Demers, the Corporation's trophy awarded to the best golfer in the provincial golf tournament for professional engineers.**

J. H. Legere.

Five Cavanagh brothers got together at the Engineer's Club in Toronto recently to fete brother J. Richard who has just gone into private practice. Left to right are: Daniel, Patrick, of Toronto; Robert, of New Jersey; Raymond and J. Richard. All are members of The Association of Professional Engineers of Ontario.

engineer for approximately one year, and assistant to the vice-president, Engineering and Manufacturing for a period of approximately 6 months.

Mr. Legere brings with him a wealth of engineering administrative experience, gained in his work and by participation in business administration and management courses through the Extension Department of McGill University.

## Ontario

### Changes in Highways

A reorganization of the Highways Department of the Province of Ontario has affected a considerable number of members of the Association.

Among the changes is the appointment of M. A. Elson, as deputy minister.

Heading the administration is the deputy minister and the chief engineer, W. A. Clarke. This in turn is broken down into five sections as follows: director of planning, W. J. Fulton; services manager, C. A. Robbins; financial comptroller; directors of personnel, to be appointed; and the registrar of motor vehicles.

P. M. Higgins, is named as consultant to the chief engineer, W. A. Clarke; W. Q. MacNee, traffic study section; and K. H. Siddall, location surveys section.

Other branches of the Department are: construction engineer John Walter; bridge engineer H. N. Lamont; maintenance engineer, C. Tackaberry, and municipal engineer, J. V. Ludgate. Consultants to the foregoing are: T. F. Francis (construction); A. Sedgwick (bridges); J. M. MacInnes (municipal).

Other appointments in the head office group include: J. P. Howard, and H. Irwin, municipal regional engineers; H L. Main, special projects engineer; H A. Tregaskes, contract control engineer; F. C. Brownridge, materials and research engineer; D. G. Ramsay, R. E Clarke, and H. W. Adcock, inspecting engineers.

New appointments affecting division engineers include: B. R. Heavysege, Stratford; H. C. Dernier, Huntsville; R. A. Panter, North Bay; J. B. Wilkes, Cochrane; E. A. Cash, Fort William; E. H Jones, Kenora; G. F. Wetherall, New Liskeard.

## British Columbia

### Public Relations Officer

R. M. Williams, M.B.E., of Vancouver, has been appointed Public Relations Director of the B.C. Engineering Society, effective July 15.

He will work from the offices of the Society at 1166 West Pender Street, as an integral member of the staff, to develop further the program which was approved by letter ballot of the membership and effectively initiated last year through the Public Relations Committee with the assistance of Mrs. Margaret Ecker Francis.

A review of this program is now being undertaken by the Committee, and a report on future plans and procedure will be published in the *B.C. Professional Engineer*.

Mr. Williams was born in Vancouver 46 years ago, and was active in local advertising and publicity until the last war, in which he served overseas as Public Relations Officer with the R.C A.F. Since then, as Chief of the Advertising and Publicity section of the Information Division of the Department of Trade and Commerce, in Ottawa, he was responsible for setting up the publicity organization for Canada's biggest international public relations effort, the Canadian International Trade Fairs. Among his other responsibilities was the public relations organization for the decennial census of Canada. He returned to Vancouver two years ago as Western Canada representative for the Financial Times.

This concrete slab, for the grandstand at Portage la Prairie, Manitoba, was precast and raised according to the patented Youtz-Slick system of lifting slabs. Structural design was done by Cowin and Company Limited, structural engineers; the lifting contractor was F. R. Lount and Sons; the general contractor was James F. Hamilton.

# Personals

## News of the Personal Activities of Members of the Institute

**T. R. Loudon,** M.E.I.C., has retired as head of the University of Toronto's civil engineering and aeronautical engineering departments. He will be associated with the design office of DeHavilland Aircraft Company.

Prof. Loudon has been actively interested in aeronautics for many years. At the University of Toronto, he was the classmate and associate of two pioneers in aviation: J. A. D. McCurdy, later the lieutenant governor of Nova Scotia, who in 1909 was the first man to fly a plane in Canada, and Casey Baldwin, first Canadian to pilot an aircraft—this was in 1908.

Prof. Loudon graduated in civil engineering from the University of Toronto in 1906. He went on the staff of the University in 1907 as a lecturer in the applied science and engineering faculty. Thus he joined his father, W. J. Loudon on the university staff, the elder Loudon having been professor of mathematics and physics for some years.

During World War I he served with the Royal Engineers overseas, and was mentioned in despatches. At the end of the war, holding the rank of major, he returned to the University as an associate professor. He commanded the University C.O.T.C. contingent, with the rank of lieutenant-colonel. Prof. Loudon's interest in aviation had been maintained since those early days of flying, and after the war he pursued the study of aerodynamics and other related subjects, which he subsequently taught when these were introduced in the engineering curriculum. He was later appointed professor of applied mechanics, and in 1943 he succeeded Dean C. R. Young as head of the Department of Civil Engineering, with the title of professor of civil engineering and aeronautics. It was in 1945 that the department of aeronautical engineering was created, and Professor Loudon was appointed to head it as well.

During his many years of academic work he was also active in the practice of civil engineering, first with the firm of Harkness, Loudon and Hertzberg. After 1929 he maintained his own practice as a consultant in civil engineering and in later years transferred his interest to aeronautical engineering.

Because of Prof. Loudon's advance knowledge and prominence in Canadian aviation he was selected to command the first school of aeronautical engineering organized in Montreal in 1940 under the British Commonwealth Air Training Plan. He was promoted to the rank of Wing Commander in the R.C.A.F. in 1940, and was appointed chief technical officer of the R.C.A.F. Test and Development Establishment in Ottawa. He became commanding officer in May 1941. On his return two years later to Toronto he retained his liaison with the armed forces, commanding the R.C.A.F. Air Training Corps at the University of Toronto.

Prof. Loudon joined the Institute as an Associate Member in 1910, transferring to Member in 1919. He was chairman of the Toronto Branch, served on the Council, and he was a vice-president in 1930-31. He acted on many of the committees of Council, notably as chairman of the Service Bureau Committee, under the direction of which the system of the Employment Service Bureau was extended in 1928 and the "E.I.C. News" was established as a weekly news and employment bulletin. He is also a member of the recently formed Canadian Aeronautic Institute, in which he is an honorary fellow. He is a past president of the Toronto Flying Club, and holds a private pilot's licence.

Prof. Loudon has been a lifelong devotee of athletics, and for many years coached the University of Toronto rowing teams, not to mention his interest in other sports. He was elected president of the Amateur Athletic Union of Canada in 1929. He still maintains his interest in sailing as an active member of the Royal Canadian Yacht Club.

**Sir Godfrey Rhodes,** M.E.I.C., consultant to the firm Peter M. Amcotts & Partners, Nairobi, Kenya Colony, visited in Canada recently. He accompanied a team of athletes from Kenya to the Empire Games in Vancouver.

C. K. Lockwood, M.E.I.C.

**C. K. Lockwood,** M.E.I.C., vice-president of the stainless steel and alloys division of Shawinigan Chemicals Limited in Montreal, was elected president of the Alloy Casting Institute at the Institute's annual meeting in New York in June.

Originally from Brighton, Ont., Mr. Lockwood graduated from McGill University with a chemical engineering degree in 1934 and with a metallurgical engineering degree in 1935.

He joined Shawinigan Chemicals in 1937 and was appointed sales manager of the stainless steels and alloys division in 1945. In January of 1953 he became vice-president, and this year was elected to the board of directors of the company.

Mr. Lockwood has been active in the American Society for Metals, serving as chairman of the Montreal chapter, as well as in the National Research Council in Ottawa. He was on loan from Shawinigan in 1951 and 1952, serving as chief of the stainless steels section, steel division of the Canadian Department of Defence Production.

**Dr. Albert R. Decary,** M.E.I.C., superintending engineer for the Province of Quebec, has retired after 54 years in the Department of Public Works, of Canada. He is a past-president of the Engineering Institute.

Dr. Decary was born in Montreal. After having completed an arts course at College Ste. Marie, Montreal, he later attended Ecole Polytechnique. Upon graduation he engaged in private practice in Montreal. In 1900 he entered

***The 69th Annual Meeting***

*of*

THE ENGINEERING INSTITUTE OF CANADA, TORONTO, ONT.

ROYAL YORK HOTEL, MAY 11, 12, 13, 1955

the public service as an engineer on the hydrographic survey of the St. Lawrence River, and five years later he was promoted to the position of district engineer at Quebec. In 1913 he was named superintending engineer for the Province.

Dr. Decary represented the Government of Canada at the World Conference of the Permanent Association of Navigation Congresses held in Philadelphia in 1912.

He was intimately connected with all important river and harbour works of the Dominion Government, including the Champlain drydock at Quebec and the Esquimalt drydock in British Columbia. In connection with this latter undertaking he was chairman of the board of engineers specially entrusted with the designing and preparation of all plans.

Dr. Decary joined the Engineering Institute in 1900 as an Associate Member and in 1907 transferred to Member. He was elected a councillor in 1914 and continued as such until 1924 when he became a vice-president. He was named president of the Institute in 1927.

When the Quebec Branch was formed in 1907 he was one of the charter members and a member of the first executive committee. He was chairman of the Branch for eight years and upon his retirement from active chairmanship, the Branch elected him honorary chairman for life.

Dr. Decary was a charter member of the Corporation of Professional Engineers of the Province of Quebec and served as its president from 1919 until 1938. He is a charter fellow of the Royal Architectural Institute of Canada and a member of the Province of Quebec Association of Architects, the Permanent Association of Navigation Congresses and l'Institut Canadien de Quebec. He is also president of the Town Planning Commission of Quebec.

He was honoured by the University of Montreal and Laval University with the degree of doctor of science.

**H. Lloyd Johnston,** M.C., M.E.I.C., has been appointed chief engineer of Du Pont Company of Canada Limited.

A native of Vancouver, B.C., Mr. Johnston was educated at the University of British Columbia and at McGill University where he received his degree in civil engineering in 1927. That same year he joined the Canada Power and Paper Corporation and served with that company until 1936 when he became associated with Canadian Industries Limited at Windsor, Ont., where he rose to the position of works manager. After 12 years in Windsor, he returned to Montreal as assistant chief engineer in 1950.

Mr. Johnston is a veteran of both wars, having served overseas with the Canadian Expeditionary Force in World War I, and with the 30th Reconnaissance Regiment Reserve during World War II. He was awarded the Military Cross for his services in the first war.

Mr. Johnston is a past chairman of the Border Cities Branch of the Engineering Institute.

**Howard W. Umphrey,** M.E.I.C., has been appointed chief engineer of Canadian Industries (1954) Limited.

A native of Miami, Man., Mr. Umphrey received his early education there. He then obtained his B.A. degree

H. Lloyd Johnston, M.E.I.C.

H. W. Umphrey, M.E.I.C.

from McMaster University and his S.M. degree in mechanical engineering from Harvard University.

Mr. Umphrey joined the company in 1934 as a construction engineer. He became works engineer of the alkali plant at Cornwall and two years later was transferred to the engineering department in Montreal as a design engineer.

In 1939 he was appointed works manager of the alkali plant at Shawinigan Falls, Que., and in 1943 was named acting production manager of the chemicals department in Montreal.

During World War II he was on loan to Defence Industries Limited as resident engineer of construction at the de Salaberry, Que. plant. He became production manager of the chemicals department of Canadian Industries Limited in 1948 and was employed in that capacity until his recent appointment.

**H. D. Davison,** M.E.I.C., chairman of the board of Welland Electric Steel Foundry Limited in Welland, Ont., has been elected chairman of the Niagara Peninsula Branch of the Engineering Institute. *(Continued on page 1126)*

(*Continued from page 1120*)

**H. D. Davison,** M.E.I.C.

Mr. Davison was born in Bridgewater, N.S. He received his early education at St. Andrews College, then in Toronto, and graduated with the degree of B.Sc. in mechanical engineering from the University of Toronto in 1913.

Upon graduation he was employed by the Welland Ship Canal until 1916. The following year he joined the British American Shipbuilding Company at Welland.

In 1924 Mr. Davison founded his own business, Welland Electric Steel Foundry Limited. The company at present operates a foundry and pattern shop, machine and fabricating shops engaged in the manufacture of articles in carbon, alloy and manganese steels, and specializing in stainless steel which the company first made in 1928.

**A. Gordon Murphy,** M.E.I.C., port manager of Montreal for the past seven years, has been appointed to the post of chief engineer of the St. Lawrence Seaway Authority.

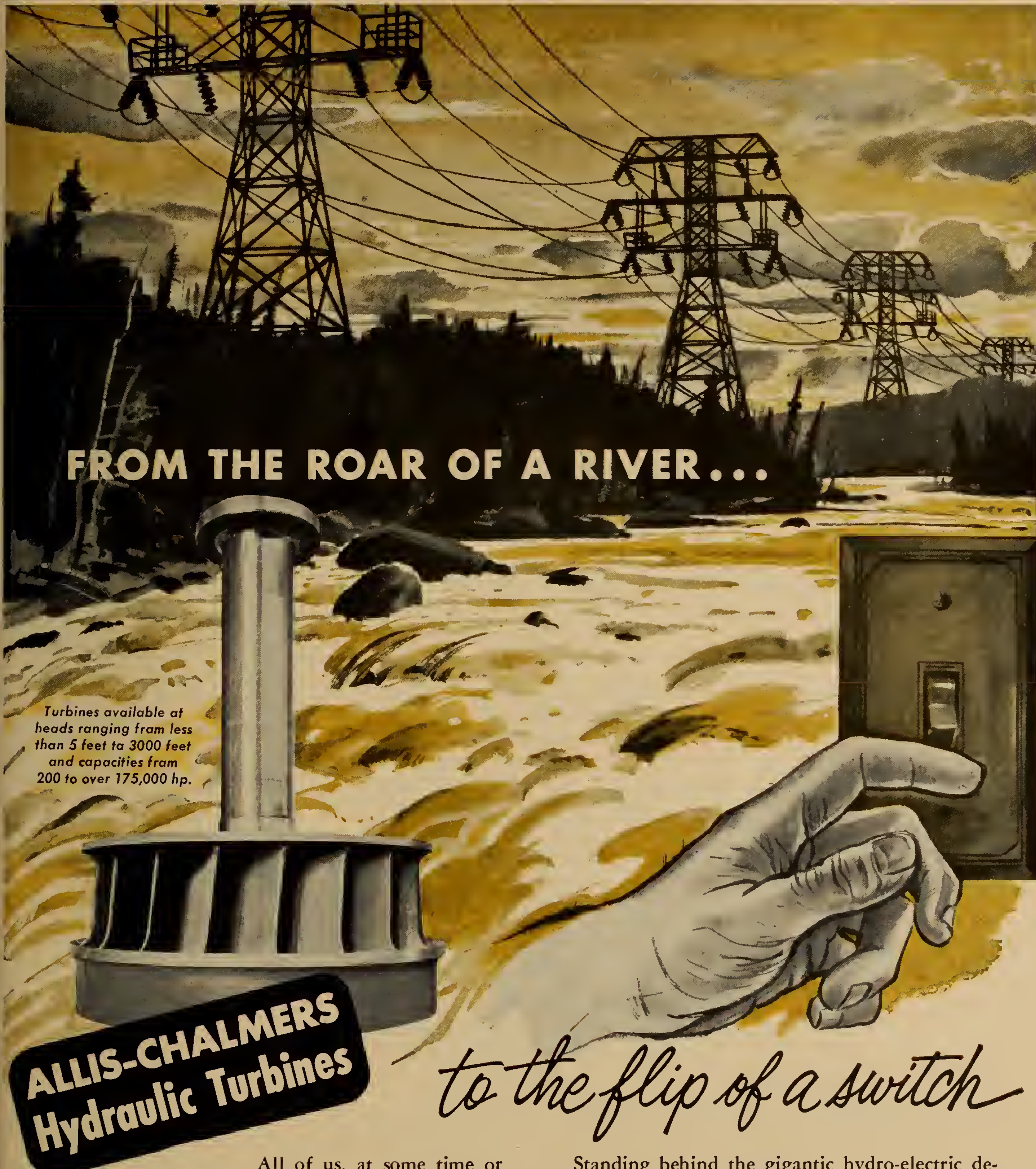
Mr. Murphy began his engineering career in 1917 when he served as inspector on the Quebec Bridge construction. After graduation from McGill University in 1922, he joined the Department of Railways and Canals as bridge and structural engineer on the Welland Canal until 1931, and for the next five years, was employed on the Hudson Bay terminal and elevator construction at Prescott.

He joined the National Harbours Board in 1936 as an assistant engineer and in April, 1947, was appointed to the position of port manager in Montreal.

**T. R. McLagan,** O.B.E., M.E.I.C., president and general manager of Canada Steamship Lines Ltd., has been appointed a member of the board of directors of Canadian Liquid Air Company Limited. Mr. McLagan is a director also of Canadair Ltd., Abitibi Power and Paper Co. Ltd., the Electric Boat Corporation.

A graduate of Lower Canada College and McGill University in mechanical engineering, Mr. McLagan began his engineering career with the Laurentide Company in Grand'mere, Que., in 1924, and has been successively a partner in Dufresne, McLagan & Associates, Montreal industrial consultants, and president and general manager of Canadian Vickers Limited in Montreal. He was appointed to his present position with Canada Steamship Lines in 1951.

**T. R. McLagan,** M.E.I.C.

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# CANADIAN ALLIS-CHALMERS

54-CAC-2

Lt. Col. C. G. Kirby, M.E.I.C.

**Lt. Col. C. Gordon Kirby,** M.B.E., M.E.I.C., has relinquished his position as assistant director of electrical and mechanical engineering at Army headquarters in Ottawa, to take up the new appointment of command electrical and mechanical engineer at Halifax, N.S.

Lt. Col. Kirby received his B.Sc. degree in mechanical engineering from the University of Saskatchewan in 1936. Previous to the war he was employed with the Vulcan Iron Works in Winnipeg, Man.

Lt. Col. Kirby was first commissioned in the Royal Canadian Engineers and in 1942 was appointed to the Royal Canadian Ordnance Corps and later to the Royal Canadian Electrical and Mechanical Engineers. He served with the R.C.E.M.E. in the United Kingdom, Italy and northwest Europe. Since the war he has held various R.C.E.M.E. appointments in Petawawa, Regina, Montreal and Ottawa.

He is a member of the Association of Professional Engineers of Saskatchewan.

**F. A. Dagg,** M.E.I.C., assistant to the general manager of Saguenay Terminals Limited and Roberval and Saguenay Railway in Arvida, has been elected chairman of the Saguenay Branch of the Engineering Institute.

Mr. Dagg was born at Holland, Man. He received his general education at the high school there and proceeded to the University of Manitoba where he gained his B.Sc. degree in civil engineering in 1929.

F. A. Dagg, M.E.I.C.

Upon graduation he joined the Winnipeg Hydro Commission to work on concrete design. In 1930 and 1931 he was employed as steel foreman for Stuart & Grant Ltd., and on bridge design for Manitoba roads. After three years in non-engineering work he became a construction engineer with the Kanuchuan Power Company.

In 1936 he was appointed district engineer with the Prairie Farm Rehabilitation and continued as such until 1940 when he joined Ducks Unlimited in Winnipeg, Man. as construction engineer.

Mr. Dagg entered the Aluminum Co. of Canada Ltd. in 1942 as a concrete design and detail engineer, working later as a construction engineer. In 1944 he was appointed superintendent of the atomizing plant at Isle Maligne, and the following year, superintendent of industrial engineering in Arvida. He was later named resident engineer in charge of construction on the Chute-à-la-Savane power house, and in 1953 he was appointed engineering assistant to the general manager of Saguenay Terminals Limited. Mr. Dagg came into his present position this year.

**W. O. Richmond,** M.E.I.C., head of the department of mechanical engineering of the University of British Columbia, has been elected chairman of the Vancouver Branch of the Engineering Institute.

W. O. Richmond, M.E.I.C.

Professor Richmond was born in Rouleau, Sask. He obtained his B.A.Sc. degree in mechanical engineering from the University of British Columbia in 1929, and in 1933 his M.Sc. degree in mechanical engineering from the University of Pittsburgh.

Upon graduation from the University of British Columbia he joined the Westinghouse Electric and Manufacturing Company in East Pittsburgh as research engineer in the mechanics division. He remained there until 1934. During 1935-36 he was research assistant in the testing materials laboratory of the Massachusetts Institute of Technology, and the following year became instructor in mechanics and materials at the Case School of Applied Science in Cleveland, Ohio.

He joined the mechanical engineering staff of the University of British Columbia in 1937 as assistant professor of mechanical engineering. He was named associate professor in 1943, and four years later, professor of mechanical engineering. He has been head of the mechanical engineering department since 1950.

The summer months from 1941 to 1946 were used for engineering work with the Powell River Co. Ltd., in Powell River, B.C., United Shipyards Ltd., in Montreal, Boeing Aircraft Company of Canada Ltd. in Vancouver, the B.C. War Metals Research Board, the B.C. Research Council, and Consolidated Mining and Smelting Co. Ltd. in Trail, B.C.

Professor Richmond is a member of the American Society of Mechanical Engineers and the Association of Professional Engineers of British Columbia.

**Dr. E. G. Faludi,** M.E.I.C., has been elected president of the Town Planning Institute.

Dr. Faludi is president and managing director of Town Planning Consultants Ltd. in Toronto, Ont. He received his doctorate in architecture from the Royal School of Engineering in Milan in 1927.

**Walter Murray,** M.E.I.C., is now president of Consolidated Insulation Limited in City View, Ont.

He was formerly associated with The Rankin Co. Ltd. as chief engineer of project construction and as assistant to the director of the Montreal division.

Mr. Murray is a graduate in civil engineering of the University of Edinburgh, class of 1926.

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*Terminal microwave Relay building on Alcan's Peribonka project showing tower at left. (Courtesy Aluminum Company of Canada Limited).*

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This includes systems engineering and selection of suitable station sites, provision of access roads, fences, buildings and towers. Power (including stand-by), installation of electronic equipment, and training of customer personnel and maintenance are also part of Marconi engineering services.

Marconi radio relay systems are simpler in design, give better, more reliable technical performance, and are easier to maintain.

You've looked to Marconi with confidence for your electronic needs in the past. Again you can turn to Marconi with confidence when it comes to radio relay systems.

*For further information consult the Commercial Products Division, Canadian Marconi Company.*

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CANADIAN MARCONI COMPANY

CANADA'S LARGEST ELECTRONIC SPECIALISTS

J. R. Mills, M.E.I.C.

J. W. Eakins, M.E.I.C.

**J. R. Mills,** M.E.I.C., president and director, has announced the formation of Geocon Limited, formerly Gunite and Waterproofing Limited.

Other officers of the new company include **N. D. Lea,** M.E.I.C., vice-president; **J. W. Eakins,** M.E.I.C., general manager; and **A. G. Hyde,** Jr.E.I.C., assistant general manager.

**David McMillan,** M.E.I.C., is chairman of the Ottawa Transportation Commission.

He was formerly associated for many years with the Department of Mines and Technical Surveys, Geodetic Survey of Canada, in Ottawa.

**G. P. Wilbur,** M.E.I.C., has retired from his position as vice-president and manager of the Ontario division of Dominion Bridge Co. Ltd., but will continue to serve the company in a consulting capacity.

G. P. Wilbur, M.E.I.C.

Mr. Wilbur was born in Victoria Harbour, Ont., and was educated in Toronto, starting his engineering career with Polson Iron Works. He then joined Canada Foundry Co. Ltd. after which he began his long association with the Toronto branch of Dominion Bridge Co. Ltd. in 1913.

He was appointed chief draughtsman of this division in 1922 and subsequently, contracting engineer and sales manager. In 1942 he was named manager of the Ontario division, and in 1952, a vice-president of the company.

Mr. Wilbur is vice-president of the Sault Structural Steel Co. Ltd. and a director of Dominion Engineering Works Ltd.

He is a past-president of the Canadian Institute of Steel Construction and of the Toronto Builders Exchange, and a past-chairman of the Toronto branch of the Canadian Manufacturers Association. He is now a director of the Toronto Industrial Commission and of the Canadian Welding Bureau, and a member of the Association of Professional Engineers of Ontario.

**R. H. Findlay,** M.E.I.C., has retired from his position of mechanical engineer of the Eastern division of Dominion Bridge Co. Ltd. His services as consulting mechanical engineer will be retained by the company.

Mr. Findlay was born in Scotland where he studied at the Royal Technical College and Glasgow University and served his engineering apprenticeship

R. H. Findlay, M.E.I.C.

He joined the Dominion Bridge Company as a draughtsman in the structural department in 1911, and later became a designer in the mechanical department, chief mechanical draughtsman and production engineer. In 1928 he was made assistant mechanical engineer at Riverside Iron Works, but returned to Lachine in 1931 when he was appointed mechanical engineer.

Mr. Findlay has served as a councillor representing the Montreal Branch of the Engineering Institute. He is a member of the Corporation of Professional Engineers of Quebec, and of the Association of Iron and Steel Engineers.

**W. G. H. Holt,** M.E.I.C., has been appointed mechanical engineer of the Eastern division of Dominion Bridge Co. Ltd., succeeding R. H. Findlay, M.E.I.C.

Mr. Holt was born and educated in

W. G. H. Holt, M.E.I.C.

Toronto. He graduated in mechanical engineering from the University of Toronto in 1936. He joined the Dominion Bridge Company that year and has since worked in the mechanical design department, production department and in mechanical sales work. At the time of his recent promotion he held the position of assistant mechanical engineer.

Mr. Holt is a member of the Corporation of Professional Engineers of the Province of Quebec and of the Montreal Board of Trade.

**P. Millar,** M.E.I.C., has been appointed works manager of Dominion Bridge Co. Ltd. at Lachine, Que.

Mr. Millar was born in Lochwinnoch, Scotland, and received his education at the Royal Technical College in Glasgow.

He served his draughting apprenticeship with Mechans Ltd. in Glasgow, and came to the Dominion Bridge Company in 1923 as a draughtsman. Before his recent appointment as works manager, Mr. Millar was successively assistant plate and boiler engineer, structural superintendent, operating superintendent and general superintendent.

Mr. Millar is chairman of the Montreal West School Board and a member of the Protestant School Board of Greater Montreal.

**William Herbison,** M.E.I.C., has been appointed general superintendent of Dominion Bridge Co. Ltd. in Lachine, Que.

Mr. Herbison was born in Clydebank, Scotland, and received his education at the Clydebank Technical School and the Royal Technical College in Glasgow. He served his shop and draughting apprenticeship at John Brown & Co. Ltd., Clydebank engineers and shipbuilders.

He joined the Dominion Bridge Company in 1926 as a draughtsman in the structural and mechanical department and later was employed as a designer in the plate and boiler department.

In 1946 he was appointed superintendent of the structural and boiler division, and six years later became assistant general superintendent.

Mr. Herbison is a governor of the Lachine General Hospital.

**J. P. Borbey,** M.E.I.C., has been appointed assistant sales manager of the Eastern division of the Dominion Bridge Co. Ltd. in Lachine.

Mr. Borbey was born in New York, U.S.A., and was educated in Toronto where he attended the University of Toronto, graduating in civil engineering in 1934.

He joined the Dominion Bridge Company in Lachine in 1936 and was employed in the plate and boiler drawing office and design department. In 1942 he entered the plate and boiler sales department.

Mr. Borbey is a member of the Corporation of Professional Engineers of the Province of Quebec and of the Montreal Board of Trade.

**H. I. King,** M.E.I.C., has been appointed manager of the precast division of the Cooksville Company Limited in Toronto.

He received his B.Sc. degree in civil engineering from the University of New Brunswick in 1937 and since 1941 has been associated with the construction industry in Montreal and Toronto.

Mr. King served with the Royal Canadian Engineers during World War II. He is a member of the Association of Professional Engineers of Ontario.

**H. G. Ambrose,** M.E.I.C., has been appointed sales manager of the precast division of the Cooksville Company Limited in Toronto.

Mr. Ambrose received his B.A.Sc. degree from the University of Toronto in 1942. In 1946, after serving overseas with the Royal Canadian Electrical and Mechanical Engineers, he entered the construction field and has been associated with civil and municipal engineering works since that time.

He is a member of the Association of Professional Engineers of Ontario.

H. I. King, M.E.I.C.

**W. T. Bothwell,** M.E.I.C., has been appointed technical superintendent of the Regina refinery of Imperial Oil Limited. He was previously assistant co-ordinator of manufacturing operations in Toronto.

Mr. Bothwell is a graduate in chemical engineering of the University of Alberta, class of 1944.

George O. Saunders, M.E.I.C.

**George O. Saunders,** M.E.I.C., has been appointed works manager of the Canadian Locomotive Company's plant in Kingston, Ont.

A graduate of Queen's University in mechanical engineering, Mr. Saunders has served with the company for 12 years. He began as an assistant in the plant engineering department, moving to diesel engineering and subsequently becoming manager of locomotive sales. He was recently appointed assistant to the works manager in charge of steam locomotive production.

Mr. Saunders is a member of the Association of Professional Engineers of Ontario.

H. G. Ambrose, M.E.I.C.

**Arnold Thomas Girard,** M.E.I.C., is now assistant manager of the Carthage Machine Company in Carthage, New York.

Mr. Girard had been employed with the Brown Corporation in La Tuque, Que., since 1946. His earlier experience included service as an instructor in hydraulics at the University of Toronto, as a lieutenant in the R.C.E.M.E. Canadian Workshops, and as design engineer on air compressors with John Inglis Co. Ltd. in Toronto.

Mr. Girard received his B.A.Sc. degree in mechanical engineering from the University of Toronto in 1943.

**J. F. McGuire,** M.E.I.C., has been appointed welding engineer with Racey, MacCallum & Associates Ltd. in Montreal.

He was formerly with Canadian Chemical & Cellulose Co. Ltd. in Montreal.

Mr. McGuire graduated in electrical engineering from McGill University in 1934.

**C. W. Currie,** M.E.I.C., has been appointed assistant district engineer with the Department of Public Works of Canada in Charlottetown, P.E.I. He joined the Department in Charlottetown in 1934 after working for six years on design with the Nova Scotia Power Commission.

Mr. Currie graduated in electrical engineering from the Nova Scotia Technical College in 1928.

**S. I. Stothers,** M.E.I.C., is a production engineer with Canadian Locomotive Co. Ltd. in Kingston, Ont. He was previously associated with J. R. Leach & Son Ltd. in Prince Albert, Sask.

Mr. Stothers graduated in mechanical engineering from the University of Saskatchewan in 1950.

**Sydney Sheinberg,** M.E.I.C., has been appointed general manager of Hollinger Machine Co. Ltd. in Montreal, Que. He was formerly with the Canadian International Paper Company in Hawkesbury, Ont.

Mr. Sheinberg is a graduate in mechanical engineering of McGill University, class of 1943.

**Helmut Wittnick,** M.E.I.C., has been appointed assistant to the industrial engineer of Alnce Wood Products Inc. in Montreal, Que., and has been placed in charge of production control.

He was previously associated with the R.C.A. Victor Company in Montreal.

Mr. Wittnick graduated in mechanical engineering from the Hamburg Technical University in 1948.

**D. R. Webster,** M.E.I.C., has joined H. J. G. MacLean Ltd. in Montreal, Que., as sales engineer. He was formerly a sales engineer with Scottish Machine Industries (Canada) Ltd. in Montreal.

Mr. Webster graduated in civil engineering from McGill University in 1944.

**Jack Langford Tremaine,** M.E.I.C., has joined the engineering staff of Canadian National Railways in Montreal, Que. He was formerly associated with the heating and air conditioning department of Canadian Industries Ltd. in Montreal.

Mr. Tremaine graduated in mechanical engineering from the Nova Scotia Technical College in 1946.

**Major M. O. Rollefson,** R.C.E., M.E.I.C., is serving in Korea as commanding officer of the Third Field Squadron of the

*(Continued on page 1134)*

## rigid concrete specifications here...

Views of Peribonka River Power Development.
Peribonka No. I Powerhouse—located at Chute du Diable, Quebec.
Owner: The Aluminum Company of Canada, Ltd., Montreal, Quebec;
Consltg. & Des. Engrs.: Shawinigan Engineering Co., Ltd.;
Contr.: Fraser-Brace Engineering Co., Ltd., Montreal.

# engineers of Peribonka Power Plants employed POZZOLITH* to help meet requirements

Specifications for these important projects were rigid and exacting. Several types and classes of concrete were involved. Engineers insisted on adequate flow and workability without excessive bleeding or segregation.

Field tests showed that despite problems introduced by air-entrapping sands, Pozzolith with its adaptations facilitated production of concrete of the specified qualities, and at a cost far less than by other known methods.

Pozzolith has proved to be an effective aid in producing excellent results and important savings on major jobs from Labrador to Kitimat.

We would welcome an opportunity to work with you to help obtain similar results on your jobs. More details on these and other hydraulic structures in Master Builders Reporter No. 3 —48 pages, illustrated. Copy on request.

***POZZOLITH**... reduces unit water content up to 15% for a given placeability, and fully complies with the water-cement ratio law. Adaptations of Pozzolith permit rigid control of entrained air. Produced in three standard formulations—High Early Pozzolith, Normal Pozzolith and Low Heat Pozzolith—to give the results required under varying job conditions.

Peribonka No. I Spillway—located at Chute du Diable, Quebec. Owner: The Aluminum Company of Canada, Ltd.; Engineers and Contractor same as Peribonka No. I Powerhouse.

Peribonko No. 2 Powerhouse—located at Chute a la Savane, Quebec. Owner and Engineers same as No. I Project. Contr.: Pentagon Construction Co., Ltd., Montreal.

**HE MASTER BUILDERS CO. LT**

P. O. BOX 501, WESTON — Products sold in Canada are manufactured in Canada — TORONTO 15, ONTARIO

## Correction

In the August Personals, page 993, an item about R. G. Johnson, JR.E.I.C., was incorrect.

Information about R. G. Johnson, president of Defence Construction (1951) Limited in Ottawa, was mistakenly entered in the membership record of R. G. Johnson, JR.E.I.C., of Windsor, Ont.

Ronald Garth Johnson, JR.E.I.C. (B.Sc., mechanical engineering, University of Saskatchewan, 1948), according to our last information was associated with the Ford Motor Company of Canada in Windsor.

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(*Continued from page 1132*)

Royal Canadian Engineers, and has been promoted from the rank of captain. He was previously stationed at Army headquarters in Ottawa in the Directorate of Works and Accommodation.

Major Rollefson graduated in civil engineering from the University of Alberta in 1941.

**R. E. Williams,** M.E.I.C., is now project engineer with the Canada Paper Company in Windsor Mills, Que. He was formerly on the staff of Canadian Comstock Co. Ltd. in Montreal.

Mr. Williams is a 1924 B.A.Sc. graduate of the University of Toronto.

**K. C. Williams,** M.E.I.C., has been appointed electrical sales engineer with Railway and Power Engineering Corporation in New Glasgow, N.S.

Mr. Williams received the higher national certificate in electrical engineering from Rugby College of Technology in 1939.

**Thomas E. Molyneux,** M.E.I.C., is now assistant project engineer with Abitibi Power and Paper Company Ltd. in Toronto, Ont.

He was previously assistant to the vice-president of Defence Construction (1951) Ltd. in Ottawa.

Mr. Molyneux graduated in civil engineering from the University of Saskatchewan in 1942.

**Dr. Alan W. Trorey,** JR.E.I.C., of Vancouver has been appointed research engineer on the staff of the California Research Corporation at La Habre.

Dr. Trorey is an engineering physics graduate of the University of British Columbia. Until recently he has been engaged in post graduate work at Stanford University where he obtained his M.S. and Ph.D. degrees.

**D. Hussman,** JR.E.I.C., has joined the Kilborn Engineering Company in Toronto, Ont. He was formerly associated with R. M. Way & Co. Ltd. in Toronto, Ont.

Mr. Hussman graduated in mechanical engineering from the University of Saskatchewan in 1947.

**E. H. P. Palmer,** JR.E.I.C., is owner and president of E. H. Palmer & Co. Ltd. of Montreal. He was previously a sales engineer with Control Equipment Co. Ltd. in Montreal.

Mr. Palmer graduated in mechanical engineering from McGill University in 1948.

**Capt. J. J. Eatock, R.C.E.,** JR.E.I.C., is the officer commanding the Northwest Territories and Yukon Works Detachment of the Royal Canadian Engineers.

This detachment provides engineer services to buildings and property of the Northwest Territories and Yukon Signals System which has radio stations as far north as Aklavik and has its headquarters in Edmonton, Alta. Approximately 20 isolated and semi-isolated stations are involved which extend west to the Yukon and east to within approximately 200 miles from Hudson Bay. This area presents many interesting problems involving construction and maintenance of buildings and utilities where perma-frost and extreme climatic conditions are involved.

Capt. Eatock graduated in chemical engineering from the University of Alberta in 1949.

**W. B. McCoy,** JR.E.I.C., has joined the Shell Oil Company in Calgary, Alta. He was previously on the staff of McGill University.

Mr. McCoy is a 1949 graduate in civil engineering of McGill University.

**S. Oancia,** JR.E.I.C., formerly with the Quebec North Shore Paper Company in Baie Comeau, Que., has joined George Mills & Sons Ltd., general contractors in Sydney, N.S. In his new position Mr. Oancia will be a project engineer and assistant superintendent on wharf and breakwater construction.

He is a civil engineering graduate of the University of Alberta, class of 1950.

**Aime Blais,** JR.E.I.C., is now process development and quality control engineer with the Panelyte division of St.

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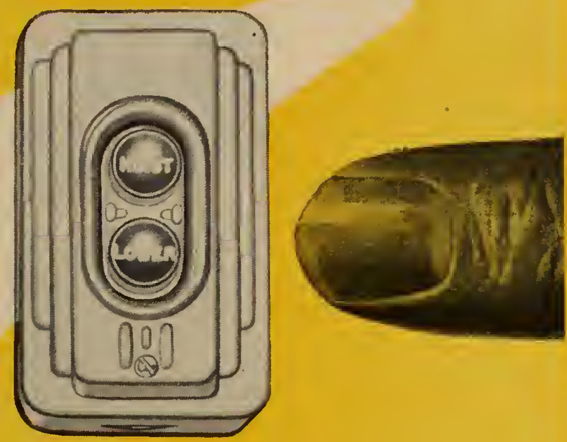
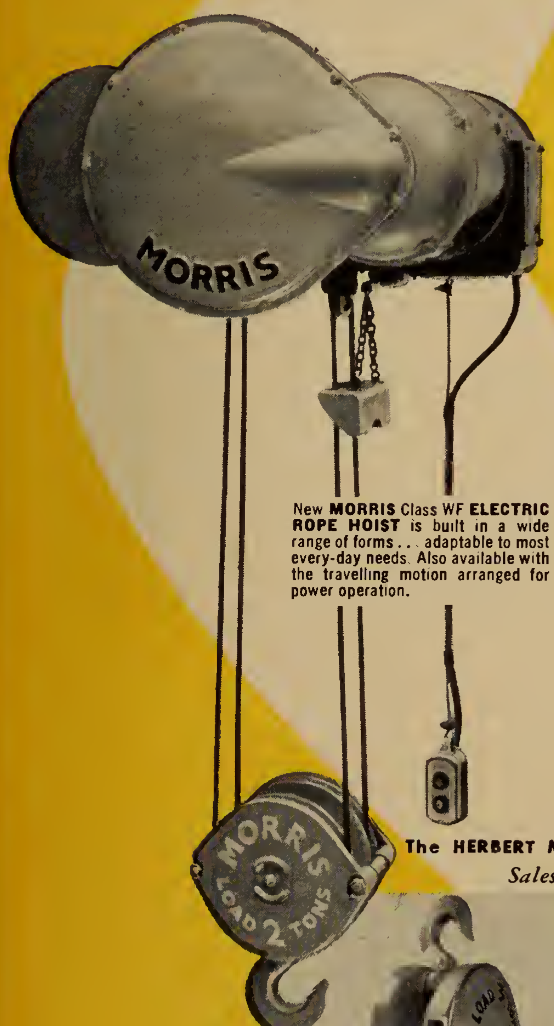


## AT YOUR FINGERTIPS . . .

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*Sales and Service Branches in Montreal, Toronto, and Hamilton.*

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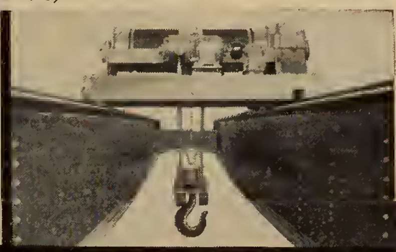

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Regis Paper Co. (Canada) Ltd. in St. John, Que.
Mr. Blais is a 1950 graduate in chemical engineering of Laval University.

**Donald W. Gordon,** Jr.E.I.C., is now associated with Bridge & Tank Co. Ltd. in Winnipeg, Man.
He was previously on the staff of the Toronto Iron Works in Toronto, Ont.
Mr. Gordon graduated in mechanical engineering from the University of British Columbia in 1950.

**Paul J. Delicaet,** Jr.E.I.C., has joined the staff of J. E. and D. P. Connolly, Bathurst, N.B. contractors. He was previously employed with New Brunswick International Paper Co. Ltd. in Dalhousie, N.B.
Mr. Delicaet is a 1951 mechanical engineering graduate of McGill University.

**S. D. Stabler,** Jr.E.I.C., has joined Canadian Petrofina Ltd. as construction engineer in Montreal, Que.
He was formerly associated with Morrison-Knudsen Company of Canada Limited and McColl-Frontenac Oil Co. Ltd. in Montreal.
Mr. Stabler graduated in civil engineering from Queen's University in 1951.

**Louis D. Roberts,** Jr.E.I.C., is the branch manager in Prince Rupert, B.C., for the Central Mortgage & Housing Corporation. He worked for the Corporation in Vancouver previously.
Mr. Roberts is a graduate in civil engineering of the University of B.C., class of 1951.

**Emeric Leonard,** Jr.E.I.C., is a field engineer on the deep waterway project with the Department of Transport in Beauharnois, Que.

**J. N. Frenette,** Jr.E.I.C., is chief design engineer with F. I. Raskin Inc., in Montreal, Que.
He was formerly resident engineer with the Provincial Road Department in Ste. Hyacinthe, Que.
Mr. Frenette is a 1952 graduate in mechanical engineering of McGill University.

**Armand Richard,** Jr.E.I.C., is associated with Canadian Johns-Manville Ltd. in Asbestos, Que.
Mr. Richard graduated in mining engineering from Laval University in 1952.

**Grant M. Locke,** Jr.E.I.C., is an engineer for Pittsburgh Des Moines Steel Company in Pittsburgh, Penn.
Mr. Locke graduated in civil engineering from the University of New Brunswick in 1952.

**C. E. Laverty,** Jr.E.I.C., is a student engineer in the switchgear sales department of Canadian Westinghouse Co., Ltd. in Hamilton, Ont.
Mr. Laverty graduated in electrical engineering from the University of Alberta in 1952.

**Jean Marc Mayrand,** Jr.E.I.C., is working for the special projects branch of the Dominion Department of Transport in Montreal, Que.
Mr. Mayrand graduated in civil engineering from Ecole Polytechnique in 1952.

**Robert Marcotte,** Jr.E.I.C., is an engineer on the staff of the Consolidated Paper Corporation in Port Alfred, Que.
Mr. Marcotte graduated in civil engineering from Laval University in 1952.

**A. D. Scharf,** Jr.E.I.C., is a sales application engineer with Ainsworth Electric Co. Ltd.
He was formerly with the Canadian National Telegraphs in Toronto, Ont.
Mr. Scharf graduated in electrical engineering from the Univesity of Saskatchewan in 1952.

**C. R. Whalen,** Jr.E.I.C., is a design engineer with the New Brunswick International Paper Company in Dalhousie, N.B.
Mr. Whalen graduated in civil engineering from the University of New Brunswick in 1952.

**Carol Wagner,** Jr.E.I.C., formerly of Truscon Steel Co. of Canada has joined Defence Construction (1951) Ltd. in Montreal.
Mr. Wagner graduated with a B.A.Sc degree in civil engineering from Ecole Polytechnique in 1952.

**Charles L. Dodge,** Jr.E.I.C., is an assistant engineer with T. C. Gorman (Nova Scotia) Ltd., in Halifax, N.S.
Mr. Dodge graduated in civil engineering from the Nova Scotia Technical College in 1952.

**Vincent M. Jolivet,** Jr.E.I.C., received his master's degree with distinction from the Harvard Graduate School of Business Administration in June, and has accepted an appointment to the faculty of the school as a research assistant in financial management. At the same time he will work toward his doctorate.
Mr. Jolivet graduated in civil engineering from McGill University in 1952.

**G. W. Spratt,** Jr.E.I.C., is a field engineer in the waterworks department of the City of Regina.
Mr. Spratt is a 1953 graduate in civil engineering of McGill University.

**Dick Jamieson,** Jr.E.I.C., is a research fellow at the Ontario Research Foundation in Toronto.

**Milton E. Reid,** S.E.I.C., is associated with Canadian Westinghouse Ltd. in Montreal, Que.
Mr. Reid graduated from Laval University in electrical engineering in 1953.

**D. R. Gilley,** S.E.I.C., is a sales engineer with Canadian Bitumuls Co. Ltd. in Toronto, Ont.
He was formerly resident engineer with the Toronto Water Works.
Mr. Gilley graduated in 1953 from the University of Toronto in civil engineering.

**Robert McWhinnie,** S.E.I.C., is on the engineering staff of Canadian Bridge Co. Ltd. in Walkerville, Ont.
Mr. McWhinnie graduated from the University of Toronto in civil engineering in 1953.

**John D. M. MacDonald,** S.E.I.C., is a bridge engineer with the Prince Edward Island Department of Public Works & Highways in Charlottetown.
Mr. MacDonald is a graduate in civil engineering of Nova Scotia Technical College, class of 1953.

**R. H. Walkey,** S.E.I.C., is working in Louiseville, Que., as a plant engineer with Laminated Structures Ltd.
Mr. Walkley graduated from the University of Toronto in civil engineering in 1953.

**F/O J. P. Pagnutti, R.C.A.F.,** S.E.I.C., has been posted to the technical training unit of the R.C.A.F. in Vancouver, B.C.
He was previously stationed in Aylmer, Ont.
Mr. Pagnutti graduated in mechanical engineering from Queen's University in 1953.

**Robert Newey,** S.E.I.C., is an engineering student apprentice with C. A. Parsons & Co. Ltd., in Newcastle on Tyne, England.
Mr. Newey graduated in mechanical engineering from the University of Manitoba in 1953.

**H. G. Cox,** S.E.I.C., is at the Guelph, Ont., works of Canadian General Electric Co. Ltd. He joined C.G.E. as an engineer in training after graduating in electrical engineering from the University of Manitoba in 1953.

**D. A. Wiegand,** S.E.I.C., joined Packard Electric Co. Ltd. in Toronto, Ont., after graduating in electrical engineering from the University of Toronto this year.

**O. N. Smith,** S.E.I.C., is on the engineering sales staff of the Minneapolis Honeywell Regulator Company in Montreal, Que.
Mr. Smith is a 1954 graduate of McGill University in mechanical engineering.

**Kingsley G. Drake,** S.E.I.C., is a sales engineer with the Minneapolis Honeywell Regulator Company in Montreal, Que.
Mr. Drake graduated this year in mechanical engineering from McGill University.

**G. S. Roy,** S.E.I.C., graduated in electrical engineering from Nova Scotia Technical College this year, and is associated with the engineering staff of the Shawinigan Water & Power Company in Three Rivers, Que.

**J. Vilagos,** S.E.I.C., an engineer trainee in the research and development department of Canadian National Railways in Montreal, is a 1954 graduate in mechanical engineering of McGill University.

**R. G. Legare,** S.E.I.C., is a sales engineer with Minneapolis-Honeywell Regulator Co. Ltd. in Montreal, Que.
Mr. Legare graduated from McGill University in mechanical engineering this year.

**E. P. Rimmer,** S.E.I.C., graduated this year and is employed as junior engineer with the Winnipeg and Central Gas Company in Winnipeg, Man.

**Quentin W. James,** S.E.I.C., is with the engineering department of Super Motor & Lighting Limited in Kitchener, Ont.
He was previously associated with Fleet Manufacturing Ltd. (Canadair) in Fort Erie, Ont.

**H. Fedorak,** S.E.I.C., B.Sc., electrical engineering, University of Alberta, 1954, has joined the staff of the Hydro-Electric Power Commission of Ontario.

**Martial Quesnel,** S.E.I.C., of Montreal, has joined the engineering department of the Iron Ore Company of Canada at Knob Lake, Que.

**L. V. Woytiuk,** S.E.I.C., is an engineering laboratory chemist in the wire and cable division of the Northern Electric Company in Lachine, Que.
He worked as an industrial sales representative with Armstrong Cork Canada Ltd. in Montreal, after graduating from McGill University in 1953.

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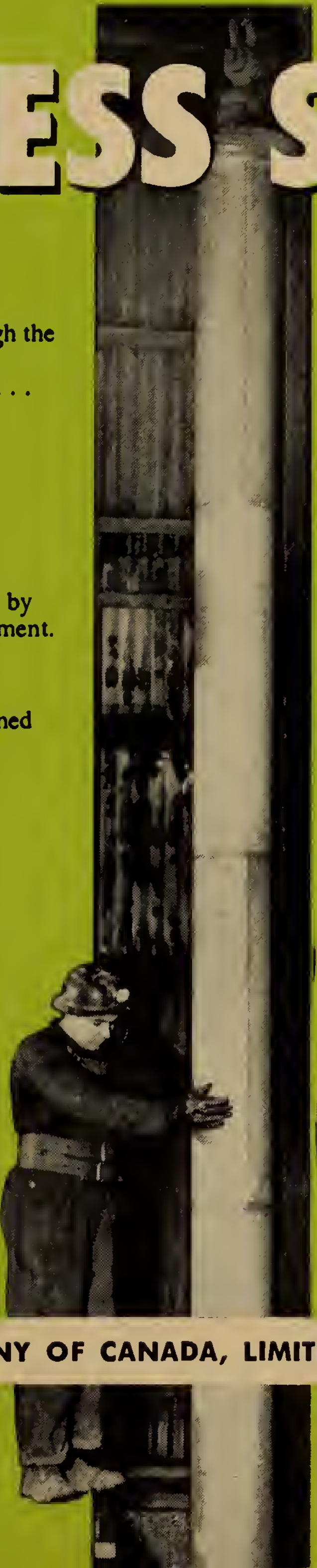
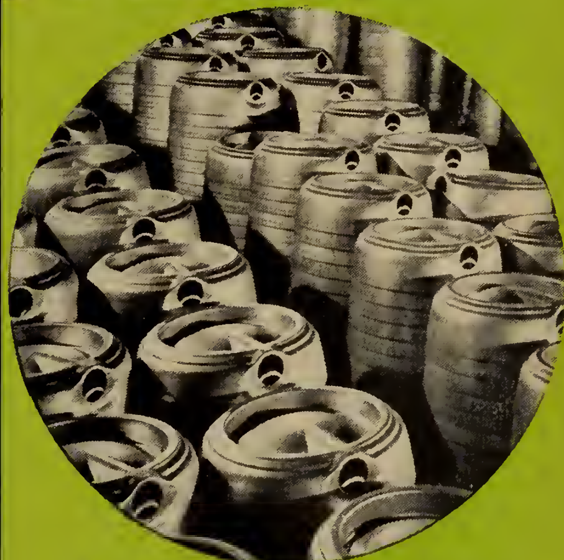
# Chromium Nickel STAINLESS STEEL

Chromium-nickel stainless steel head box on a Fourdrinier machine in the plant of Provincial Paper Limited, Thorold, Ont.



Hundreds of companies are today setting new standards of low-cost performance through the use of chromium-nickel stainless steels. Not only can you trim bulk and deadweight . . . you can assure longer service life because these alloys are resistant to attack by nearly all oxidizing acid conditions. In elevated temperature service they resist creep, scaling or oxidation, and at low temperatures they remain tough and offer exceptional resistance to impact. Investigate all the economies you may obtain by using chromium-nickel stainless steel equipment.



Firestone chromium-nickel stainless steel beer barrels, manufactured in Canada by The London & Petrolia Barrel Company Limited, London, Ont.

## SOURCES OF SUPPLY

Nickel-containing stainless steel can be obtained either direct from the mill or from warehouse stocks located in the principal cities of Canada.

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Over the years, a fund of useful information on the properties, treatment, fabrication and performance of chromium-nickel stainless steels has been accumulated. This information is yours for the asking.

Mine water pipe lines made of Type 316 stainless steel are providing excellent service in Canada's major metal mines. Fabricated by Welland Electric Steel Foundry Limited, Welland, Ont.

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Twenty-two tanks of Type 304 clad stainless steel installed in the up-to-date fermenting room at Vancouver Breweries Limited, Vancouver, B.C. The tanks were fabricated by Ellett Copper & Brass Co., Ltd., Vancouver, B.C.

**THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED**

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# Obituaries

*The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.*

**Charles Ross Lindsey,** M.E.I.C., retired vice-president of The Shawinigan Engineering Company Limited, died at his home in the Town of Mount Royal, Que., July 12, 1954, following a lengthy illness. Mr. Lindsey was the engineer who did most of the investigative work on the hydro-electric potential of Quebec's St. Maurice River.

Mr. Lindsey was born in Congress, Ohio, on May 21, 1879. He took his engineering degree at Ohio Northern University and spent several years on geological survey work for the United States government. In 1906 he joined the Shawinigan Water and Power Company to work on the installation of a turbine at Shawinigan Falls, remaining there until 1925 as a leading figure in the growth of the St. Maurice Valley centre. He planned and laid out much of the present city, serving frequently as town engineer, and was the architect and builder of the first Protestant church there.

One of his last duties before retiring from the Shawinigan Engineering Company early in 1951, was the final inspection of the Trenche hydro-electric development which he had first envisioned 35 years earlier on the Upper St. Maurice. He had been appointed vice-president of the Company in 1947.

During his career he investigated power potentialities of 36 sites on the St. Maurice River and also carried out power surveys of other rivers in Quebec, Ontario, British Columbia and New Brunswick. Between 1946 and 1949, he supervised the design and construction of the Bridge River development in British Columbia.

Mr. Lindsey joined the Engineering Institute as an Associate Member in 1916, transferring to Member in 1940 and becoming a Life Member in 1951

**Edward Horace Phillips,** M.E.I.C., died on June 15, 1954, at his home in Saskatoon, Sask., after a long illness.

One of Saskatchewan's pioneer civil engineers, Mr. Phillips was born in Whitby, Ontario, on December 19, 1878. He graduated from the School of Practical Science at the University of Toronto in 1900. His early topographical work in 1900 and 1901 took him to the Crow's Nest Pass area, to Rogers Pass in the Selkirk Mountains and to Northern Alberta. He became a Dominion Land Surveyor about this time and worked for the Department of the Interior. In 1904 he went to Saskatoon as inspector of surveys for the Department, and returned to Ottawa to work in the Surveyor General's office. In 1907 he settled in Saskatchewan, taking the position of district surveyor and engineer for the provincial government.

Mr. Phillips worked for the provincial government until 1909, when he entered private practice with W. M. Stewart, now deputy-minister of highways, and Roger M. Lee, now retired, under the firm name of Phillips, Stewart and Lee. He remained active in this business until 1951 when it was taken over by his son, E. K. Phillips, M.E.I.C.

In the earlier days, Mr. Phillips and his associates surveyed many subdivisions in the city of Saskatoon, as well as many town and village sites and branch lines for the two railways. In his latter years in practice, he concentrated on the survey of Saskatoon lots.

Mr. Phillips joined the Engineering Institute as an Associate Member in 1917, transferring to Member in 1940 and became a Life Member on January 1, 1953. A charter and life member of the Saskatchewan Land Surveyors Association, he was its president at one time, chairman of the Association's first board of examiners, and its representative on the University of Saskatchewan senate for several years. He was an honorary member of the Canadian Institute of Surveying and Photogrammetry, and an original member of the Saskatchewan town planning committee, under the chairmanship of Dr. C. J. Mackenzie.

**Leopold Laferme,** M.E.I.C., died suddenly on June 20, 1954, at his home in Montreal. Mr. Laferme was for many years superintendent of Public Works for Montreal's Western Division.

Mr. Laferme was born in Paris, France, on March 6, 1891. He matriculated from New College, England, and from 1908 to 1911 he was a pupil with Melleish & Harding, Land Surveyors, in London.

When first employed in Canada by the Canadian Pacific Railway from 1911 to 1914 he was rodman and instrumentman on location and construction.

He served from 1915 to 1917 as an inspector for the Imperial Ministry of Munitions, after which he was overseas for two years with the Canadian Railway Troops.

He returned to railway work with the Canadian Pacific Railway, and in 1920 became an assistant engineer for the Grand Trunk Railway. He was on the staff of the City of Montreal Technical Services from 1922 to 1941, being appointed superintendent of Public Works for the Western Division in 1941, and retiring in 1953. He has since been associated with the Sicily Asphalt Co. Ltd. in Montreal.

He joined the Engineering Institute as a Junior in 1920 transferring to Associate Member in August of 1921.

**Harold Sawbridge Clark,** M.E.I.C., passed away on March 31, 1954, at his home in Windsor, Ont. He was a field engineer for the Ford Motor Company of Canada at Windsor, Ont.

Mr. Clark was born at Port Dalhousie, Ontario, on August 10, 1889. He received his B.A.Sc. degree from the University of Toronto in 1911.

His early engineering experience was gained in railroading, when he served for the Canadian Pacific Railway's Ontario Division. He worked before the First World War on the location and construction of the Welland Ship Canal. He was in the Canadian Army from 1914 to 1919, serving in England. He was adjutant of the Canadian Base Depot from 1917 to 1910, and was mentioned in despatches.

Mr. Clark returned to the Department of Railways and Canals to work on harbour construction in connection with the Welland Ship Canal. About 1938 he joined the Ford Motor Company in Windsor, Ont., as a construction and maintenance engineer.

In 1921 he joined the Engineering Institute as an Associate Member, and transferred to Member in 1940.

**Walter Raymer McCaffrey,** M.E.I.C., general manager of Canadian Standards Association, died suddenly at his home in Ottawa on July 11, 1954.

Col. McCaffrey was born at Markham, Ontario, on June 23, 1894. He attended Riverdale Collegiate and studied civil engineering at the School of Practical Science, University of Toronto, graduating in 1915. During the First World War, he enlisted in the Canadian Cyclist Corps, transferring overseas to the Royal Field Artillery. After the war he commanded the Seventh (Toronto) Regiment, Royal Canadian Artillery, comprising the 3rd Field Brigade and 4th Medium Brigade, and transferred to Reserve of Officers in 1937.

His earliest work was in hydrometric engineering for the Irrigation Branch of the Dominion Government in Alberta. After World War I he was associated with the National Fireproofing Company of Canada in Toronto for eight years, and later with the brick manufacturing industry for nine years.

He was appointed secretary of the Canadian Engineering Standards Association, Ottawa, in 1937, and when the name of the Association was changed to the Canadian Standards Association he was its general manager. His work for the association has been of great importance to the engineering profession in Canada. He was to have attended the International Standards Association meeting in September in Geneva, Switzerland.

Col. McCaffrey joined the Engineering Institute as a Member in 1939. He was also a member of the Association of Professional Engineers of Ontario. He was a speaker for the British Israel World Federation and president of the Ottawa Branch.

# Employment Service

**THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.**

**NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.**

**REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.**

**INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.**

## SITUATIONS VACANT

### CHEMICAL

GRADUATE CHEMIST, required to be trained as assistant to chief chemist. Plant located at Cardinal in Ontario in one of Canada's oldest food industries. Forward all details of experience, education, with pictures, and anticipated salary to File No. 4837-V.

GRADUATE CHEMICAL ENGINEER from Canadian University required by manufacturer of organic chemical products. Attractive opening in new project located in Ontario. Several years of practical experience in production and process development is required. File No. 4900-V.

CHEMICAL ENGINEER required to work in control department of paper mill located in Province of Quebec. Graduate from a Canadian or British University. Pulp and Paper experience desirable but other chemical engineering experience would be acceptable. File No. 4915-V.

CHEMICAL ENGINEER or chemist, preferably with experience in paint, printing inks, rubber or plastic industries. To sell chemicals in Toronto district. Apply fully in writing to File No. 4960-V.

### CIVIL

QUALIFIED ENGINEER required as principal Ahsanullah Engineering College, Dacca, Pakistan. Candidate should possess a good honours degree in civil engineering from a recognized University. He must have enough of practical experience of actual execution of large projects, and their organization, and teaching and administrative experience in a recognized engineering institution. Candidate should preferably be 45 years of age or thereabouts. Further information apply File No. 4878-V.

THE CITY OF MONCTON, N.B., invites applications from engineers preferably with municipal experience, for service in the city engineers office. In reply please give details of experience, including any service with H.M. Forces and indicate salary required. File No. 4887-V.

GRADUATE CIVIL ENGINEER for company in Brazil as technical assistant for chief planning. Age around 40, with 5 years experience in: 1) preparing and completing preliminary and basic studies and layouts of hydro electric developments for consideration as to technical and economic feasibility, 2) analysing and evaluating hydrological topographical and geological data with relation to power development studies, 3) determining survey work required. Position requires engineer of maturity and judgment with teaching experience and leadership ability. File No. 4888-V.

CONSTRUCTION DEPARTMENT of prominent oil company with headquarters in Maritimes requires experienced man to supervise construction of bulk plant facilities and pipelines. Position has an excellent potential. Please write details, and if possible enclose photo. File No. 4889-V.

THE TOWN OF BRIDGEWATER, Nova Scotia, requires the services of an experienced civil engineer for regular municipal services. Reply stating age, municipal experience, and when available to File No. 4921-V.

SALES ENGINEER for promotion and sales in professional field. Background in structures and/or construction. Preferred age early thirties. Location Ontario. File No. 4922-V.

GRADUATE CIVIL ENGINEER with about 2 years experience required by major oil company. Duties include job inspection; service stations, bulk storage depots and marine terminals. Preferably bilingual but not necessary. Territory Quebec and Eastern Ontario. File No. 4932-V.

CIVIL GRADUATES. Recent graduates in Civil Engineering required by structural steel firm, Montreal. Men to be employed in Engineering Department. Experience in structural steel design of advantage but not necessary. Chances of advancement excellent. File No. 4938-V.

CIVIL ENGINEER required by established construction firm operating in the west suburbs of Toronto. Duties entail sewer, water and road layouts planning and general construction problems. Opportunity for a young man wanting to advance. Please reply stating age, education and experience. File No. 4939-V.

CIVIL ENGINEER required in a city in Western Canada to assist in the planning and designing and supervising of construction in extensions of sewers and also sewage treatment plant. File No. 4940-V.

OFFICE ENGINEER AND ESTIMATOR REQUIRED BY LARGE CONSTRUCTION organization opening new office in Montreal. Services of bilingual graduate engineer experienced in heavy construction. Duties involve quantity takeoffs, estimating and design. Good opportunity with permanent position for right party. File No. 4945-V.

CIVIL ENGINEER or architect engineer to act as assistant to chief engineer with large organization in the flour, feed and associated industries. Ten years in civil engineering required. 5 years of design, foundations, superstructures, steel and reinforced concrete, 3 years in construction, 2 years in project co-ordination and administration. $12,000. starting with annual improvements, benefits include health insurance, retirement plan etc. File No. 4946-V.

GRADUATE CIVIL ENGINEERS required for specialized work in soil mechanics and foundation engineering. Post graduate study essential. Locations Montreal and Toronto with some travelling. File No. 4968-V.

### ELECTRICAL

ELECTRICAL ENGINEER (Electronics) required by major world-wide electronics organization. Present opening for a fully experienced electrical engineer to do project development work on monochrome T.V. The successful candidate must have a minimum of 3 years in T.V. receiver design and 10 years in electronics in general. Salary will be commensurate with ability. Reply in writing, stating details of age, experience education and salary desired. All applications will be held in strictest confidence. File No. 4892-V.

JUNIOR ELECTRICAL ENGINEER—single, 25 to 30 years of age with 1-5 years experience in metering department of a large public utility or manufacturer. Location Rio de Janeiro, Brazil. File No. 4898-V.

GRADUATE ELECTRICAL ENGINEER wanted as demonstrator in the electrical engineering department, University of Toronto for the session 1954-55. Session commences on September 20, 1954, and extends seven months. File No. 4911-V.

ELECTRICAL SALES ENGINEER required by manufacturer of switchboards high and low tension, panelboards, busways and switches to cover territory East of Province of Quebec and Maritimes. Bilingual preferred. Opportunity for the right man to become district sales manager. File No. 4918-V.

ELECTRICAL ENGINEER required to take charge of draughting and inspection of switchboards, panelboards, busways, switches, etc. Location Province of Quebec. Bilingual preferred. Opportunity for right man to become plant superintendent. Previous practical experience preferred. Permanent position, salary depending upon qualifications. File No. 4918-V.

ELECTRICAL ENGINEER required by paper mill located in the Province of Quebec. Well qualified engineer to act as assistant electrical superintendent. File No. 4925-V.

PROJECT ENGINEER to join a rapidly expanding company which is a leader in the electronics field and offers scope for advancement. Applicant should be graduate in Electrical Engineering with a minimum of 2 years experience in Television designing, and the development of television and radio receivers, a knowledge of production manufacturing and production processing desirable. Excellent working conditions and a complete program of employee benefits. Salary is open for discussion. File No. 4927-V.

LARGE ALBERTA ELECTRICAL wholesale firm will, due to retirement, require an executive, qualified as an electrical engineer about 45 years of age. Must be a first rate administrator, now holding a very responsible position and able to manage a large portion of the company. A substantial investment in this company, will be made available to a top man with proper qualifications, personally and technically. File No. 4930-V.

PROCESS ENGINEER with about ten years manufacturing experience preferably in the electrical industry. He would report to the works manager and would be responsible for methods and cost reduction studies, plant layout work and the supervision of time study, tool room and maintenance departments. A knowledge of sheet metal work, plastic moulding, metal finishing, assembly operations, material handling, etc., is desirable. The salary would depend upon the applicant's qualifications. File No. 4931-V.

A LARGE MANITOBA UTILITY requires a graduate electrical engineer to fill the position of assistant to the distribution engineer. Applicant should have at least three years experience in distribution practices, including layouts of large distribution areas; estimating of costs of distribution changes and extensions; improvement of voltage conditions and expansion of existing systems, basic economic studies and design of transformer and other special distribution system structure. Ability to write clear and concise reports to supervise one or more junior engineers and a group of draughtsmen and to deal with field staff is essential. A limited amount of travel within the province will be required. Location is in Winnipeg. Applicants should submit details of family status, age, educational background and experience. Applications will be treated confidentially. File No. 4948-V.

ELECTRICAL ENGINEER with at least five years experience on electrical maintenance and operating problems of generating stations and substations, of public utility companies. Permanent positions with long established consulting organization New York. Some travel in Latin America. Spanish or Portuguese useful. Salary commensurate with experience. Reply stating age, education, experience and personal particulars. File No. 4950-V.

ELECTRICAL ENGINEER required as junior or assistant distribution engineer. Graduate with at least 3 years field experience operating utility company. Permanent position with long established consulting organization New York. Some travel Latin America necessary in future. Knowledge of Spanish or Portuguese useful. Salary commensurate with experience. Reply giving age, education, experience and personal particulars. File No. 4950-V.

TWO COMPETENT EXPERIENCED graduate electrical engineers, with approximately 10 years experience in design, operation and maintenance of distribution facilities in established rapidly growing utility located South America. Reply giving resume education, experience and personal data to File No. 4950-V.

GRADUATE ELECTRICAL ENGINEER interested in a career in Latin America with a Canadian owned electric light and power utility located Maracaibo, Venezuela. Age limited 30 years and should have 4 to 5 years' experience in electrical distribution. Immediate prospects for promotion to assistant distribution superintendent and ultimately to executive position if qualified. File No. 4953-V.

ELECTRICAL ENGINEER required by oil refinery in Montreal to act as instrument engineer. Duties include the design and maintenance of flow instruments. File No. 4958-V.

### MECHANICAL

MECHANICAL ENGINEER required as product designer. Recent graduate with Canadian background for training in spring and hydraulic components design, one year experience in production and general machine shop practices desirable. Location in Montreal. Write giving full particulars of training and experience. File No. 4884-V.

TOOL DESIGNER REQUIRED, mechanical engineering graduate or equivalent in actual experience. Should have approximately five years experience in design of cutting tools, light, sheet dies, forging dies, fixtures, jigs and gauges. Canadian background required. Location in Montreal. Write giving full details of training experience and state salary desired. File No. 4884-V.



MECHANICAL ENGINEER required in the lubrication department of prominent oil company with headquarters in Maritimes to be trained in doing lubrication surveys and selling same. Position has an excellent potential. Please write details and if possiblo enclose photo. File No. 4889-V.

MECHANICAL ENGINEER required in Edmonton, Alberta, who has graduated from a recognized Canadian University, and who has about five (5) years experience in a chemical plant or refinery. He will deal mostly in equipment used in the manufacture of petro-chemicals and synthetic fibres. Duties will consist of general engineering, which will include design, layout, estimating and some administration. Must be able to handle project work and general plant engineering problems. File No. 4891-V.

MECHANICAL ENGINEER required who has had practical experience in structural design. He will be required for commercial vehicle designing particularly. This is a good opportunity with a sound future. Location Ontario. File 4893-V.

MECHANICAL ENGINEER $4,100.00-$5,820.00 for Post Office Department Montreal, P.Q. Details and application forms at your nearest Civil Service Commission Office, Post Office or National Employment Office. File No. 4916-V.

WANTED GRADUATE MECHANICAL ENGINEER with several years experience for work on design of steam power plants and industrial steam plants. South Eastern Ontario location. State full details, your letter will be treated in strictest confidence. Our staff knows of this ad. File No. 4933-V.

GRADUATE MECHANICAL ENGINEER required by Quebec (Eastern Townships) paper mill to act as assistant to mechanical superintendent. Some experience preferred but not essential. File No. 4944-V.

MECHANICAL ENGINEER with approximately ten years experience in production and administration for small metal plant located in Toronto vicinity. Excellent opportunity for future. File No. 4949-V.

MECHANICAL PLANT ENGINEER required by operating division of service organization. University graduate preferred having 5 to 10 years experience in operation and betterment of steam plants operated by public utilities. Location New York, some travel. Spanish desirable, but not necessary. Reply by letter giving age, education, experience, personal data, and minimum salary acceptable. File No. 4950.

SENIOR TOOL DESIGNER required by high class tool and gauge manufacturer in Southern Ontario. Must be mechanical engineering graduate or equivalent in actual experience. Should have approximately five years experience in design of cutting tools screw thread systems, fixtures, jigs and fixed and indicating types of gauges. Position provides good prospects for the future. Salary will be commensurate with ability. Reply in writing, stating details of of age, experience, education and salary desired. Applications will be kept confidential. File No. 4951-V.

YOUNG MECHANICAL ENGINEER required for sales work. Must be energetic, have a good personality and the ability or a real desire to sell. Some knowledge of heating and ventilating equipment and their applications is desirable. Good opportunity for ambitious man, with right future in a growing business. Location Montreal. Write giving full particulars including training, experience, age and marital status. File No. 4954-V.

GRADUATE MECHANICAL DESIGN ENGINEER experienced in heavy industry machine design. He should have three or more years of applicable experience. His general duties would include, supervision of work of several draughtsmen, stress analysis of structural steel machine frames and machine parts. Evaluation of new designs and improvements to existing designs. Good salary and opportunity for the right man with a well established medium sized manufacturer of pulp and paper-mill equipment. Location, northern New York State. Enclose full details as to qualifications, experience, salary expected, and recent photograph. File No. 4955-V.

MECHANICAL ENGINEER required in Regina, Sask., who is a graduate mechanical engineer and has at least five years practical experience in the design of heating, ventilating, air conditioning and refrigeration systems for buildings. Applicants reply giving full details and expected salary in first letter. File No. 4963-V.

MAINTENANCE ENGINEER required for the works engineering department of a chemical process industry. Preferably mechanical engineering graduate with three to five five years of applicable plant engineering or maintenance experience. Must have ability to supervise craft foremen. Works is located in a P.Q. town, twenty miles from Ottawa. File No. 4967-V.

### MISCELLANEOUS

LECTURER REQUIRED in an expanding department. Subjects economic geology, geomorphology, stratigraphy, M.A. desirable. University year September 15 to May 15. Salary range $2,500 to $3,000. File No. 4880-V.

YOUNG ENGINEER either mechanical or electrical to assist in the design and manufacture of blueprinting and white printing. Location Ontario. File No. 4894-V.

CANADIAN SALES REPRESENTATIVE, preferably a professional engineer required with successful sales record to industrial organizations. Must have knowledge of materials handling, dust collection and fume disposal equipment. Work can be undertaken in conjunction with other activities if desired. Exclusive territory. File No. 4896-V.

STRESS ENGINEER, graduate in mechanical or civil engineering, with two or three years experience in stress analysis of steel structures and machinery. Required by manufacturer in the Montreal area. opportunity for varied experience in the stress analysis of heavy machinery and structures Salary commensurate with experience. File No. 4897-V.

A CIVIL OR MECHANICAL engineer preferably with knowledge of soil mechanics and some practical experience to work on the engineering aspects of snow and ice research, especially on field studies of ice and snow. A physicist on engineering physicist with M.Sc. or Ph.D. degree to assist with the research program. Positions are in connection with the completion of special laboratory facilities for snow and ice research in the new building, Research Centre, Ottawa. Salaries will depend on training and experience. The opening provides challenging opportunities in a new field of work. File No. 4899-V.

ELECTRICAL UTILITY has opening for two junior electrical engineers or engineering graduates in Halifax, N.S. The work will provide opportunities for advancement along both technical and administrative line. Applicants should have a university degree and have not over three years post graduate experience. File No. 4904-V.



HEATING VENTILATION AND air conditioning specialists. Salaries up to $7,200 per annum. Department of Public Works, Transport and National Defence at Ottawa. Details and application forms at your nearest Civil Service Commission Office and National Employment Office. No. 54-1209. File No. 4905-V.

ELECTRICAL ENGINEERS (electronics and radar), salaries up to $6,840. per annum. Department of National Defence and Post Office Department, Ottawa. Details and application forms at your nearest Civil Service Commission Office, and National Employment Office. No. 54-1150. File No. 4906-V.

PROJECT ENGINEER, Process-Instrument Engineer, and Piping Layout Draughtsmen required by consulting firm located in Niagara Peninsula. Applicants must have considerable experience in refinery and chemical plant design and construction. Please write stating qualifications and full details to File No. 4910-V.



MECHANICAL OR ELECTRICAL ENGINEER with education equivalent to graduation in engineering and at least four and preferably six years of engineering experience. Must be registered professional engineer. Experience in plant maintenance and plant engineering is desirable, as well as experience in job installation supervision and in layout and design. Duties will consist of preparation of equipment layout for supermarkets and supermarket renovation and warehouse; plans for refrigeration, air conditioning, ventilation, plumbing, electrical, etc., for supermarkets, supervision of mechanical plans prepared by consultants and correlation of these plans with architectural plans; calling of tenders for mechanical trades; the preparation of maintenance work orders for field forces and minor amount of field supervision. File No. 4914-V.

PATENT OFFICER REQUIRED at Ottawa. The successful applicant will be required to undertake various duties dealing with patent applications in the electronic field. University graduation in engineering physics, electrical engineering or physics, with specialization in electronics is required. Pertinent experience desirable but not essential. Initial salary up to $4,620.00 per annum depending on qualifications. Apply by letter giving full details of education and experience. File No. 4917-V.



FIRE PROTECTION ENGINEER required for employment on a National basis in Canada preferably with headquarters at Ottawa, under direction of a group of regional and national forest industry associations to design and carry out fire research on all phases of the fire protection problem in Canada, to co-ordinate educational activities in fire protection and fire prevention, to generally conduct a public relations program on fire protection for the improvement of the standards of fire protection in all classes of properties and occupancies. Should have qualifications for membership in the Society of Fire Protection Engineers. Should have experience in modern fire prevention theory and practice with some knowledge of the principle of fire insurance underwriting and fire loss adjustments; and should have ability to meet and address the public with authority on the above subjects. Salary commensurate with qualifications. Duties to commence as soon as satisfactory arrangements can be made. File No. 4919-V.

TECHNICAL MINING EDITOR required by Canadian Mining Journal established 1879. Must hold mining engineering degree from recognized university and have had some practical operating experience in industry. Position offers excellent salary, prestige, and opportunities for travel. Please state qualifications, experience, references, earliest possible starting date. File No. 4920-V.

OPERATIONS MANAGER required by long established and progressive premixed concrete company in major Canadian City. Man who is capable of taking complete charge of operating its 5 modern concrete plants and 100 plus truck mixer fleet. Applicants must have had previous experience and successful record in a similar capacity. Give age, particulars of experience, references, state when available and salary requirements. All replies will be treated strictly confidential. File No. 4924-V.

THE SASKATCHEWAN RESEARCH COUNCIL requires an industrial engineer preferably with mechanical or chemical experience to assist in making industrial surveys, to prepare reports on process and developments, and to provide liaison between science and industry. Position available immediately. Salary will depend on academic attainments and experience. Apply with all particulars, recent photo and addresses of reference, to File No. 4926-V.

GRADUATE ENGINEER required to act under the supervision of the plant engineer by manufacturer of telephone dial switching equipment and associated apparatus such as telephone relays, etc. The incumbent will be connected closely with the maintenance of equipment and the provision of general plant building service. One or two years general experience in this field would be of considerable assistance to the person selected. File No. 4928-V.

NATIONAL PARKS ADMINISTRATIVE OFFICERS, $4,260.00-$4,860.00. National Parks and Historic Sites, Department of Northern Affairs and National Resources, Ottawa. Details and application forms at your nearest Civil Service Commission Office, Post Office or National Employment Office. Quote No. 5:-652. File No. 4934-V.

SPECIALIST ON WEAPON Analysis. Salary up to $7,900.00 depending upon qualifications. Department of National Defence, Ottawa. Preferably graduation in mechanical or electrical engineering. Details and application forms at your nearest Civil Service Commission Office and National Employment Office. Quote No. 54-1205. File No. 4935-V.

TECHNICAL ASSISTANT to the Chief Cartographer. Department of Mines and Technical Surveys, Ottawa. Salary $5,760.00 to $6,480.00. Address all enquiries to the Civil Service Commission of Canada, Ottawa, and quote competition No. 54-1707. File No. 4936-V.

ASSISTANT CHIEF ENGINEER. Salary $10,000.00 per annum. Harbours and Rivers Branch Department of Public Works, Ottawa. Details and application forms at your nearest office of the Civil Service Commission, Post Office and National Employment Office. Competition No. 54-1258. File No. 4937-V.

ENGINEERING FIRM, Toronto, requires the services of a graduate engineer with high academic standards and particular interest and qualifications in applied gas dynamics and fluid mechanics with special reference to flow machines. Applicant must also be willing to work on a broad range of investigation, design and development assignments including both mechanical and electro mechanical problems. File No. 4941-V.

DESIGN ENGINEER REQUIRED to undertake, under general supervision, the design and development of a wide range of mechanical products and devices. Preference given to applicants having Higher N.C. and with design experience on aero engines or their accessories, alteratively to University graduates with post graduate experience in design of highly stressed light weight mechanical devices. Small engineering company located in Toronto Suburb. File No. 4941-V.

TWO MARINE ENGINEERS draughtsmen required preferably with experience in pipe arrangements for engine room work. Preferably those with U.K. training to engage in work on Marine installations in the engine drawing office. Location Victoria, B.C. File No. 4942-V.

APPLICATIONS ARE INVITED for positions requiring engineers and technicians with adequate technical qualifications and practical in board and paper industry. Locations in West Pakistan. Free furnished married accommodation will be provided. Appointment on contract for 3 years including six months probation and provision for passage and leave. Successful applicants required at site early October, 1954. Applications stating full qualifications, experience, position held, age and accompanied by copies of reference and passport size protographs should be sent in duplicate. For further information apply to File No. 4947-V.

YOUNG GAS ENGINEER wanted in connection with operation of two manufactured gas plants and distribution systems. Excellent opportunity for future. Desire mechanical chemical graduate with few years experience manufactured gas. Reply stating age, experience, education and personal particulars. Location Panama, R. de P. File No 4950-V.

METER SUPERINTENDENT required by established rapidly growing utility in Brazil with 10 years experience in meter department of Canadian or large Latin American public utility to supervise meter departments in several operating companies. Single man preferred as considerable travelling involved. Reply giving resume education, experience and personal data. File No. 4950-V.

FIRE PROTECTION ENGINEERS required by well known insurance brokers office. After a period of training, duties would consist mainly in inspection work and sprinkler equipments and eventually general work usual to an insurance brokerage business. Position offers excellent prospects to right party. File No. 4952-V.

SALES ENGINEER required by manufacturers of centrifugal pumps offer opportunity to young college graduate age 22-28, in sales engineering career. Edmonton area. Salary and commission. Reply in writing giving full particulars of age, education and background, including photograph. File No. 4956-V.

MECHANICAL OR ELECTRICAL ENGINEER for the position of instrumentation engineer to be responsible under the chief design engineer, for the application, design and selection of instrumentation and control equipment in connection with all operational phases of a self contained pulp and paper mill. File No. 4957-V.

ENGINEER FOR PATENT ATTORNEY'S office. Ambitious recent graduate with flair for writing and willing to learn, wanted as technical assistant in large Toronto patent law firm. This man will qualify to try registered patent agent examinations in three years. Apply by writing giving full details of education and experience. File No. 4959-V.

SALES ENGINEER required by progressive Vancouver company specializing in process equipment in Western Canada. Canadian graduate preferred with experience in chemical or petroleum industries. Excellent opportunity for man with initiative and personality. File No. 4961-V.

INDUSTRIAL ENGINEER required to head department of plant manufacturing diversified machinery and structural steel. Location Province of Quebec. Prefer bilingual French Canadian. Good opportunity for advancement. Applicant should have good basic training, qualifications and technical references. Applications should be written in French and will be held in strict confidence. File No. 4966-V.

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**SENIOR DESIGN ENGINEER**

A professional engineer with a degree in electrical engineering is required for our rotating machines, direct current design section.

Applicants should be between 30-45 years of age, with at least six years experience on design of rotating electrical direct current machines in all sizes, including motors, generators, converters and rotating regulators. He must possess ability to organize, plan, schedule, promote cost reduction and product improvement in Engineering. In addition, he must have a thorough knowledge of direct current machine application, and the ability to promote teamwork.

This is a senior appointment with excellent opportunity for promotion.

Reply in confidence, giving full personal resume, experience, salary expected and occupational goal to

Manager, Graduate Placement,

**CANADIAN WESTINGHOUSE COMPANY LIMITED**
**Hamilton, Ontario**

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CITY OF CALGARY
ELECTRICAL DISTRIBUTION SYSTEM
requires

## ELECTRICAL ENGINEER

DUTIES: To prepare reports on problems of electrical distribution and utilization; to consult with large wholesale power customers concerning their electrical supply; to maintain technical records and perform related engineering tasks as required.

SALARY: $335 to $408 per month (graduated scale).

QUALIFICATIONS: Graduation in electrical engineering from a recognized university with some experience, preferably in electrical distribution system work.

APPLICATION forms are to be obtained from and returned to the Personnel Director, City Hall, Calgary, Alberta, not later than Oct. 15, 1954.

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**SENIOR DESIGN ENGINEER**

A professional engineer with a degree in electrical engineering is required for our rotating machines, small motor design section.

Applicants should be between 30-45 years of age, with at least four years experience on design of all types of fractional horsepower motors. He must possess ability to organize, plan, schedule, promote cost reduction and product improvement in engineering. In addition, he must have a thorough knowledge of small motor application and the ability to promote teamwork.

This is a senior appointment with excellent opportunity for promotion.

Reply in confidence, giving full personal resume, experience, salary expected and occupational goal to

Manager, Graduate Placement,

**CANADIAN WESTINGHOUSE COMPANY LIMITED**
**Hamilton, Ontario**

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**SENIOR ESTIMATOR WANTED**

An outstanding opportunity for a qualified graduate engineer.

Applicants must have had extensive supervisory experience in the construction of highways, dams, tunnels, bridges and like projects, together with a thorough knowledge of estimating and the preparation of tenders.

This is a permanent position with an established firm. Write giving full particulars.

**PERINI QUEBEC INC.**
**1510 Drummond Street,**
**Suite 850**
Montreal, Quebec

## SITUATIONS WANTED

ELECTRICAL ENGINEER, B.Sc., (E.E.) Manitoba, 1943, P.Eng. (Ont.). M.E.I.C., age 34, married, requires immediate employment. Six years with industrial motor control manufacturer, mainly application engineering including circuit design, plus general supervisory and manufacturing experience and liaison with sales, purchasing, production and inspection department. Eighteen months with National Research Council, Ottawa. Three years Cdn. Army (R.C. Signals) immediately after graduation. Desires responsible position with consultant or manufacturer. Will locate anywhere. File No. 1408-W.

MECHANICAL ENGINEER M.E.I.C., with apprenticeship and university background available for responsible position, on reasonable notice. Interested in representing manufacturers wishing to develop and service markets in Canada or abroad. Experience includes design, construction and maintenance in the pulp and paper industry, several years handling sales of power plant equipment. Working knowledge of French and German. Free to travel. File No. 2642-W.

MECHANICAL ENGINEER, M.E.I.C., P. Eng. (Ont.), B.Sc., (Queens) 1941, age 38, 13 years experience in manufacturing methods, process engineering, production engineering of high precision components, plant layout and engineering desires position as plant engineer or mechanical superintendent; available immediately. File No. 3272-W.

MECHANICAL ENGINEER. Jr.E.I.C., P.Eng., interested in design or development work in I.C. engine, automotive or similar field or in instrumentation and control. Available on one months notice to present employer. File No. 3460-W.

CIVIL ENGINEER, Jr.E.I.C., Alberta 1951, Veteran, age 38, single. 3½ years experience in hydro-electric field, both in design and field work. Also experience in municipal engineering. Two years experience in airport construction with the Department of Transport. Location preference, Alberta or British Columbia. Desires position in hydro electric field, but will welcome offers from other civil engineering fields. Available on month's notice. File No. 3489-W.

MECHANICAL ENGINEER, Jr.E.I.C., single, age 26, N.S.T.C., 1951. Seeking position with insurance underwriters or in some branch of sales. Experienced in building construction, design of manufactured gas installation and presently employed as fire survey engineer. File No. 3903-W.

GRADUATE ENGINEER, 1951 (Mining), age 30, is interested in position offering scope and responsibility where an engineering background is helpful (not necessarily in the mining field). Other training includes military engineering, R.C.A.F. service and business management course. Mining experience as miner, surveyor, layout engineer and mine engineer in base metal and industrial mineral operations. More recent duties have included engineering reports and studies and supervision of construction. Married, one child, available on reasonable notice. File No. 4000-W.

GRADUATE MECHANICAL ENGINEER, Jr.E.I.C., age 28, with four years experience in design and research in the hydraulic field is seeking position with a progressive company as designer and/or sales engineer. File No. 4102-W.

CIVIL ENGINEER, B.A. (Honours) maths, B.Sc. (Civil Eng.) M.Eng. (McGill University). About two years experience in field and design work (structural and hydraulic work) in Canada. Age 26. Married, one child. Citizen of India. Available from October, 1954, for teaching engineering design work in India or Colombo Plant countries, or Indonesia. Keen, hard working good references. File No. 4108-W.

GRADUATE ENGINEER, B.Sc., 1951, Jr.E.I.C., P.Eng., married, 3 years varied experience in mechanical handling and municipal engineering desires position in plant, mechanical handling or industrial engineering. File No. 4207-W.

MECHANICAL ENGINEER, Jr.E.I.C., '51 McGill graduate, 29 years of age, single. Completed 2 years graduate student training course with Canadian Electrical manufacturer. Presently engaged as manufacturing engineer. Desires a position with opportunity to demonstrate his ability. Location—anywhere. File No. 4217-W.

1943 GRADUATE IN civil engineering, University Berlin, age 3?, married, 2 children, specialist in hydraulics, 7 years experience in design of navigable waterway, dams, locks and hydro power station. Hydraulic research and hydraulic laboratory work and also river regulations and water supply. File No. 4244-W.

CONSTRUCTION ENGINEER, Jr.E.I.C., B.Eng. (Civil), McGill 1951, married. Considerable experience in design and field supervision of industrial and commercial projects, including steel, concrete and timber structures. Thoroughly familiar with office routine, estimating, writing specifications and preparing plans for tendering. Interested in position with progressive, growing firm of consultants or contractors. File No. 4273-W.

CHEMICAL ENGINEER with several years' experience in control, operation and development in the field of metal finishing and protective coatings for appliances, chemical and food industry. Has had varied experience in finishing, design and maintenance of large factory equipment as well as small serial articles in aluminium, magnesium, steel and brass. Multicolor finishing on anodized aluminium. Formulation of cleaning, etching and phosphating solutions, etc. Desires permanent position with opportunity for advancement. Will locate anywhere. File No. 4359-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950 graduate, Toronto, veteran, 32, single; some research experience, over three years in chemical industry on project and design work, involving process and services equipment and piping, instrumentation and building construction, including some estimating, purchasing, expediting and inspection. Desires position of greater responsibility in similar work or in maintenance work of a general nature. File No. 4418-W.

GRADUATE MECHANICAL ENGINEER, 1952, Jr.E.I.C., married, age 30, with varied maintenance experience on high pressure equipment in the chemical industry, electrical repair for a mining company and some industrial engineering experience. Desires employment on plant maintenance or field supervision of industrial equipment installation and alteration. Location preferably in Ontario. File No. 4453-W.

CIVIL AND STRUCTURAL ENGINEER, Jr.E.I.C., P.Ont. Cambridge University, 1947. 6½ years experience, civil and structural engineering in industry, consulting engineering and research. Expert knowledge in structural analysis, specialising in prestressed concrete. Presently employed in Toronto. Desire change of employment where experience could be best utilized. File No. 4467-W.

ADMINISTRATOR, professional engineer in early forties, extensive manufacturing experience large corporations; well qualified industrial relations including contract negotiations, arbitrations, proven record in safety, supervisory training, policy formation, cost budgetting, maintenance and stores control; sales and warehousing experience; seeks challenging position in small or medium company. File No. 4496-W.

CIVIL ENGINEER, member E.I.C., A.C.I. graduate University of Pennsylvania, U.S.A., bilingual, married, 2 children, 18 years varied experience abroad and in Canada. Last 9 years specialized in design and supervision of reinforced concrete and steel structures of all types. Seeking permanent position where technical skill and experience would be of value. Available on reasonable notice. File No. 4533-W.

CIVIL ENGINEER, graduate of technical university of Norway, 1949, age 30, married, no children. 3 years experience in structural engineering and two in construction. Desires position in construction engineering. Free to travel, but would prefer to be in eastern provinces. File No. 4534-W.

CIVIL ENGINEER B.Sc., Jr.E.I.C., 1950 grad., R.C.A.F. veteran, age 34, married with 2 children. Have had extensive experience in plant maintenance, administration and design. Now wishes to broaden experience and would be interested in a responsible position in the field surveying or general field engineering. Will be available July 15th. File No. 4538W.

CIVIL ENGINEER, B.Sc., U.B.C., 1951, Jr.B.C.P.E., Jr.E.I.C., age 25. 3 years heavy construction experience having responsible work in layout and construction supervision during the excavation and construction of an underground power house and power tunnels. Seeks position in design office or responsible field position where experience will be of value. Preferably in Montreal or vicinity. File No. 4539-W.

MECHANICAL & INDUSTRIAL ENGINEER, graduate, 1937; M.E.I.C., P.Eng., A.S.M.E., age 45, married, now employed as plant manager, wishes to locate outside Quebec. Reason, Plant closing. Seasoned senior engineer with vast mechanical experience in paper making, construction and the steel industries. Well qualified for the positions of plant manager, chief engineer, plant engineer, mechanical superintendent, etc. Seeks a position in a reliable company where application and effort will be rewarded with advancement, peace of mind, and permanency in order to establish a home. File No. 4540-W.

ELECTRICAL ENGINEER, B.E., M.E.I.C., 12 years of experience in responsible positions including operation and testing of AC and DC machinery, design and supervision of construction of transmission lines, overhead and underground distribution systems, and substations, also system planning, report writing, economic studies, budgeting, staff supervision etc. Desires position with increasing responsibility. Excellent references. Available on suitable notice to present employer. File No. 4541-W.

CHEMICAL ENGINEER 33, veteran, graduate with five years wide experience in mechanical, chemical and electrical engineering, presently employed by plant manufacturers in Scotland, available for employment in Canada in August, 1954. Desires responsible position in planning, plant or production engineering, or industrial research and development work. Resume and references on request, languages, locality no barrier. File No. 4542-W.

CIVIL ENGINEER P.Eng., M.E.I.C., with extensive experience in design and detailing of R.C. structures. Seeks part time employment in Toronto area. File No. 4544-W.

MECHANICAL ENGINEER, Jr.E.I.C., Polytechnique, 1953, P.Eng., equivalent of 4 years in plumbing and heating business as an apprentice, service man, design, estimate, sales and surveillance of complete plumbing and heating system for a contractor in Eastern Townships. Seeks employment in similar work preferably in Eastern Townships or Montreal but would locate anywhere. Married, one child, 26 years old, bilingual. File No. 4548-W.

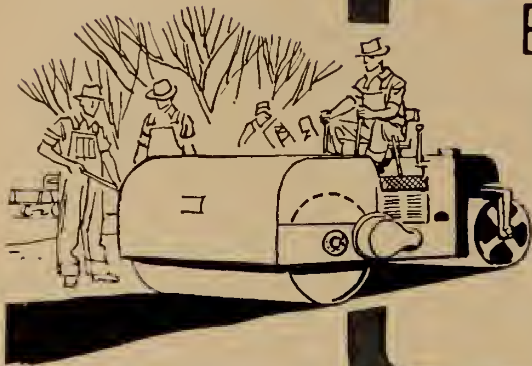
CHEMICAL ENGINEER, M.A. (Hons. Engineering), Cambridge University, England; A.F. Inst. of Petroleum, 28, married, recently arrived from England. Four years service with Royal Engineers as survey officer in the Middle East. Three and a half years supervisory experience in control, development, and maintenance of various types of petroleum refinery plants. Desire responsible position any where in Canada. File No. 4551-W.

CHEMICAL ENGINEER, M.E.I.C., P.Eng., Toronto, 1942, married, 12 years industrial experience in chemical plant project supervision, process equipment and piping design and fabrication. Seeks position with chemical company on new projects supervision or with process plant design engineering and construction company. File No. 4552-W.

ELECTRICAL ENGINEER, McGill, 1953, S.E.I.C., presently employed, seeks position which calls for judgment, initiative and willingness to accept responsibility. Over two years varied experience (including summer work) in switchgear, rotating equipment, household appliances, sales, and drafting. Location Montreal. File No. 4553-W.

PROFESSIONAL ENGINEER, Jr.E.I.C., B.A., B.A.Sc., Athlone Fellow '52, age 27, bilingual. Post graduate studies in engineering production and management principles, Birmingham University, England. One year experience in

*(Continued on page 1218)*





*The practical design of the new Chute-a-la-Savane powerhouse is photographically illustrated above. Hatch covers of crimped, batten-seamed aluminum, form the roof over the G-E Generators. The aluminum housed, rail-mounted 250-ton gantry crane, can be spotted over each generator for servicing. The covers roll back and aluminum sides can be lowered on the crane to make a weather-proof work area above each unit. If rotors must be removed for repair or inspection, they can be moved to a large repair bay at one end of the powerhouse.*

# on the Peribonka . . .

FIVE giant G-E Generators, installed in one of Canada's first "outdoor powerhouses" at Alcan's Chute-a-la-Savane project on the Peribonka River, add another quarter million horsepower to Northern Quebec's electrified industries in the Saguenay - Lake St. John area.

The new Savane powerhouse, one of two built on the Peribonka by the Aluminum Company of Canada, is unique in that the conventional walled-superstructure to house the generating equipment, has been eliminated. Instead, the reinforced roof of the permanent structure is approximately level with the tops of the generators. Access to the equipment is gained through galleries at various levels around the generators. From these galleries maintenance work, including coil replacement, is carried out.

This practical powerhouse design involved no change in the concrete work on the machine areas. It cut down on the amount of material shipped into this remote location, saved on building costs and added flexibility and safety to the structure. The skilled technicians who build and install giant G-E Equipment for such remote regions, know from extensive experience the magnitude of the engineering, construction and transportation difficulties involved. They consider the Chute-a-la-Savane project a credit to all those who contributed to its successful completion.

To the C-G-E engineers it represents another big job satisfactorily completed in the service of our many customers. They're ready to provide the same kind of service for you through nation-wide sales and engineering offices. For help on any job, big or small, contact the nearest C-G-E office, or write to: Apparatus Division, Canadian General Electric Company Limited, 212 King Street West, Toronto.

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**CANADIAN GENERAL ELECTRIC COMPANY LIMITED**


**Activities of the Forty-seven Branches of the Institute**
**and**
**abstracts of papers presented at their meetings**

## Hamilton

N. A. Parry, jr.e.i.c.,
*Secretary-Treasurer*
F. Gue, jr.e.i.c.,
*Branch News Editor*

***The Engineers' Ball***

The 1954 Engineers' Ball Committee of the Hamilton Branch is busy with preparations and arrangements for a function designed to duplicate, or if possible improve upon, the successes of past years. The Ball has been announced for Friday, October 15, and will occupy the combined Century and Burgundy Rooms of Fischer's Hotel in downtown Hamilton. Featuring music from 9.00 to 1.30 by Chris Lovett's orchestra, favours and prizes which proved so popular last year, and a buffet lunch at 11.30, the Ball promises to be one of the events of the year for Hamilton engineers. Tickets are in circulation at $5.00 each.

## Peterborough

R. A. Blount, jr.e.i.c.,
*Secretary-Treasurer*
G. T. Davis, jr.e.i.c.,
*Branch News Editor*

***Annual Outing***

The annual outing of the Peterborough Branch of the Engineering Institute of Canada took place on June 26. Approximately 60 members attended a tour of the operations of the Nepheline Mines which are located approximately 40 miles north of Peterborough.

Company officials acted as guides for the event and the visitors were able to examine the operation of the open pit mine, the underground workings, and the mill. The hill on which the workings are located is practically pure nepheline and the actual tonnage available is not known. However, the hill is approximately 3 square miles in area and 300 to 400 ft. high. Drillings have been taken and they reveal that the mineral is still to be found well below the base of the hill.

The material taken from the open pit mine is trucked to the top of several shafts that have been cut vertically down through the hill. The bottom of the shafts is approximately at the level of the mill and the material that is dropped down the shafts is taken by rail cars to the mill where it is crushed and ground to various grades.

During the milling operation magnetic impurities are extracted by magnetic separators. There is an extremely small percentage of waste in the mined material.

The mill product is used widely in the manufacture of glass and also used to a considerable extent in the manufacture of pottery.

After the tour the visitors enjoyed themselves in a game of baseball and following this they cooled themselves off in a nearby lake. After the sporting event was over a very fine camp cookhouse dinner was enjoyed.

## Kingston

D. R. Graham, m.e.i.c.,
*Secretary-Treasurer*

***Annual General Meeting***

The Annual General Meeting of the Kingston Branch was held on May 18, at the Cataraqui Golf and Country Club. Dinner and refreshments were served to members and guests.

Following the dinner two films were shown. These were provided through the courtesy of the Aluminum Company of Canada, Limited. The films, entitled "Prelude to Kitimat" and "Platform Pilots" are in colour. The first deals with the construction of the Kenney Dam and progress made at Kemano and Kitimat. The second, produced by Bell Aircraft Corporation, deals with the use of helicopters in connection with the work at Kemano.

## Winnipeg

**Electrical Section**

C. S. Landon, m.e.i.c.,
*Secretary-Treasurer*
G. Flavell, jr.e.i.c.,
*Section News Editor*

***Metalclad Switchgear***

The final meeting of the season for the electrical section was held on March 29th. A large group of section members heard D. A. Drynan, supervisor of engineering in power switching equipment of the Canadian General Electric Company speak on "What's New in Switchgear".

Mr. Drynan explained the features of modern metalclad switchgear emphasizing its versatility, ease of maintenance, low installation costs, greater service continuity and greater safety.

Modern metalclad switchgear comes from the factory as a packaged unit, and requires the minimum of installation time and equipment. A completely enclosed structure, it provides positive safety for substation employees. Mr. Drynan showed with the aid of a working scale model how safety features are present throughout the design of the cubicle, particularly in the circuit breaker and the potential transformer sections. Bus bars, potheads and other components are contained in isolated sections to reduce hazards to a minimum, but are still accessible through bolted panels that makeup the unit.

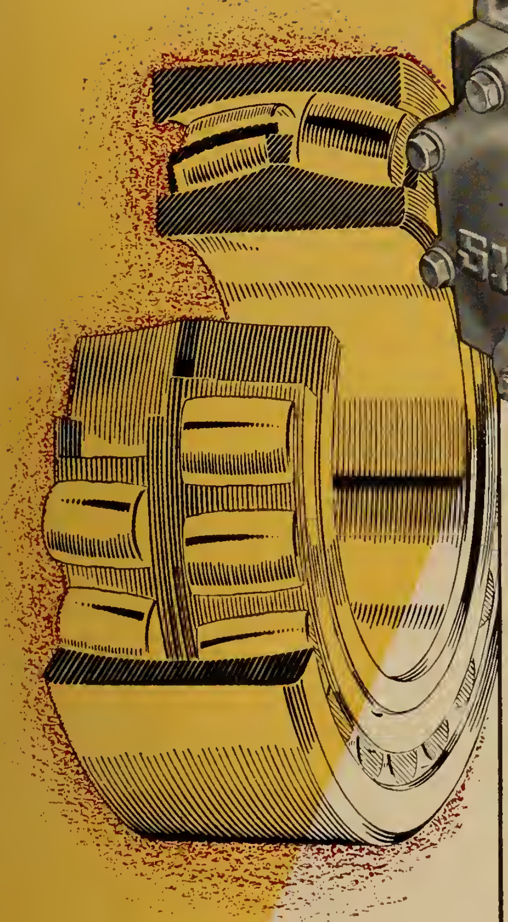
***Scale Model***

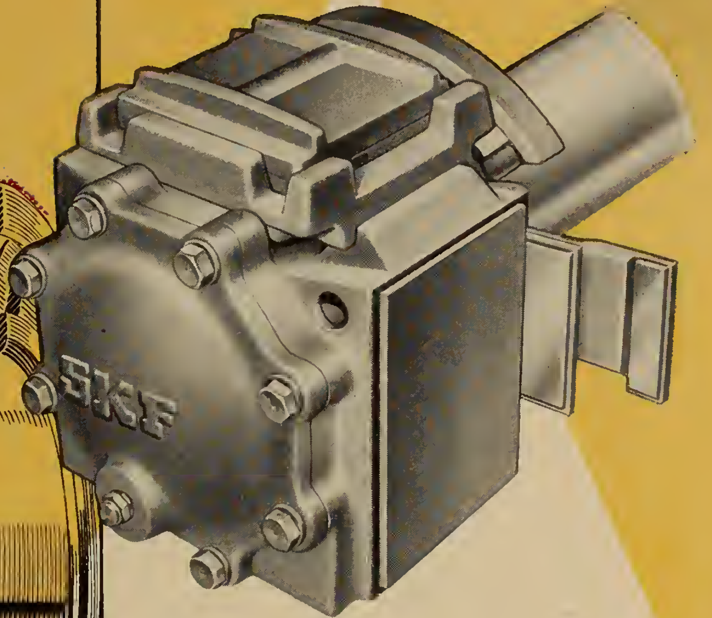
Using his scale model, Mr. Drynan showed how the circuit breaker is positioned in the cubicle. The model is made of steel and brass, and can be stripped and reassembled exactly as the equipment itself could be. It is scaled 1" to 1' and was constructed by Mr. Collet of the apparatus division who spent some 300 hours perfecting it.

The gears in the circuit breaker rating mechanism were obtained from a watch. These were pinned to their shafts by a drill whose diameter was less than three times the thickness of a human hair.

After an interesting discussion period members were invited to inspect the model.

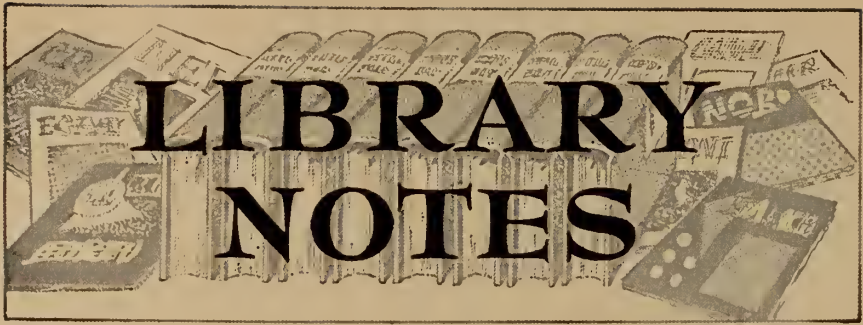
Mr. Drynan was heartily congratulated for providing a very interesting evening. The meeting was then adjourned for refreshments.








CANADIAN PACIFIC




## Additions to the Institute Library

**Reviews — Book Notes — Abstracts**

## BOOK REVIEW

**The international year book and statesmen's who's who: with supplement** London, Burke's peerage, 1954. 1125p., £8.8.0.

The first edition of this publication appeared in nineteen fifty-three, and in less than a year has proved itself an invaluable reference tool and mine of world information.

This nineteen fifty-four second edition, contains two hundred more pages than its predecessor, besides a supplement of information received too late for press.

The so called introductory section gives accounts of the various International Organizations of the world, including scientific and cultural organizations and large quasi-political bodies.

Following this comes the Diplomatic List, which groups, under each of the world capitals, the ambassadors and ministers accredited to each state. The Reigning Royal Families of the world, and a map section, complete this first portion.

Entitled the States of the World, the first main section includes the form of government of each country, constitution, population and area, financial and banking system, exports and imports, production, legal and educational systems, and religions. Brief information regarding origins of new states is included.

About ten thousand biographies comprise the second half of the main section, the entries being limited by the canons of selection. But what the policy of these same canons of selection can be remains an enigma, no matter how long we study the section. Apart from the apparent inconsistency of representation with a preponderance of "business executives", and "company directors" from one country, the inestimable value, otherwise, of this section lies in its variety.

Well known figures in very small states and countries throughout the world are included, people whose biographies would otherwise be very difficult to find.

Readers who are familiar with the Almanach de Gotha, which ceased publication in nineteen forty-four, will be pleased to read that this volume is a potential successor to that almost two hundred year old publication, and it will be published ultimately, it is hoped in more than one language.

Packed with world wide information, this International Yearbook is a must for most libraries, and an invaluable asset to both individuals and business offices who have any dealings in international affairs, in any country. E. K.

## BOOK NOTES*

**Prepared by the Library**
**The Engineering Institute of Canada**

* Review provided through the courtesy of the Engineering Societies Library in New York.

***Airplane structures,** volume I. A. S. Niles and J. S. Newell. New York, Wiley, 4th ed. 1954. 607p., $7.75.

This is essentially an elementary text on the general theory of structures, with emphasis on methods for the analysis of structures in which high strength/weight ratios are required, and with examples drawn mainly from the aeronautical engineering field. While all chapters have been revised to incorporate new methods and applications to new types of structures, the most important change is the increased emphasis on thin metal construction. There are lists of reference after most chapters.

**Analyse matricielle des réseaux électriques.** P. Le Corbeiller; tr. G. Lehr. Paris, Dunod; Montreal, Fomac, 1954. 124p., $4.50

Originally published in the United States under the title Matrix analysis of electric networks, the object of this volume is to present an elementary introduction to calculation methods of fixed electrical networks.

Bibliographic footnotes and illustrative problems and diagrams are liberally included, and the book will be a welcome addition to the French technical field.

**Beton-Kalender, 1954.** Berlin, Ernst, 1954. 2v., figs, together DM. 16.

In spite of the growing knowledge of concrete here, up to date information from the European continent is both welcome and informative.

This handbook of concrete and reinforced concrete is in its forty-third year of publication, and comes in two volumes, in cloth and paper.

The first volume is divided into fourteen chapters, and the second into ten, each chapter prepared by a specialist in the particular field.

All types and conglomerates of cement and concrete are considered, and their building potentialities in the various fields.

Graphs, diagrams, illustrative drawings, and tables are copious. References are to German standards, and in many cases these are included.

This will be an invaluable contribution to its field.

**Britain: an official handbook.** Ottawa, United Kingdom Information Office, 1953. 334p., maps, $1.40 pa., $2.00 cloth.

Presenting a factual background of Great Britain to-day, this *handy* little volume will both serve as a *vade mecum* to the traveller, and an information booklet for thousands of potentially interested readers.

Historical background, government and administration, defence, finance, trade, industry and labour, social welfare, religion, the arts, and radio broadcasting, are all covered, and included at the back is an excellent bibliography arranged by chapter and subject.

**Cathode-ray tubes,** M.G. Say, ed. Toronto, British Book Service, 1954. 216p., figs., $4.25.

This is an authoritative and up-to-date account of cathode-ray tube theory and practice. The first sections deal with the operation, design, construction and

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performance of the tubes, while later sections cover television, radar, instrument and modern camera tubes, as well as oscilloscope technique. A final section deals with switch, storage and other special tubes.

**Chauffage et rafraichissement combinés des habitations,** 2e ed. C. Boileau. Paris, Dunod; Montreal, Fomac, 1954. 313p., Complete vol. v. 1, $6.80; v. 2, $3.30.

Largely the result of discussions and findings at the International Convention of heating ventilating and air conditioning, held in Paris in May nineteen fifty-two, the idea of the author, in writing this double volume was to provide a handbook for interested engineers.

Panel heating, heat exchangers, and thermodynamics, and refrigerating machines, are particularly treated in this edition, from the domestic point of view. The book carries a few bibliographical footnotes.

*__Design and operation of septic tanks.__ Third European seminar for Sanitary Engineers, 1952. World Health Organization (Monograph Series, no. 18) Geneva (available in U.S. and Canada from Columbia University Press) 1953. 122p., paper. $1.50 (U.S.).

A collection of papers on the treatment and disposal of domestic sewage in unsewered areas, with special reference to Europe. The papers cover health considerations, design of small sewage plants, a study of the effectiveness of treatment in small plants, a review of septic tanks and small plants in Switzerland, and a comparative study of septic tanks. There is also a selective bibliography.

**Dry rot and other timber troubles.** W. P. K. Findlay. Toronto, McGraw-Hill, 1953. 267pp., illus., $5.50.

Written in non-technical language this volume explains why timber decays, its nature, causes of deterioration, discolouration, stains and blemishes, and its destruction by insects and disease.

The importance of prompt action in dealing with the first signs of dry rot and other deterioration is stressed, and wood preservatives and their uses are discussed and explained. The book has a short bibliography and a detailed index.

**Electrical earthing and accident prevention,** M. G. Say, ed. Toronto, British Book Service, 1954. 248p., illus., $4.25.

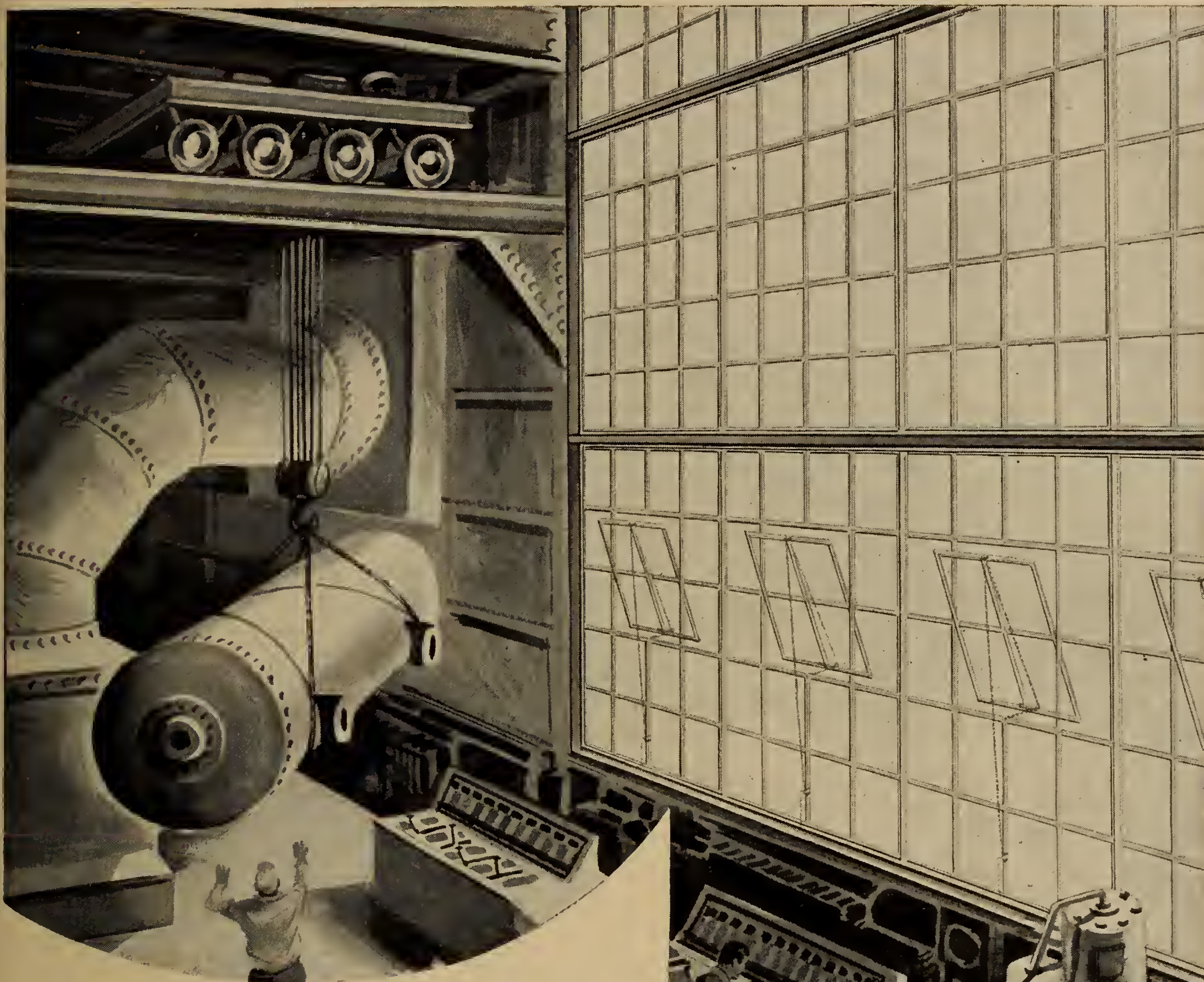
Written by nineteen specialists in the field, this book covers current practice and recent developments in the earthing of power systems, installations and communication systems. Domestic and industrial installations, telecommunication systems, ship, mining and aircraft installations and electric traction systems have all been covered, as has been the earthing of portable tools, etc.

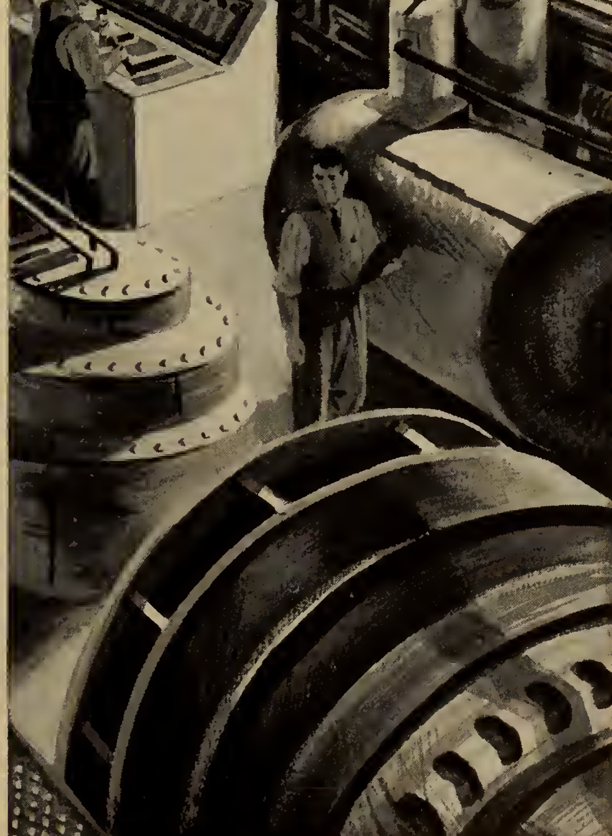
*__Electronics.__ T. B. Brown. New York, Wiley, 1954. 545p., $7.50.

This textbook for a basic course covers thermionic tubes, electron emission, gas in electron tubes, radio frequency circuits, and instruments. Descriptions of laboratory and demonstration experiments are integrated with the text in order to emphasize practical applications.

*__Elements of structural engineering.__ E. C. Harris. New York, Ronald press, 1954. 505p., $7.00 (U.S.)

A textbook on analysis and detail de-





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sign, written for non-civil engineering students. The first six chapters discuss basic principles of analysis; equilibrium reactions, shear, thrust, and bending moment, trusses and braces, moving loads, and deflections in beams. The last four chapters deal with the design of steel members and connections, and design in concrete and wood. Examples and problems are from mechanical, electrical and other non-civil engineering fields.

*__Enginering analysis.__ D. W. Ver Planck and B. R. Teare, Jr. New York, Wiley, 1954. 344p., $6.00.

An exposition for graduate and undergraduate students of professional methods for the solution of engineering problems. Most of the book is made up of cases, drawn from electrical mechanical, and industrial engineering fields, which illustrate how to define a problem, plan an approach, check results, and draw conclusions useful in dealing with future problems.

*__Ferrous process metallurgy.__ John L. Bray. New York, Wiley, 1954. 414p., $6.50.

A junior or senior text covering raw materials, blast and electric furnaces, the Bessemer and open hearth processes, and ingots and ingot molds. It differs from the author's earlier Ferrous Production Metallurgy in the use of physical chemistry as a tool for explaining processes, and in the omission of historical, price, statistical, and other data.

**How to use meters.** J. F. Rider. New York, Rider, 1954. 156p., pa. $2.40 (U.S.)

The aim of this book is to provide information for all those interested in the practical application of a-c and d-c voltage and current measuring devices. Very little theory is included, and most of the book is concerned with the application of meters to home electronic devices, radio and television receivers, radio amateurs transmitters, etc.

**Introduction to color TV.** M. Kaufman and H. Thomas, New York, Rider, 1954. 140p., illus., pa. $2.10 (U.S.)

The purpose of this book is to present the fundamentals of the system proposed by the National television system committee for the transmission and reception of colour television. Emphasis is placed on the receiver, and both the three-gun and single-gun tube is described, although the former is treated in greater detail as it was more easily available at the time receiver production was started.

**Introducton to the theory of plasticity for engineers.** Oscar Hoffman and George Sachs. Toronto, McGraw-Hill, 1953. 276p., figs., $7.80.

Intended both as a text for advanced engineering students, and as a reference book for practicing engineers, this volume presents the fundamentals of the theory of plasticity, and its more important applications.

Part I deals with the mechanics of continua and the basic theories of postelastic behaviour. The second and third parts present problems in plastic flow, the majority being those involving small plastic strains. However, the last chapter of Part III, and all of Part IV are devoted to problems characterized by large plastic strains. The fourth part is also specifically concerned with metal-forming processes.

It is assumed throughout the text that

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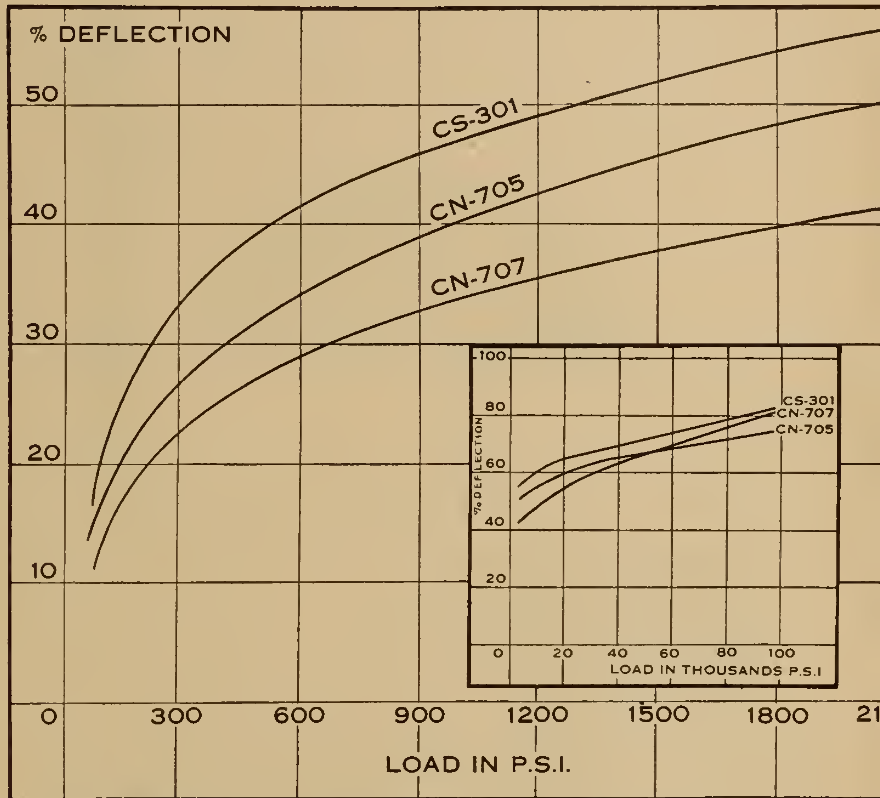


**LOAD-COMPRESSION CURVES.** Main graph shows that Accopac compresses under very light pressures. Inset reveals that Accopac retains its compressibility without rupture up to 100,000 psi. Together, these smooth, unbroken curves prove Accopac will seal equally well on light and heavy flanges.


**NEVER DRIES OUT.** These two fiber sheet gaskets were used for 6 months in a gear pump circulating hot hydraulic oil. The conventional gasket lost its glycerine plasticizer, dried out, shrunk, hardened — and leaked badly. The Accopac gasket remained virtually unaffected as shown in the above photo.

# ARMSTRONG'S ACCOPAC

the reader has a knowledge of calculus, and the authors have tried to present the material in a way best adapted to the needs of engineers.

**Kempe's engineer's yearbook, 1954,** 59th ed. London, Morgan brothers, 1954. vol. 1, 1345p.; vol. 2, 1413p., $15.00.

The normal procedure in reviewing these handbooks which are published year after year, is simply to inform the members of slight additions and changes, and when new developments have been included.

This fifty-ninth edition of Kempe, however, is the one that must be bought, regardless of which other ones you may have purchased in the past.

From the physical point of view, it has been completely reset in Times Roman 6-point. With the resetting, copious revisions were inevitable, as well as numerous additions, which latter include chapters on Atomic power, Explosives, Fundamentals of Electrical Engineering, Industrial Safety, Mechanical handling, Plastics, Powder metallurgy, and Theory of structures. Headings and technical terms have been revised and brought up to date, and new developments added.

It is also a pleasure to have many of the advertising pages omitted.

All in all, the new Kempe well merits your considered attention.

***Lubrication of industrial and marine machinery.** W. G. Forbes. Rev. by C. L. Pope and W .T. Everitt. New York, Wiley, 2nd ed. 1954. 351p., $6.50.

This is a practical manual integrating discussion of fundamental principles of lubricants with explanation of common mechanisms and their lubrication requirements. It causes the chemistry refining, compounding and specifications of lubricants; lubrication of such mechanisms as bearings, gears, pumps, etc; and practical examples of the lubrication of equipment.

**Magnetic amplifiers and saturable reactors,** M. G. Say, ed. Toronto, British Book Service, 1954. 198p., figs., $3.60.

Another in the Electrical engineering progress series edited by M. G. Say, this volume deals with the magnetic amplifier in which interest has recently been revived. The aim of this book is to provide an account of how saturable reactors, magnetic amplifiers and magnetic modulators function, and how they may be applied to particular problems. An Appendix gives an account of the M.K.S. system of units.

**The mathematical solution of engineering problems.** M. G. Salvadori. Toronto; Oxford, 1953. 245p., $4.50.

Originally prepared as a set of mimeographed lecture notes for engineering mathematics at Columbia University School of Engineering, the object of this volume is to bridge the gap between a knowledge of theoretical mathematics and the technique of solving physical problems by mathematical methods.

A certain knowledge of undergraduate mathematics and calculus is assumed. Each mathematical technique is introduced by a simple physical problem. The solution of the problem is then carried to its numerical conclusion, with special emphasis on accuracy of computation and practical numerical schemes. The book has a good detailed index.

**Mathematics for students of engineering and applied science.** L. B. Benny. Toronto, Oxford, 1954. 783p., $5.25.

Prepared for students reading for general science and engineering degrees, the bulk of this volume treats of differential equations, partial differential equations, harmonic analysis, and vector analysis. The author also considers Bessel and Legendre functions, theory of errors, spherical trigonometry, and astronomy. Numerous exercises are included as well as many illustrative examples, and the volume is briefly indexed.

**Mechanics of materials:** 3rd ed. P. G. Laurson and W. J. Cox. New York, Wiley, 1954. 414p., $5.75.

Originally written in nineteen thirty-seven, the volume is now in its third edition sixteen years later.

Some of the most noteworthy changes since the last edition include an increased emphasis on stresses by statics and free-body diagrams; increased emphasis has been placed upon Mohr's Circle in the section on combined stress; information on mechanical properties of materials has been almost completely rewritten, and tables of structural shapes have been revised to conform to present standards.

Fourteen pages of tables follow the text, and the book is indexed.

**Modern developments in fluid dynamics: high speed flow.** Comp. Fluid motion sub-committee of the aeronautical research council, ed. L. Howarth. Toronto, Oxford, 1953. 2 vols. $12.50 per set.

Issued as a part of the Oxford Engineering Science series, this is a companion volume to Goldstein's Modern developments in fluid dynamics.

The findings contained are largely the result of developments during the last war, and deal with compressible flow at subsonic and supersonic speeds, both theoretical and experimental.

Each section is written by a specialist in the field. Bibliographic references are included; figures and diagrams are numerous throughout the text, and illustrative plates are grouped towards the back of the first volume.

There are detailed author and subject indices.

**Modern wiring practice,** 2nd ed. W. E. Steward. Toronto, British Book Service, 1954. 228p., illus., $3.00.

The aim of this book is to provide a guide to the most up-to-date methods of wiring domestic and industrial premises for lighting and power. The latest British wiring rules and regulations are explained, and other topics covered include installation methods, various wiring systems, lighting fittings, switches, etc., earthing and testing.

***Molecular theory of gases and liquids.** J. O. Hirschfelder, C. F. Curtiss and R. B. Bird. New York, Wiley, 1954. 1219p., $20.00.

Part one surveys equilibrim statistical mechanics as the basis for theoretical development of the equation of state and discusses main applications of the theory. Part two covers non-equilibrium statistical mechanisms, transport phenomena, and hydro-dynamic applications. Part three deals with the electro-magnetic and quantum mechanical theory of forces between molecules, atoms, ions, and free radicals. The book is intended for students in chemical physics and as a reference work for industrial engineers and others.

**Out of the earth: the mineral industry of Canada.** Toronto, University Press, 1954. 126pp., illus., $3.50.

It would be a fairly safe assumption that, apart from specialists in the field, the majority of Canadian people would like to know more about mines and minerals in this country.

For these thousands of people, this book is the answer. Related in non-technical language, it briefly explains how mineral deposits came to be, how they are located and taken from the earth. The processing of the ores is also described, and the transforming of crude oil into high grade gasoline.

How a mine is financed is described with the explanations of the prospector —engineer—government—mine operator —financier and investor combination. The resulting jobs, professional and otherwise, are then discussed.

In short, the whole thing is interesting, fascinating and challenging — a really Canadian book.

**Power and process-steam plant,** E. Molloy, ed. Toronto, British Book Service, 1954. 184p., figs., $3.00.

The aim of this book is to provide the latest information on the use of combined power and process-steam plants. It covers the principles of power and process-steam schemes, the choice of prime movers, turbines, steam engines, boilers, and thermal storage. It is intended both for the engineer who has to decide what type of plant to use, and for the works engineer who is responsible for the installation and maintenance of steam-driven prime movers.

*__Relays for electronic and industrial control,__ R. C. Walker. Toronto, British Book Service, 1953. 303p., figs., $7.25.

This is a descriptive survey of the features and uses of relays as switching devices, intended to make some of the less known controls more familiar to engineers. Opening chapters deal with functions and classification of relays, fundamentals of electromagnetics, relay coils, and contacts. Then follow chapters on direct and alternating current relays, high speed relays, and time elements in relays. The last two chapters cover methods of control, and miscellaneous applications. A list of references follows most chapters.

**Rotating amplifiers: the amplidyne, metadyne, magnicon and magnavolt and their use in control systems,** M. G. Say, ed. Toronto, British Book Service, 1954. 152p., figs., $3.00.

Many industrial processes now call for a precision of performance which is obtained by the use of an automatic control or a servo mechanism. An amplifier, through which a very small error can develop large compensating power, is an essential feature of this type of control. This book covers the operating principles, construction, testing and maintenance of the four commercial amplifying machines, and the principles of control systems and their various applications

**Statistical yearbook, 1953.** United Nations. Toronto, Ryerson, 1953. 582p., $7.50 cloth, $6.00 paper.

Compiled by the Statistical office of the United Nations, this fifth edition of the Statistical yearbook contains all the information in the 1952 edition, with the addition of statistics for 1952.

A great variety of topics is covered, ranging from statistics on population and manpower, to those on industry, trade and finance, and education. The information is arranged geographically, and explanations of the tables are given in both French and English. There are two indices, one arranged alphabetically by subject, and the second by country; these indices are also given in both languages.

*__The steel skeleton. Volume I: Elastic behaviour and design.__ J. F. Baker. Toronto, Macmillan, 1954. 206p., $8.50.

Largely a report of investigations made for the Steel Structures Research Committee (Great Britain) from 1929 to 1939, with some references to later work bearing directly on the subject. There are chapters on tests made of experimental frames, hotel, office, and residential buildings; on stresses and loadings of beams and columns; and on a design method developed by the Committee. An appendix discusses design of bomb-resistant frame structures.

**Who's who in British science.** London, Hill, 1953. 292p., 42/-.

There are over 3,000 entries in this directory of workers in British science, both pure and applied. The fields covered include chemistry, physics, engineering, agriculture, microbiology, mathematics, social sciences, etc. The information for each entry was obtained from questionnaires sent to those whom the editors wished to include.

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Here at last is a condensate pump that incorporates more customer suggestions than any other on the market! Designed for use with all types of heating and process equipment, the universal Darling UNICON transfer unit features a completely enclosed impellor, hydraulically balanced; a stainless steel shaft with a submerged permanent graphite bearing that *requires no lubrication* and is not subjected to pump pressure. The pump has been designed without close clearances: efficiency is thus maintained and there is no wear on moving parts. Another vital feature, from the user's standpoint: the Darling UNICON Condensate Pump is fitted with a motor that is readily interchangeable with *any* other Canadian make. Motor requires no lubrication—it is sealed for life. Finally, the pump has been fitted into a **cast iron** receiver of novel design.

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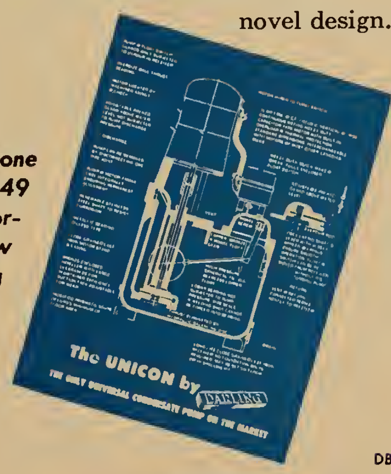


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This Who's Who will be a useful volume for all those interested in any way in British science.

**Winter concreting: abbreviated translation into English of Direction no. 17, Betonstobning om Vinteren.** P. Nerenst, et. al. Copenhagen, Danish Institute of Building Research, 1953. 61p., $1.25.

Dealing with all aspects of cold weather concreting, this volume considers also soil engineering, and the effect of cold and intense cold on its structural properties, and these same aspects of cement and concrete mixtures.

The English edition is an abbreviated translation of the more detailed Danish, and must be used along with the original, as this latter contains all the original diagrams.

This merits the attention of all our members interested either in concrete, or in cold weather construction.

## BOOKS RECEIVED

**CABMA register, 1954-1955, of British products and Canadian distributors.** London, Iliffe, 1954. 780p., $7.50.

**Canada yearbook, 1954.** Ottawa, Queen's Printer, 1954. 1324p., illus., maps, $3.00.

**Canadian trade index, 1954.** Toronto, Canadian manufacturers' association, 1954. 1127p., $7.50.

**Climatological atlas of Canada.** Canada, National research council, Ottawa, N.R.C., 1953. 253p., maps, $2.00.

**Coastal engineering. Proceedings of the fourth conference on coastal engineering, October 1953.** Berkeley, Council on wave research, 1954. 398p., illus., $5.00 (U.S.)

**Economic almanac, 1953-1954.** National industrial conference board. New York, Crowell, 1953. 740p., $3.95 (U.S.)

**Estimating construction costs.** R. L. Peurifoy. Toronto, McGraw-Hill, 1953. 315p., illus., $7.95.

**Fundamentals of transistors.** Leonard Krugman. New York, Rider, 1954. 160p., pa. $2.70 (U.S.).

**How to locate and eliminate radio and TV interference.** F. D. Rowe. New York, Rider, 1954. 128p., pa. $1.80 (U.S.)

**Industrial fermentations, v. 1.** L. A. Underkofler and R. J. Hickey, eds. New York, Chemical publishing co., 1954. 565p., illus., $12.00 (U.S.)

**National building code of Canada, 1953.** Canada, National research council, 1953. 15 parts, 25 cents each.

**National reference book on Canadian business personalities, 10th ed., 1954.** Canadian newspaper service. 850p.

**Principles of industrial psychology.** T. A. Ryan and P. C. Smith. New York, Ronald, 1954. 534p., $5.50 (U.S.)

**Statistical analysis in chemistry and the chemical industry.** C. A. Bennett and N. L. Franklin. New York, Wiley, 1954. 724p., $8.00.

**Technician's guide to TV picture tubes.** Ira Remer. New York, Rider, 1954. 160p., $2.40 (U.S.)

**Transient analysis of a-c machinery.** W. V. Lyon. New York, Wiley, 1954. 310p., $7.00.

**V-2.** Walter Dornberger. Toronto, Macmillan, 1954. 281p., illus., $5.95.

**Who's who, 1954.** Toronto, Macmillan, 1954. 3266p., $15.00.

**Wind tunnel testing, 2nd ed.** Alan Pope. New York, Wiley, 1954. 511p., illus., $8.50.

## TECHNICAL BULLETINS AND PAMPHLETS RECEIVED

**American society for testing materials. Special technical publications:**

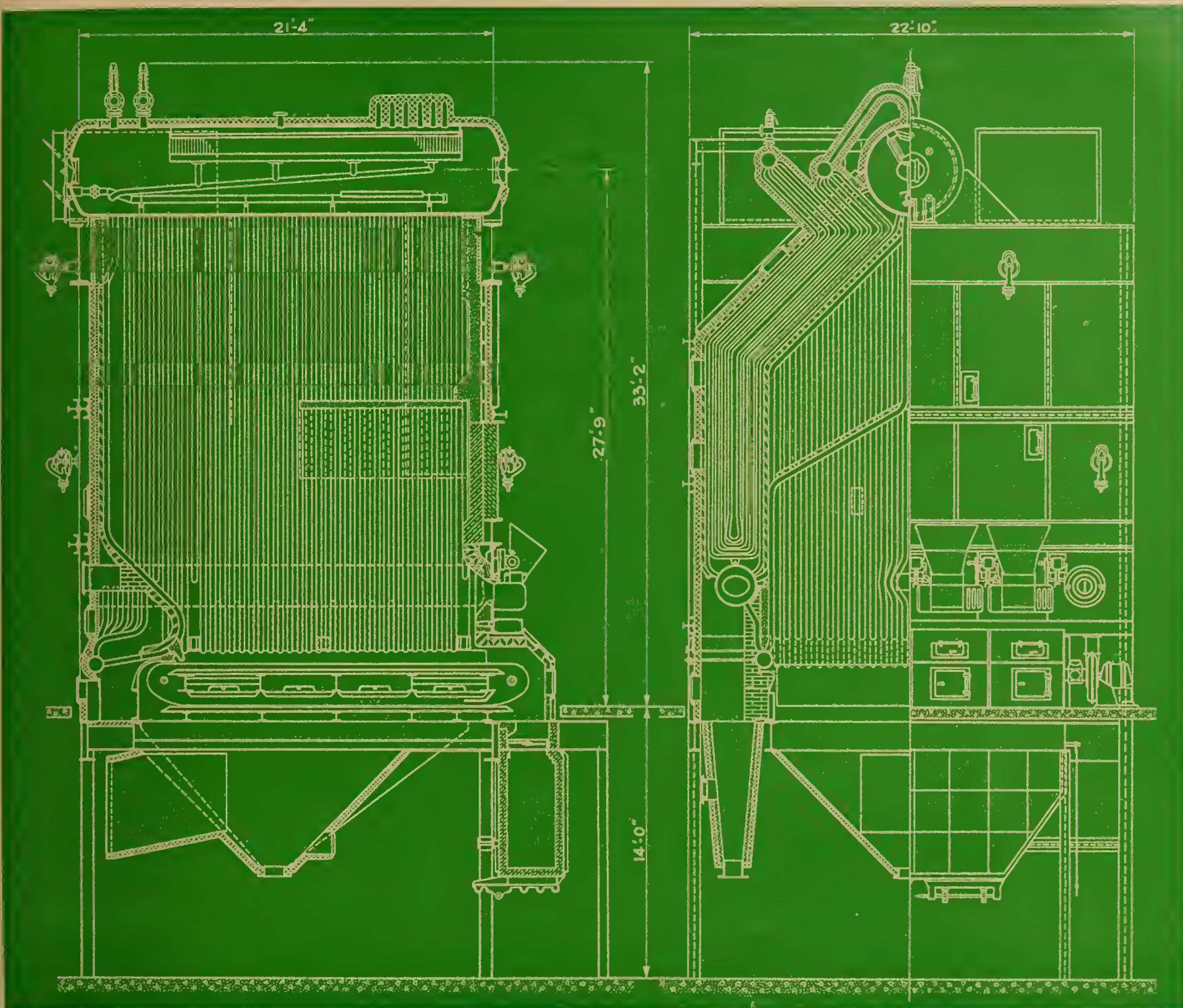
No. 41-C—Index to the literature on spectrochemical analysis, part III, 1946-1950, by B. F. Scribner and W. F. Meggers. No. 157—Symposium on fluorescent X-ray spectrographic analysis.

**American welding society:**

Tentative specifications for copper and copper-alloy welding electrodes. (ASTM No. B225-53T. AWS No. A5.6-53T).

**Canada. National research council. Canadian government specifications board. Specifications:**

1-GP-91—Paint, binder; marine, anti-condensation, fire-retardant. 4-GP-55—Compound; textile preservative water and rot resistant for field treatment. 4-GP-56—Compound; textile preservative water, rot and flame resistant for field treatment. 51-GP-1—Thermal insulation (amosite) for piping, machinery and boilers for marine use. 51-GP-2—Thermal insulation (calcium silicate-asbestos) for piping, machinery and boilers for marine use. 51-GP-3—Thermal in-

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sulation (85% magnesia) for piping, machinery and boilers for marine use.

**Canadian chamber of commerce:**
Conference on Canada-Mexico relations, February 1954.

**Canadian construction association:**
Convention report, 1954.

**Canadian good roads association:**
Facts and figures on highways and highway transportation.

**Engineering societies library. Bibliography:**

No. 9—Bibliography on filing, classification, and indexing systems for engineering offices and libraries.

**National audio-visual association:**
Membership list and trade directory, 6th ed., 1954.

**United States. National research council. Highway research board. Bulletins:**

No. 81—Parking meters; a study of their number, revenue and use. No. 86—Urban traffic congestion. No. 88—Better laws for better highways.

## STANDARDS REVIEWED

**ASTM standards, American society for testing materials, 1916 Race Street, Philadelphia.**
**1953 supplement to book of ASTM standards, including tentatives, 7 parts, 1954.**

**American welding society specifications, American welding society, 33 West 39th Street, New York 18, N.Y.**

**A5.9-53T—Tentative specifications for corrosion-resisting chromium and chromium-nickel steel welding rods and bare electrodes.** (ASTM No. A371-53T).

These specifications cover stainless steel filler metals for use with the inert-gas metal-arc process, and are issued jointly by the ASTM and the AWS. They include corrosion-resisting chromium and chromium-nickel steel welding rods and bare electrodes. The rods are for use with the atomic hydrogen and inert-gas metal-arc (nonconsumable electrode) welding processes. The bare electrodes are used with the submerged arc and inert-gas metal-arc (consumable electrodes) welding processes.

Thirteen classifications of filler metal are established by these specifications. A table gives the chemical analysis of the different classifications. An Appendix is included as an aid to users in selecting the most suitable filler metal for their needs.

**British standards, British standards institution, 2 Park Street, London, W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Ont.**

**B.S. 115:1954 — Metallic resistance materials for electrical purposes.** 3/-.

This revision of the 1938 edition classifies the various forms of resistance material, i.e. wire, strip, tape and sheet as follows:

Class A. Applications where low temperature coefficient of resistance is of primary importance.

Class B. Applications where the temperature coefficient of resistance is important but may be larger than that permitted for Class A.

Class C. Applications where the working temperature is above 250°C. or where the temperature coefficient of resistance may be larger than that permitted for Class B.

The electrical requirements dealing with resistivity and resistance and appropriate tolerances are unchanged as are the tolerances on dimensions of metallic resistance materials in their various forms.

All references to resistance castings have been omitted from this edition. A table of standard wire sizes is included for reference purposes.

**B.S. 1498:1954 — Gear hobbing machines for turbines and similar drives.** 4/-.

This specification was drafted for the purpose of establishing standards of accuracy for gear hobbing machines intended for the production of high grade gears for turbines and similar drives.

This revision introduces a number of amendments in detail which have been found desirable as the result of experience in use. The two grades of accuracy originally specified are maintained: Grade A for machines capable of producing gears for relatively heavy loads with high pitch line velocity, and Grade B for machines suitable for producing high quality gears for normal loads and pitch line velocities.

The text has been revised and the sections re-arranged in a more logical sequence, and a chart showing maximum permissible transverse pitch errors, based on the formulae given in the text, has been added.

**B.S. 1523: 1954 — Glossary of terms used in automatic controlling and regulating systems.**
**Section 3: Kinetic control. 4/-.**
**Section 5: Components of servo-mechanisms. 5/-.**

Section three covers the terms used in kinetic control systems, i.e. systems for controlling the displacement, velocity or acceleration of a mechanical load, such as a crane, a die-sinking machine, or a gun; it therefore includes terms associated with servo-mechanisms.

This section includes terms covering basic principles, feedforward and feedback, types of control systems, parts of a servo system, types of servo-mechanisms, types of continuous control action, and the performance of control systems. In defining a monitored control system, notes are given setting out the difference between a closed loop system and a system with a closed sequence of dependence.

An appendix is included giving the effects of derivative and integral controls in a displacement-displacement kinetic control system for a load possessing inertia and viscous friction.

Section five defines many of the terms which relate to the mechanical and electrical devices used in the building up of servo-systems — particularly those dealt with in Section three—and

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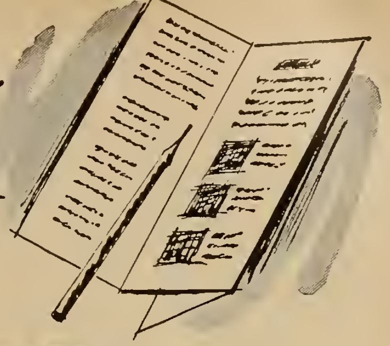

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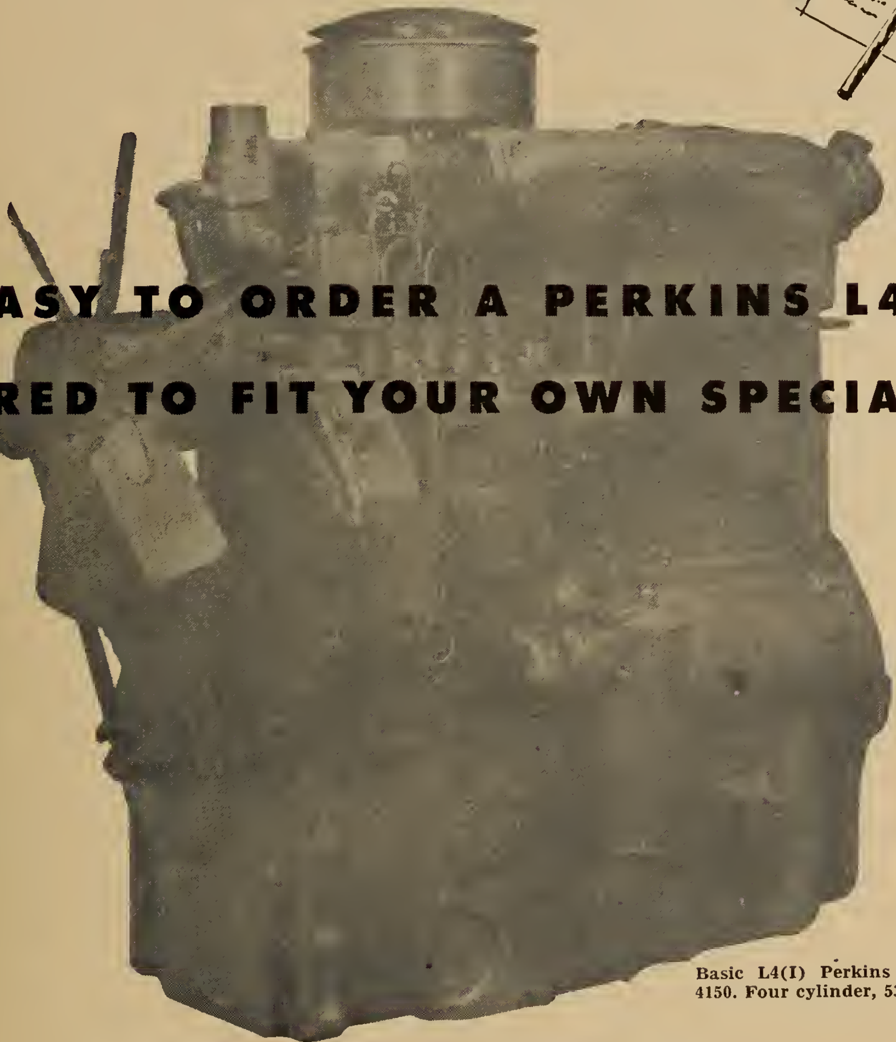

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covers devices used for deviation measurement, amplifiers and their components, computing devices, stabilizing and response-modifying devices, servomotors and tachometers.

Transductors, which are important components of magnetic amplifiers, have been fully dealt with; their definitions have been made clearer by the inclusion of diagrams showing the various arrangements of windings.

Important components of servo-mechanisms are synchros and their various modifications, which are known by a variety of existing proprietary and descriptive names. The difficulty of dealing with these has been solved by the inclusion of an appendix which compares the 'Standard' terms with names of existing variations and gives some details of the latter in respect of the number of their winding paths and their energy transfer systems.

In each section a distinction is drawn between preferred and deprecated terms.

**B.S. 2094:1954—Glossary of terms relating to iron and steel. 6 parts.** Part 1, 6/-; Parts 2-6, 2/6 each.

Part 1—General metallurgical, heat treatment and testing terms.

Part 2—Steel making.

Part 3—Hot rolled steel products (excluding sheet, strip and tubes).

Part 4—Steel sheet and strip.

Part 5—Bright steel bar and steel wire.

Part 6—Forgings and drop forgings.

The Glossary has been prepared to establish as far as possible uniformity in the interpretation of the numerous terms in current use.

The scope has been limited to those terms in general use in the different producing sections of the iron and steel industry. Terms dealing with the various applications of iron and steel products, e.g. in welding and electrical engineering are covered in other British standard glossaries.

Part 1, covering general metallurgical heat treatment and testing terms, is complementary to the other parts of the glossary which deals with particular sections of the industry.

**B.S. 2457:1954—Protractors for drawing office use. 2/-.**

**B.S. 2458:1954—French curves for drawing office use. 2/-.**

**B.S. 2459:1954—Set squares for drawing office use. 2/-.**

**B.S. 2460:1954—Drawing instruments for drawing office use. 2/-.**

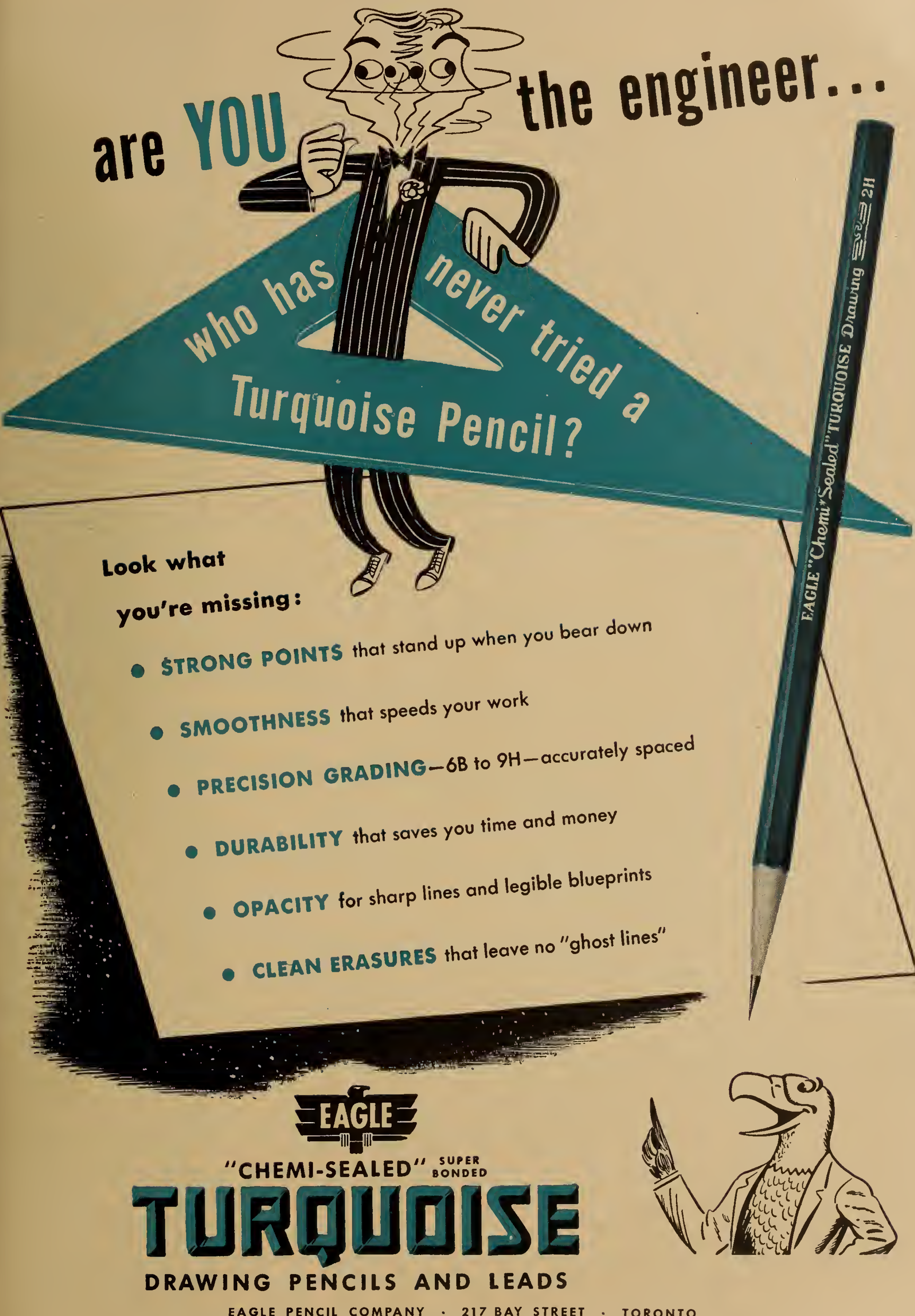
These standards are part of a series perpared to cover the range of standard drawing office equipment and materials.

Preferred sizes are listed, based on current practice; and recommendations are made for other dimensional factors—thickness, graduations, tolerances—with the object of establishing standard ranges of articles of sound quality.

Full, medium and small sets are recommended, to meet the requirements of the expert draughtsman as well as the apprentice and student.

The properties of suitable metals for the manufacture of drawing instruments are set out, but no definite material is specified. Guidance is, however, provided on this subject.

Manufacturing requirements are given in some detail in order to ensure uniformity of quality in instruments supplied by various makers. The dimensions and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material of needles are, in particular, clearly specified.

The meaning of the B.S.I. Certification marks scheme is explained.

**B.S. 2464:1954—Hose couplings for petrol, oil and lubricants (¾ in. to 4 in. nominal size). 7/6.**

This Standard applies to the reduced bore type of couplings and adaptors for hose of size ¾ in. to 4 in., for use at pressures not exceeding 100 lb. per sq. in.

Two forms of screw threads have been specified for the couplings: Whitworth (B.S.P.) threads in accordance with B.S. 84 and American threads in accordance with ASA specification B33.1 and with Federal Standard Stock Catalogue ZZ-H-466b. Details of these American hose coupling threads are given in the appendices.

These couplings may be secured to the hose by clamps, by clips, or by other suitable means.

**B.S. 2469: 1954 — Tins for lubricating greases. 2/-.**

This standard for round tins for lubricating greases standardizes the nominal diameters and gross lidded volumes based on nominal net weights with the requisite ullage. Heights of tins are not defined as their standardization would result in differences in volumes of the tins owing to the fundamental differences in the designs of lever rings and caps.

**B.S. 2475: 1954 — The performance of octave-band-pass filters. 2/-.**

This standard deals with a set of band-pass filters intended primarily for the analysis of noise into a series of consecutive frequency bands each one octave wide. The minimum performance characteristics specified have been chosen so that they can be met without too great difficulty by filters of simple design.

The purpose of the standard is to ensure:

a. Uniformity in the choice of frequency ranges.
b. Consistency between results obtained with different filter sets.
c. That the filter shall have an equivalent bandwidth equal to one octave within the tolerances given for a distributed spectrum in which the rate of variation with frequency of the sound pressure level is not too great.

It is not intended to imply that filters with the frequency ranges and the minimum characteristics specified in this standard are suitable for all purposes.

**B.S. 2478: 1954 — Tapes and spools for commercial and domestic magnetic tape sound-recording and reproduction. 2/-.**

The standard specifies the dimensions and certain features concerning the use of magnetic tape and spools in magnetic sound-recording and reproduction apparatus for normal commercial and domestic purposes.

Information on tape dimensions and tape speeds is given, together with certain requirements concerning recording and reproducing from dual track tape.

Dimensions for spools are specified, and a table sets out the nominal length of tape that may be accommodated on standard size spools.

**B.S. 2499: 1954—Tests to assess the properties of hot applied joint sealing compounds for concrete pavements. 4/-.**

This standard is intended to define the necessary properties of joint sealing compounds of the hot applied type for use on roads and airfields. Special requirements outside the scope of this standard may, however, be necessary for the application of this material to airfields used by jet aircraft.

The important properties required are that the compounds can be applied without difficulty, that that they adhere strongly to concrete, are sufficiently extensible to accommodate joint movements at low temperatures with cracking, and that they do not become so soft in hot weather that they flow or permit ingress of excessive quantities of grit into the joint.

It is extremely difficult to combine all the desirable properties to a satisfactory degree in one compound. The standard lays down a series of testing procedures for each of the above aspects of the behaviour of sealing compounds, and limits are prescribed appropriate to Great Britain.

**SP. 107 to SP. 112: 1954 — Tab washers for unified hexagons for aircraft. 2/6.**

These standards specify the materials, dimensions and finish of mild steel and corrosion-resisting steel straight, right angle and left angle tab washers suitable for use with the aircraft series of unified hexagons. A recommended method of application when washers are fitted into drill holes is shown in an appendix.

**S.P. 113: 1954 — Cadmium plated close tolerance shear pins for aircraft. 3/-.**

This standard specifies the materials, dimensions, finish and part numbers of the shear pins, which are cadmium plated to be suitable for insertion in aluminum alloy material. The standard is divided into three sections, the first specifying the requirements applicable to all pins, and the others dealing with the particular requirements for pins machined from bar and those produced by a cold heading process.

**British standard codes of practice. CP 304 (1953) — Soil and waste pipes above ground. 6/-.**

This code is concerned with the design and installation of sanitary plumbing systems. Included are soil, waste and ventilating pipes where they occur above ground, both inside and outside a building. Topics covered are materials, design considerations, work both off and on site, inspection and testing, and maintenance.

**British standard code of practice. Draft code 352—Mechanical ventilation.** 12/6.

This code, with its associated subcodes, deals with the work involved in the general designing, planning, installation and testing of ventilating systems, whereby air is forced into, or extracted from, buildings.

When all comments received on the draft have been considered, the code will be published as part of the series of Codes of practice for buildings.

**Canadian standards, Canadian standards association, National research building, Ottawa, Ontario.**
**A82 Series—Brick and hollow tile.** $3.75 a set.

The seven specifications in this series are:

A82.1—Building brick (made from clay or shale).

A82.2—Standard methods of sampling and testing brick.

A82.3—Sand-lime building brick.

A82.4—Structural clay load-bearing —wall tile.

A82.5—Structural clay non-load-bearing tile.

A82.6—Standard methods for sampling and testing structural clay tile.

A82.7—Facing brick (made from clay or shale).

The first editions of these specifications were issued in 1944, and numbers one to five have now been revised and are based on the standards of the American society for testing materials, slightly modified to bring them into conformity with Canadian practice. The sixth specification in the series is a re-affirmation of the 1944 edition, whilst the seventh is completely new, although based on an ASTM standard.

**A82.31-1954—Gypsum wallboard application.** 50 cents.

This specification is designed to provide minimum requirements for gypsum wallboard application. In addition to details on the actual methods of application, information is also given on delivery, handling and storage, as well as definitions of the material used. An appendix gives recommendations for decorating gypsum wallboard.

**A82.32-1954—Design requirements for reinforced gypsum concrete.** 50 cents.

Included in the scope of this specification are units precast at manufacturing mills, as well as those poured-in-place. Details covered are materials, strength of gypsum concrete, allowable stresses, and design.

**A82.33-1954—Poured-in-place reinforced gypsum concrete roof decks using permanent formboards.** 50 cents.

This specification covers the installation of "Poured-in-place" reinforced gypsum concrete roof decks erected over permanent formboards. It does not cover the structural design of reinforced gypsum concrete which is covered in A82.32 listed above.

Details covered include forms and reinforcing, mixing and pouring, and cold weather operations.

**A82.34-1954—Gypsum formboard.** 50 cents.

This specification covers requirements for gypsum formboard for poured-in-place reinforced gypsum concrete roof decks. Details are given on composition, sampling and testing, flexural strength, dimensions, weights, and permissible variations, finish, shipment, inspection, rejection and rehearing.

**C22.2, No. 15-1954—Construction and test of electrically-heated warming pads,** 2nd ed. 75 cents.

Applying to electrically-heated warming pads for connection either in single-phase a-c. or d-c. circuits of 125 volts or less between conductors, this specification covers both general-use and waterproof pads for both hospital and domestic purposes. Details are given for the construction and marking of pads, and the tests to which both pads and thermostats should be subjected.

**C22.2 No. 21-1954—Construction and test of cord sets and power-supply cords,** 3rd ed. 75 cents.

Another in the series of Part Two of the Canadian electrical code, this specification applies to cord sets and power-supply cords designed to be employed on circuits operating at not more than 125 volts, and for use in making electrical connection between outlets and portable lamps, appliances, etc. In common with other specifications in this series, details are given for construction, marking and tests to be applied.

**G30 Series-1954—Reinforcing materials for concrete.** $1.00.

The six specifications contained in this series cover the various materials used in concrete reinforcing. These are: billet-steel bars, rail-steel bars, cold-drawn steel wire, fabricated steel bar or rod mats and welded steel wire fabric. The specifications are all revised editions and have been altered to bring them into line with change in similar standards issued by the ASTM.

The sixth specification giving the minimum requirements for the deformation of deformed steel bars for concrete reinforcement is a new Canadian specification, but is also similar to one issued by the ASTM.

**O121-1954—Douglas fir plywood and western softwood construction plywood,** 2nd ed. 50 cents.

Prepared at the request of the Plywood manufacturers association of British Columbia, this specification lists the requirements for plywood manufactured from Douglas Fir and Western softwood. In addition to these, the various tests are also listed, as are many definitions connected with this material.

**Z7.1.7.17-1954—Tentative specification covering 16-millimeter optical sound film projector class B (for industrial and educational use).** $1.25.

This specification has been prepared to define the minimum performance standards of 16-millimeter sound projectors for industrial and educational use only. Both minimum performance requirements and operating requirements are given, as are methods of test for cooling systems, film driving mechanism, frequency response, etc.

**Z129-1954—Insecticide vapourizers (continuous type).** 75 cents.

Since the application of the principle of continuous vapourization of chemicals for insect control was first made on this continent in 1947, one of the main problems has been to reach an air concentration of chemical which will be effective and yet not dangerous from a health point of view. This standard provides for the design, construction and installation of thermal devices adjustable in output to the volume of air to be treated, or fixed to suit specific spaces. It also covers markings and tests and testing methods.

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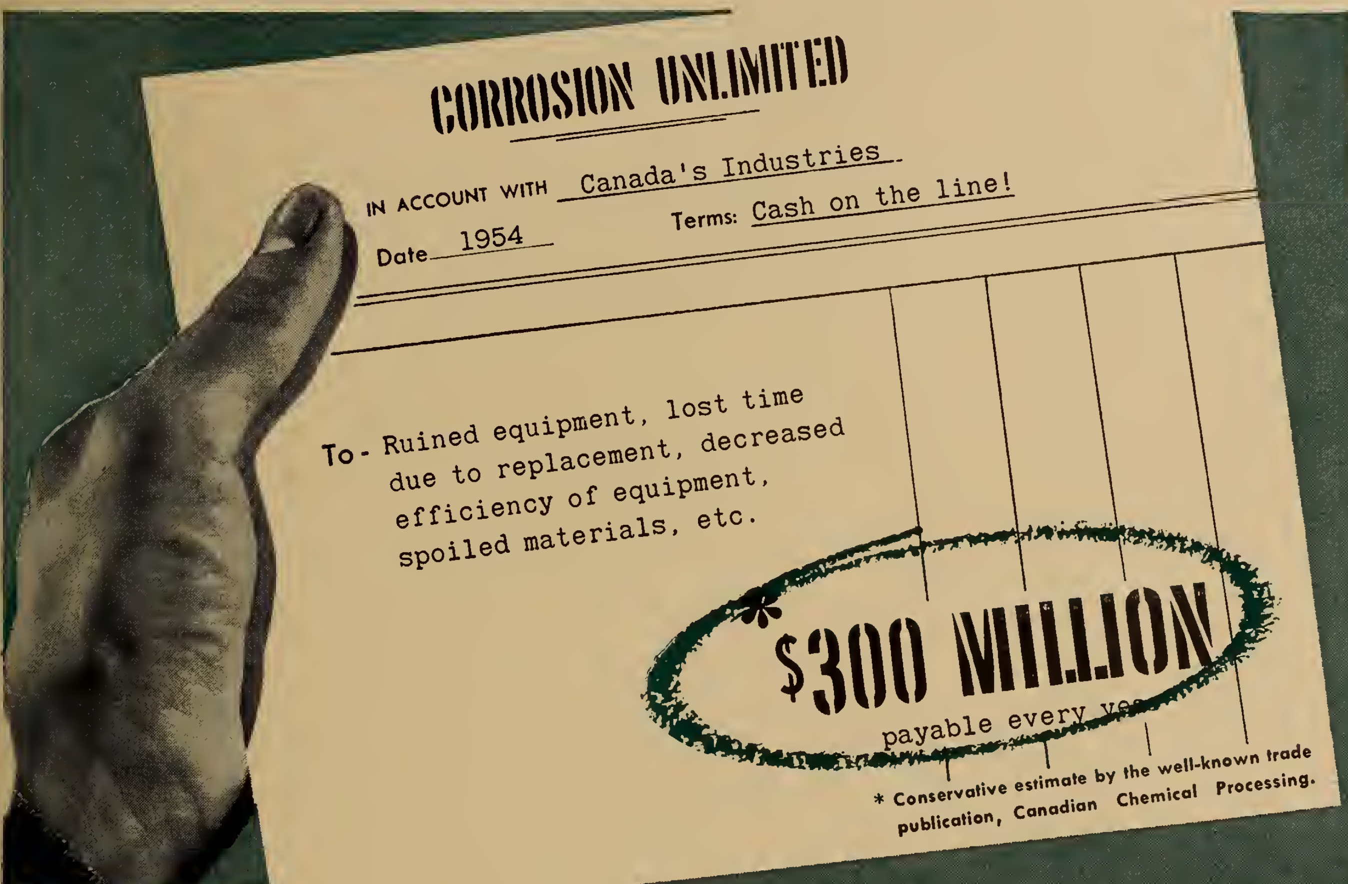


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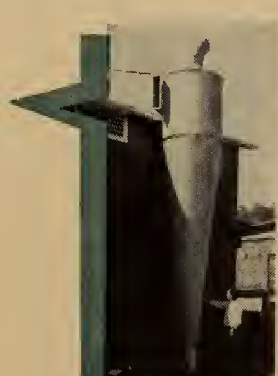

This cyclone-type dust collector made from Atlas stainless steel, has replaced a galvanized unit which failed due to the corrosive action of hot, moisture-laden air and fine dust. The galvanized unit had to be replaced about every 18 months. The service life of the stainless steel unit is conservatively estimated at 10 years. While the Stainless equipment costs approximately twice as much as the galvanized, its greatly increased life expectancy (up to 10 to 1) means very obvious overall savings.

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# BUSINESS & INDUSTRIAL BRIEFS

*A Digest of Information*

*received by*

**The Editor**

## Appointments and Transfers

**Frank W. Shaw.**—United Steel Corporation Limited announce the appointment of Frank W. Shaw as general manager, Standard Steel Construction Company, Port Robinson, Ont. Mr. Shaw joined the Company in 1950 as chief engineer.

Frank W. Shaw

Previous to that time, he was associated with Dominion Bridge Company, Limited, Toronto and Canadian Bridge Company, Walkerville.

●

**Dominion Bridge Co.**—Following the retirement of G. P. Wilbur, W. Taylor-Bailey, president, announces the appointment of R. C. Pearse to the position of vice-president and manager of the Ontario division. Mr. Wilbur's services are being retained in a consulting capacity.

Mr. Pearse was born in the town of Ipswich, near London, Eng., and received his formal and technical education there. He left England in 1929 to join the Montreal staff of Dominion Bridge as a mechanical designer. During the next 10 years Mr. Pearse filled various positions with the company. During most of World War II, he was manager of the Vancouver Ordnance plant. In 1944 he returned to the east as assistant works manager of the Lachine plant and a year later he was appointed works manager. In 1953, he went to Toronto as assistant manager of the Ontario Division. (For other officers of the company see Personals.)

●

**H. R. Stenson and No-Co-Rode.**—No-Co-Rode Company Limited is the new name of the fibre conduit division of Dominion Tar & Chemical Company Limited. This announcement of the change in name comes simultaneously with the appointment of H. R. Stenson as vice-president and general manager of the company.

Head office of the newly named company has been moved to Cornwall, On-

Mr. R. C. Pearse


TRAVELLING BRIDGES




MECHANICAL DIVISION*
DOMINION BRIDGE
COMPANY LIMITED

tario, from the Sun Life Building, Montreal.

Mr. Stenson, prior to this appointment was associated with Canada Creosoting Company as Eastern regional manager, in Toronto. His appointment to the No-Co-Rode Company Limited almost coincides with completion of that company's plant expansion in Cornwall, Ontario.

●

**C.I.L. (1954) Limited.**—The following company officers and department managers are announced by Canadian Industries (1954) Limited:

*Officers:* H. Greville Smith, president; *Leonard Hynes and W. T. D. Ross, vice-presidents; *D. W. Shales, secretary; *E. L. Hamilton, treasurer; *W. H. Flynn, assistant treasurer.

*Department Managers:* J. F. Armitage, real estate; J. C. Asselin, Q.C., legal; *Monty Berger, public relations, *A. F. M. Biggs, advertising; J. D. Converse, chemicals; D. S. Hart, traffic and customs; L. W. Haslett, explosives and ammunition; Leonard Hynes, paints and coated fabrics; **S. C. Jones, employee relations; *D. S. Kirkbride, development; V. B. Lillie, agricultural chemicals; H. G. Littler, plastics; I. R. McHaffie, research; *H. W. Umphrey, engineering; E. J. Wain, purchasing.

*—Occupy posts not held previously.
**—New department combining industrial relations and staff unit.

●

Gordon C. Campbell

**Bird-Archer.**—With headquarters in Calgary, the new sales and service representative for Alberta of the Bird-Archer Co., Ltd., water treatment engineers, is Gordon C. Campbell.

●

**Geocon Limited.**—The formation of Geocon Ltd., formerly Gunite and Waterproofing Ltd., was recently announced by J. R. Mills, president and director. The original name of the company was not suitable for the broadened scope of work it engaged in. Under the new set-up, which retains the original Charter, there will be three divisions known as: Gunite and Waterproofing, Geotechnical Services and Pre-Engineered Steel Buildings. The division managers are: A. G. Hyde, J. Morgan and M. F. Rodger, respectively. Secretary-treasurer of the company is S. A. MacLeod and F. R. J. Traynor is the ass't. secretary-treasurer.

●

**G. L. Read for Bucyrus-Erie.**—George L. Read has been appointed Canadian Sales Manager for Bucyrus-Erie Co., according to an announcement from the company's main office in South Milwaukee, Wis. He takes over responsibility for the sales of all Bucyrus-Erie products except water and oil well drills in all provinces of Canada east of and including Saskatchewan. His new office and residence is located at 1 Swindon Road, Toronto 18, Ontario, Canada.

●

**Rybka's Regina Office.**—William N. Stowe will be in charge of the Regina office recently opened by Karel R. Rybka, M.E.I.C., consulting engineer. The new office will be located in the Black Block.

●

**Bulldog Electric's New Sales Offices.**—Opening of new district sales and service offices at Montreal and Vancouver has been announced by J. H. Wilson, general sales manager of Bulldog Electric Products Company (Canada) Limited.

Appointed district sales managers are: Clifford C. Barrett of Montreal and Warren G. Sutton of Vancouver.

Announcement of the new branches coincided with announcement of a change in company from Dominion Bulldog Limited, to Bulldog Electric Products Company (Canada) Limited.

●

**C.I.L. Explosives Division.**—M. J. Watson, assistant manager of the explosives division of Canadian Industries (1954) Limited, has been appointed manager, succeeding C. A. Kirkegaard who retired on pension on August 1. Mr. Watson joined the company in 1928 and has held various positions at C.I.L. commercial explosives plants at James Island, B.C., Nobel, Ont., and Beloeil, Que.

●

# New Equipment and Developments

**Indoor Potential Transformers.**—A new indoor potential transformer completely enclosed in a tough, shatterproof plastic casing and costing 10 per cent less than previous models, has been announced by Canadian General Electric Company's Apparatus Division.

Representing the first major change in indoor potential transformer design in 24 years, the new unit is easier to install, offers longer life, eliminates maintenance and exceeds the requirements of the highest metering accuracy, according to development engineers at the company's Davenport (Toronto) Works.

Approved by the Department of Trade and Commerce, the new transformer—designated type PV-3—is rated up to 15 kv. class of insulation—200 volt amps—and is obtainable in voltage from 6900 volts to 13,800 volts high voltage —115 volts low voltage. It is designed to replace the old steel-encased compound-filled types currently used by utilities, industries and switchboard manufacturers for operating meters, instruments, relays and control devices.

Completely Canadian-designed, the new transformer can be installed in any position and offers adjustable feet for surface mounting. It has a higher impulse level than previous models—110 kv. compared to 70 kv. and weighs only 65 pounds. It has a thermal rating of 1.75 kva. and its metering accuracy rating of .3WXYZ exceeds the highest requirements. Flash-over arc distances have been doubled.

The epoxy resin plastic envelopes enclosing the element ensures shatterproof construction and requires no painting.

●

**Mathematical Services Mathematical Computing Service.** 67-24 211th St., Bayside 64, N.Y., specializes in performing services for industries desiring engineering calculation, charts and nomographs of a high degree of complexity and the treatment of related mathematical problems in the various fields of engineering. An important function of the group is the mathematical formulation and complete solution of a problem from given physical data. The staff consists of consultants holding doctorate degrees who are qualified to treat problems in applied mathematics related to the physical sciences.

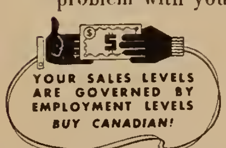
●

**Electrical Demonstrating Equipment.**—The Canadian Westinghouse Company has adopted unique demonstrating equipment to keep sales and service personnel well informed of new developments in the supervisory field. The demonstrator is a completely-portable, working model of the Westinghouse visicode supervisory control and will be scheduled for demonstration at major centers from coast to coast.

The demonstrating model consists of two major parts—the dispatcher's panel and the substation panel—joined by a 2-wire channel. Operation is similar in all respects to an actual installation, except that the substation panel contains latching relays to simulate circuit breakers. Control relays, escutcheons and pushbuttons are the same as those used in commercial equipment.

Practically every feature of an actual




YOUR SALES LEVELS ARE GOVERNED BY EMPLOYMENT LEVELS
BUY CANADIAN!






No!
Don't kid me!

visicode installation may be demonstrated. The operator may select a point, note the check-back signal and perform a control operation such as closing a breaker. The equipment will close the breaker, change the lamp indication and check the operation. The model shows how this same point may provide a synchronizing indication when delayed operations, such as the closing of a motor-operated disconnect switch, may be shown. Quantities at the substation may be telemetered. Battery and channel failure are brought to the operator's attention by bell and lamp alarms. An automatic operation at the substation is seen reporting an alarm to the dispatcher's panel and if more than one such operation occurs simultaneously, the reports reach the dispatcher individually.

●

**Workshop Ohmmeters.** — Evershed workshop ohmmeters are intended for quick, easy and accurate measurements of insulation or conductor resistance, and are particularly suitable for large quantity production testing. They are similar in principle to the well-known "Megger" insulation tester, except that the hand generator is replaced by an external d.-c. supply. The d.-c. source may be a battery, a generator, or rectifier, depending on the application, and whether low or high voltage is required.

The moving element consists of two coils, (the control coil and the deflecting coil) fixed at an angle to one another, swinging in the field of a permanent magnet, and arranged so that the torques developed by the coils are in opposition to each other. When a current of any value flows through the control coil, but no current is flowing in the deflecting coil, the control coil, (influenced by the magnetic field) brings the pointer to rest at the infinity end of the scale. If the movement is displaced from this position (by current flowing through the deflecting coil) the control coil develops a restoring torque which increases with the displacement. This coil, therefore, is effectively similar to a spring.

The coils are so connected that one is influenced by the current flowing in the resistance under test, and the other by the applied voltage. The ratio between the two values indicates the resistance under test. The design of the ohmmeter circuit depends on the range of the instrument. The instruments are highly accurate, individually calibrated. Insulation testers have a "guard" system which prevents error due to leakage on or in the instrument.

Two types are available: (a) Switchboard type, with 6½ inch scale, for vertical mounting. (b) Bench type in teakwood case, with 4½ in. scale arranged horizontally.

Detailed specifications may be had in List 414/2a, available from R. H. Nichols Ltd., 2781 Dufferin St., Toronto 10.

●

**Cominco Gives $325,000.** — Gifts of recreational facilities totalling about $325,000 to Trail, Rossland and Fruitvale were recently announced, by R. W. Diamond, executive vice-president, western region, on behalf of The Consolidated Mining and Smelting Company of Canada Limited.

For Trail, the company will provide a large modern gymnasium with seating for 900 spectators and all other necessary facilities at a cost in the order of $275,000. The building will form a planned extension of the Trail Memorial Centre which already houses a number of community facilities, including the ice arena presented by Cominco in 1949.

Forty thousand dollars will be given to Rossland for the completion of the ice arena.

●

**System Logs 48 to 144 Points.**—A recording system capable of continuously logging conditions found in multiples of 48 to 144 points, at the rate of a point every one to five seconds, has been developed by the industrial division of Minneapolis-Honeywell Regulator Company.

The new multipoint logging system was especially designed for testing and research applications where a record of all measurements is required. It has a single set point as contrasted to the firm's more expensive elaborate electronic scanning system which has one set point for each group of nine points and which scans and logs up to 270 points.

The new system includes a strip chart recording instrument, a junction box (functioning as the control center for the system) and up to three switch units. Each switch assembly controls two banks of thermocouple points—24 points to a bank. Also incorporated in the system is an alarm signal unit. This provides a signal light when an abnormal condition exists and remains on until reset manually.

The multipoint logger may be stopped on any one point and utilized as an indicator recording that point continuously.

There are two types of the new system—a 24 volt d.-c. system and a 115 volt, 60 cycle a.-c. system. Special arrangements are available to modify the new system for some double range calibration.

●

**House of Weather Magic.** — A "House of Weather Magic" has gone into operation at Trane, creating samples of "terrible weather" from almost anywhere in the world, and then helping develop the machines to overcome it.

It's all the work of the new research and testing laboratory of The Trane Company, La Crosse, Wis., constructed for research and product development in the company's fields of air conditioning, heating, ventilating and heat transfer.

The laboratory is one of the few on the continent devoted exclusively to the science of heat transfer, contributing to solution of problems affecting the public in many ways.

Heat transfer problems range from heating a home to cooling a guided missile, from air conditioning a factory to figuring in the purification of nitrogen or performing a vast number of varying duties in the process industries.

Heat exchange is vital in a host of processes in industries including foods, drugs, chemicals, petroleum and metals such as steel and aluminum. While in some industries, the need is for handling higher temperatures, some processes in other industries now demand 300 to 350 F. below zero.

Unusual features of the laboratory include a "room-within-a-room" where the outside of the inner chamber is refrigerated to simulate outdoor winter conditions and enable testing and rating

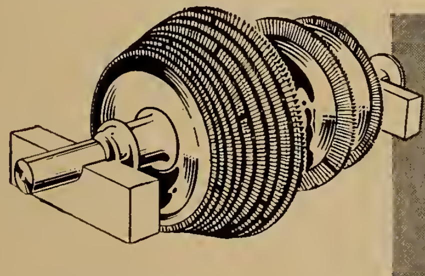

# Inglis turbines

## POWER "CANADA AFLOAT"

Around the Horn or through the Soo, for peaceful trade or vigilant defence, Inglis turbines power "Canada afloat."

There are two good reasons for the supremacy of Inglis turbines. One is Inglis itself, one of Canada's great engineering manufacturers, with every technical resource, and with the highest standards of workmanship and quality. The second reason is Inglis' association with Parsons and Pametrada, the world's most famous builders and engineers of turbines. Through this association, Inglis has access to the most advanced developments in turbine engineering as soon as they are produced.

To Canadians afloat or ashore, the Inglis plant has much to offer, whether it be turbines, pumps, compressors, boilers or special equipment for every basic industry.



Inglis
CANADA

**JOHN INGLIS CO. LIMITED · TORONTO · CANADA**

GENERAL ENGINEERING DIVISION

6-900-54

MONTREAL WINNIPEG CALGARY EDMONTON VANCOUVER of heating equipment in the inner room.

In normal operation, the inside wall of the inner chamber is maintained at about 55 degrees F. by this refrigerating system to simulate wall temperatures in an average home on a winter day. It could, however, be made much colder because temperatures in the shell around it could be driven down to 10 or 20 degrees below zero if desired for any special test project.

The shell surrounding walls, floors and ceiling of the inner chamber can also be equipped for heating so as to test air conditioning equipment in the inside room.

A network of sensitive recording instruments make it possible to take all necessary temperatures and other measurements from outside the exterior chamber. This is done because body heat from a technician in the test chamber would upset results of such tests.

The scope of the work to which the laboratory may eventually contribute includes atomic energy, jet aircraft, guided missiles, electronics.

●

**International Electro-Technical Commission.**—E. W. Henderson, manager of rotating equipment engineering of the English Electric Company of Canada, Limited is chairman of T.C. 2 of the Canadian National Committee of International Electro-Technical Commission, as well as being second vice-president of the Canadian National Committee. Due to the present activity in new insulating materials, and in the standardization of motor dimensions, this Committee is particularly active. Mr. Henderson expects to be one of the Canadian representatives to attend the Jubilee Convention this fall.

The celebration of the Golden Jubilee of the International Electro-Technical Commission is to be held in Philadelphia in September of this year. The aim of this Commission is the recommendation of international standards in the very wide field of electrical apparatus and electricity in general. Its membership includes all countries the world over.

Canada is represented in this work through the Canadian National Committee of I.E.C., the Committee being sponsored by and responsible to the Canadian Standards Association as a special committee interested in standardization.

●

**X-Ray Microscope.**—The General Electric Co. has disclosed development of an X-ray microscope that "looks inside" magnified specimens and is capable of wide use in medical science, biology and industry.

The disclosure, at an international scientific meeting in London, climaxes many years of effort in the laboratories of the U.S. and European countries to develop a practical device of this kind that can be produced in quantity.

The instrument, which magnifies up to 1,500 diameters, is expected to:

Aid in the development of new alloys and in studies of such things as corrosion and welding of metals; help researchers learn more about tooth decay, diseases of the bones and such other human ailments as mineral deficiencies and hardening of the arteries; assist in the study of such things as the covering or bonding quality of paints, adhesives and finishes, and in some cases provide a speedy substitute for chemical analysis.

In the study of alloys, plastics and composition rubber, the X-ray microscope shows the mixture of the materials and can identify them by their relative X-ray absorbing power.

To understand the principle of the X-ray microscope, think how you can cast a shadow on a wall by placing your hand near a lighted candle. The image of your hand is magnified in ratio to the distance of the candle from the wall and from the candle to your hand. But how sharp the shadow is depends upon how small the flame is.

By replacing the candle flame with an X-ray source, an enlarged X-ray image is obtained, and can be made visible by a fluoroscopic screen or an X-ray negative. But, as in the case of the candle, the sharpness of the X-ray image depends upon how small the X-ray source can be made. A conventional X-ray source cannot be made less than about one-eighth inch in diameter, and even a source as


This is one of the rotary kilns in which "HAYDITE"* aggregate is being produced from pure iron-bearing high silica-alumina lorain shale at temperatures exceeding 2000° Fahrenheit. This intense heat burns out all foreign matter and causes an explosive expansion of the shale creating myriads of microscopic, totally-enclosed non-interconnecting air bubbles, each in its own vitreous shell. This is "HAYDITE" aggregate, which is chemically inert, highly resistant to fire and humidity and light in weight—concrete made with "HAYDITE" aggregate weighs 33% less than sand and gravel concrete. In "HAYDITE" kilns some of the largest buildings on this continent have been born!

**Let us tell you about "HAYDITE" for poured-in-place structural reinforced concrete; for precast roof and floor slabs; for roof and floor fill; for refractory concrete; for guniting applications, and for building blocks.**

**Registered trade mark*

THE **Cooksville Company** LIMITED

*general sales offices:* 1055 Yonge Street, Toronto

*montreal:* Aerocrete Construction Co. Ltd., Lakefield Ave., Montreal East small as one 1,000th of an inch gives magnification no greater than an ordinary reading glass.

In the G-E X-ray microscope, the X-ray source is only one 100,000ths of an inch—300 times smaller than the diameter of a human hair.

This is achieved by focussing the electrons—tiny electrically-charged particles from which x-rays are made—through two electro-static lenses, which are essentially doughnut-shaped metal rings to which voltage is applied. The magnified x-ray image thus obtained can be seen by the eye or photographed for permanent record.

The instrument also provides great stability for the longer exposures needed for high quality pictures, and is the first to employ a built-in camera that provides developed photographs immediately after a subject is exposed.

It is not affected by magnetic materials and therefore can be used in the study of steel and alloys.

The wave length of x-rays can be changed without changing focus, making it possible to vary the contrast of pictures. The instrument also has built-in safety controls to protect the operator from accidental exposure to x-rays.

•

**B.t.u. Recorder.**—Fast, continuous measurement and control of rate-of-heat input or output is now possible through the use of the new Dynamaster B.t.u. recorder-controller systems just announced by The Bristol Company of Canada Limited, 71-79 Duchess St., Toronto, Ontario. These can be used to measure and record the quantity of heat supplied to or drawn from process vessels, refrigerating plants, air conditioners, and a wide variety of other heat-exchanging devices. Control apparatus is available for regulating the temperature or flow-rate of the heat-transfer medium.

In the basic Bristol B.t.u. recording system, one Dynamaster measures the temperature difference with two resistance thermometer bulbs and receives the flow-rate from a flow transmitter. From the two variables, it then continuously computes and records the B.t.u. product.

Other systems are offered that provide for recording temperature difference along with B.t.u. on a single round or strip chart by a single two-pen Dynamaster, recording of B.t.u. and either flow-rate or temperature difference by two separate instruments. In most instances, totalizers can also be furnished with the B.t.u. recorder to integrate the energy or heat-transfer.

Matched resistance bulbs are not required. An optional bulb trimming adjustment can be supplied, enabling the user to install a replacement bulb, and match it to the system by trimming the bulb and lead wires with the bulb trimming adjustment.

Other systems, to meet specific needs, can be provided.

•

# Publications

**For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.**

**Please mention *The Engineering Journal* when writing.**

**Safety Standards.**—A completely revised edition of the "Handbook of Industrial Safety Standards", a recognized classic in its field for more than 30 years, is now available, the Association of Casualty and Surety Companies announced recently. The handbook has been developed by Accident Prevention Department of the Association, with the assistance of outstanding engineering specialists of the Association's member insurance companies.

The new ninth edition, which is 50 per cent larger than the previous edition, includes several new chapters, illustrations and tables in its 315 pages. The subject matter runs the gamut of industrial safety topics.

Copies may be obtained from any of the Association's member companies or directly from the Association at 60 John Street, New York 38, N.Y. The price is $1.40 per copy.

•

**Training Brochure.**—Persons faced with business or industrial training problems will be glad to learn of a free booklet

"The Training Job and How to Meet It", offered by the Cooperative Training Division of the International Correspondence Schools, Scranton 9, Penna.

The 24-page illustrated booklet traces the correspondence approach to industrial training pioneered by ICS for more than half a century. The sudden and urgent industrial expansion during World War II underscored the value of this type of industrial training.

"The Training Job and How to Meet It" appraises the various ways that correspondence education can be adapted to meeting training problems on either an individual or group basis.

Outlines of typical courses now being used by more than 4,500 companies in the U.S. and Canada are included in the brochure.

•

**Conveyors.** — Stephens-Adamson Mfg. Co. of Canada Limited, Belleville, Ontario. announce the availability of a new engineering catalogue No. 66 which will be of interest to companies having conveyor problems. The 655-page book contains all the latest technical information regarding bulk material handling and the use of conveyors and elevators in industry. Copies are available by request on company stationery.

•

**Tips for Steel Valve Users.**—A "Technical Tips" booklet describing and illustrating data gathered by the Edward laboratories on valve material, installation and usage has just been published by Edward Valves, Inc., subsidiary of Rockwell Manufacturing Company, East Chicago, Indiana.

Subjects discussed include "what heat does to valve trim hardness", "what thermal expansion does to valve materials", "use of globe valves for throttling service", "high temperature lubricants for valve studs and bushings", and "creep robs metal strength at high temperatures".

Copies of the "Technical Tips" bulletin 542 are free and may be obtained from Edward representatives or directly from Edward Valves, Inc., 1201 W. 145th Street, East Chicago, Indiana.

•

**Lighting Equipment.**—A new Curtis condensed catalogue was recently issued. This catalogue is designed for the convenience of the user. It covers the complete Curtis line with full illustrations and simplified index. Copies are available on request from Curtis Lighting of Canada Limited, 195 Wichsteed Ave., Toronto 17, Ontario.

•

**Mapping and Reports.**—The Charpeney-Coopman area ,which covers over 200 square miles of Saguenay County, is described in a preliminary geological report P.R. No. 296. just released by the Department of Mines of the Province of Quebec. It gives the results of an investigation made for the Geological Surveys Branch of the Department. The map-area is 40 miles east of Seven Islands and extends inland from the Gulf of St. Lawrence for 15 miles.

The area is underlain by Precambrian gneisses and intrusive rocks. Concentrations of titaniferous magnetite are found in gabbroic rocks.

The Ste. Justine area, in Montmagny, Bellechasse and Dorchester counties about 50 miles southeast of Quebec City, is also described, in a preliminary geological report. P.R. No. 297.

The rock of the area range in age from Cambrian (or Precambrian) to possibly Devonian and are folded into northeasterly-trending belts. They are, for the most part, sandstones, slates and quartzites, with some volcanic rocks and gabbroic instrusives.

The area has recently been the scene of considerable prospecting, following the discovery in 1951 and 1952 of nickel, copper and zinc deposits, and of gold, in areas not far to the north.

The reports and geological maps may be obtained from the Department of Mines, Parliament Buildings, Quebec, Que., or from offices of the Department situated elsewhere in the Province.

•

**Heat Drying of Coal.**—"New Development in the Heat Drying of Coal", a paper describing research in the use of multi-louvre dryers for drying and pelletizing fine coal, has been published in Link-Belt book No. 2507. The paper was prepared by W. W. Coffin, engineer in charge of dryer equipment for Link-Belt.

An extensive experiment was conducted to determine the drying characteristics of fine coal with a 20 per cent moisture content and the amount of pelletization possible. The findings, supplemented by pictures, tables and a flow diagram, are covered in this book.

In addition, a plant designed to reclaim commercially suitable product from a 35 acre bituminous coal slurry is pictured and described.

Copies of this paper are available from Link-Belt Ltd., P.O. Box 173, Station "H", Toronto 13, Ont.

●

**Humidity Engineering.**—A new issue of the humidity Engineer, devoted to industrial humidity conditioning problems has just been released by the Kathabar division of Surface Combustion Corporation.

One article describe the air conditioning and mechanical system installed in the southwestern home office of the Prudential Insurance Company of America, Houston, Texas.

A second article discusses the air conditioning needs of the photographic film industry. Typical installations for solvent evaporation, emulsion chilling and raw film strip drying are described.

This issue also describe the latest application of humidity conditioning. One is the drying of caves and mines, so they can be used for underground storage areas. Another is the conditioning of pilot plant operations for the making of germanium transitors. The third discloses the availability of facilities to test glue and gelatin. The object is to develop a time-temperature cycle for low temperature drying, peculiar to individual products and processes.

A new 18-page brochure on "humidity conditioning" is also offered. It contains case histories, a section on humidity problems and their solution.

Copies of this issue may be obtained by writing the Editor, The Humidity Engineer, Surface Combustion Corporation, Toledo 1, Ohio.

●

**Preventive Maintenance.**—"Preventive Maintenance for Industrial Trucks", an article written by John A. Draxler of the Elwell-Parker Electric Company, and presently available in reprint form, details the many requirements of a proper preventive maintenance program for industrial vehicles.

Explaining the importance of good lubricants and correct lubrication, and enumerating the principal causes of equipment failure and breakdown, the booklet also contains several maintenance forms used by Elwell-Parker which may be copied for a company's own use.

Additional sections of this article emphasize the vital importance of accurate record-keeping and development of the proper attitude by employees toward maintenance regulations.

A preventive maintenance check list which is included provides a valuable aid to all users of industrial trucks, whether their schedule necessitates weekly, monthly or quarterly check-ups.

Copies of this report may be obtained without cost from the Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland, Ohio.

●

**Air Conditioning and Hot Water Storage Heaters.**—Two new publications are now available from Sarco Canada Limited. One is a catalog issued by the Patterson-Kelley Co., Inc. on hot water storage heaters. This catalog gives complete engineering data on the company's type B (horizontal) and type L (vertical) units designed for service where hot water requirements are not constant or where a large volume of heated water must be held in storage.

The second publication is a bulletin on the Modine Air-conditioner, a new heating and cooling unit designed for year 'round air conditioning of individual rooms. Both are available from Sarco Canada Limited, 611 Gerrard St. E., Toronto 8, Ont.

●

**Mechanical Power Transmission.** — A newly revised 8-page, two-colour catalogue (B20-53) describing the complete line of Morse mechanical power transmission products is now available from United Steel Corporation Limited, 58 Pelham Avenue, Toronto 9.

The new catalogue describes and illustrates silent chain, roller chain and Hy-Vo drives; sprockets, cable chains, drive shafts, couplings and clutches.

New information is included in the catalogue on taper-lock sprockets, cam clutches and torque limiting clutches. Brief specifications, stock sizes, applications and descriptions are included for each product.

●

**New Quarrymaster Bulletin.**—Ingersoll-Rand has announced the availability of a new and colourful bulletin describing the New QM-2 Quarrymaster, which the manufacturer claims is the only machine of its kind developed as a dual purpose

blast hole drill for either rotary or percussion drilling.

Th new bulletin tells the story of the QM-2 as a percussion drill pointing-up its features and its uses. Two additional pages do the same thing for the unit as a rotary drill. The center spread, by means of a large illustration and easily read captions, depicts the individual features that make up the Quarrymaster.

Other pages of the bulletins show "in-use" pictures, give dimensions and specifications and list accessories that are available.

For your copy of the bulletin write Canadian Ingersoll-Rand Company, Limited, 620 Cathcart Street, Montreal, Quebec, or contact your nearest Canadian Ingersoll-Rand branch office and ask for Form 4153.

●

**Brown Boveri Publications.** — Brown Boveri recently issued two publications, No. 2346E — Large Condensing Steam Turbines, and No. 2323E — Gas Turbines. They deal with subjects of timely importance to Canadian engineers, since today the trend is toward prime movers, other than water power, to drive the generators producing Canada's electric power.

Within the next two months, a 25,000 Brown Boveri steam turbo-alternator will be started up at Winnipeg, Manitoba, and Canada's first gas turbine generating station, a complete Brown Boveri plant, will begin feeding power into Alberta's power system at Vermillion. Copies of the publications are available from the company at 1015 Beaver Hall Hill, Montreal.

●

**Steam-Water Cycle Deposits.**—The application of analytical techniques which assure positive identification of deposits found in steam-water cycles has reached the point where constituents are normally reported in terms of mineral names rather than chemical formulae.

As a means of helping operators obtain a better understanding of such analyses, Allis-Chalmers water conditioning section has prepared a tabulation giving the mineral name, chemical formula, usual areas in which the deposits are found, the normal causes, and some suggested preventive measures.

Copies of this general information, Bulletin 28X8155, are available on request from Allis-Chalmers Manufacturing Company, 1270 S. 70th Street, Milwaukee, Wisconsin.

●

helicopters designed for future airline services operating to city centres. The 173 carries 16 passengers at a cruising speed of about 135 m.p.h.

Two companies are working on turbine-powered helicopters. Fairey Aviation Co. Ltd. are building the Rotodyne which will be powered by two Napier Eland turboprops, mounted on stub wings, with rotors driven by jets mounted at the tips. The Rotodyne is designed to hold 40 passengers and baggage, with a cruising speed of 150 m.p.h. Percival Aircraft Ltd is developing an 8-seat machine, the Percival P74. This has a Napier low-pressure system claimed to make mechanical coupling between the source of power and the rotor blades unnecessary.

●

**Dial Square for Engineers.** — A new precision engineers' square, incorporating a highly sensitive dial gauge, has been patented by The Acru Electric Tool Mfg. Co. Ltd., Chapel St. Levenshulme, Manchester 19, England. Used for testing the angles between finished plane surfaces, the square enables angular error to be read directly from the gauge.

The glass-hard blade of the square is pivotally mounted into the stock, so that the included angle may be varied. The true right-angle and the extent of departure from it is indicated. The dial can be rotated to zero, and each division represents 0.001" error per foot. Errors up to 0.030" per foot plus and minus can be read. Any variation caused by a knock or jar is automatically recorded on the dial and can be eliminated before any harm is done.

Other advantages over the rigid square are that no feeler gauges have to be used, angles of both 90° and 270° plus-or-minus 0.030" per foot can be measured instantaneously, and if required the centre screws can be tightened making it as rigid as an ordinary square.

Patents for the square have been taken out in Switzerland, the U.S.A. and Western Germany and agents have been appointed in Canada and the U.S.A

●

**Overhead Travelling Crane.**—An overhead travelling crane, believed by its makers to be the first of its kind, has been produced by J. H. Carruthers and Company, Ltd., of Glasgow, Scotland. For some years the firm has been investigating the ratio between lifting capacity and the deadweight of overhead cranes for different spans. The object has been to evolve a design which would give a considerably lower deadweight for a given span than would be possible for conventionally designed cranes fabricated from rolled-steel sections. The outcome is a crane entirely fabricated from tubular steel, excepting for the end plates, traveller rails and wheel-carriages.

The weight of the main girder is stated to be approximately half of that of a similar girder fabricated from structural steel. In the case of a crane spanning 55 feet (16.76 metres) there is a saving in weight of approximately ten tons. This saving in weight leads to several advantages, in that the load on the columns supporting the running rails is reduced by a like amount which, in the case of a building proposed for erec-

## Notes From Britain

**Accurate Measurement of Shaft Speed.** — The latest techometer, which has an accuracy of better than 0.1% at all speeds, is an electronic precision engine speed indicator made by The Plessey Company Limited, Ilford, Essex, England. The tachometer, which gives an accurate direct reading, is portable and extremely versatile. It will find applications in many fields of engineering and is ideal for use as a standard when calibrating other instruments

To operate the indicator, the rotary motion of the shaft is converted into electrical pulses. This may be done in a number of ways: aero engines are usually equipped with a small electric generator used in conjunction with the normal magnetic-drag tachometer, and the output from the generator can be used to control a frequency multiplier unit. For engines not fitted with such a generator, a photo-electric device, which imposes no load on the shaft to which it is attached, has been specially developed. It consists of a photo-cell amplifier with an associated opaque disk having 60, 30 and 10 equally spaced slots. The disk is attached to a synchronous motor driven by the aircraft tacho-generator, and when the 60 slot spacing is selected the instrument reading is direct in r.p.m.

The instrument counts the number of pulses generated during a period of one, two or four seconds and gives the result in terms of revolutions per minute on a dekatron display unit. Normally, the pulses are counted for one second, the result is displayed for 0.8 second and the apparatus then returns to its original state, when the cycle is recommenced. A switch enables any result to be retained for as long as desired, after which continuous counting may be resumed. The result is given in terms of r.p.m. by a display unit consisting of four dekatrons to record thousands, hundreds, tens and units. The one-second period is controlled by a 4 kc/s. crystal oscillator, accurate to 0.005%, the output of which is divided to produce a 1 c/s. pulse. In addition, a 2 kc/s. signal may be switched and fed to the input terminal to check the operation of the display unit.

The magnetic-drag tachometer seldom had an accuracy of greater than 0.5% at full scale deflection and is subject to ageing, whereas with the electronic precision engine speed indicator an accuracy of 0.1% is easily obtained. At high rates of counting the accuracy becomes even greater, reaching a limit of 0.03% at 3,000 pulses/second, with a one-second count and results better than 0.01% are available when a longer count can be used.

●

**Future of Helicopters.** — With the opening of the new British European Airways passenger service with helicopters, the Society of British Aircraft Constructors has been reviewing the present experimental services. It is hoped that a larger and faster twin-engined helicopter will follow the present experimental type and that later on the turbine-powered helicopter will come into its own.

Experimental work on "rotor-bus" helicopters includes three twin-engined Bristol 173's being built for service with the B.E.A. These are powered by two Alvis Leonides Major piston engines at each end of a 28' fuselage. A synchronizing shaft runs along the roof of the fuselage, ensuring that both rotors turn at the same speed, and that one engine can drive both rotors if the other engine should fail. British authorities insist on this twin-engined safety factor in all tion, permits the use of lighter columns and foundations for any given lifting capacity. Conversely, by replacing a crane of conventional design with one of tubular construction, a greater lifting capacity can be obtained for the same total weight and load on the columns.

The makers point out that, whereas a 15-ton crane of 100 foot (30.48 metres) span and of conventional design can lift only 15 tons, a similar crane of tubular construction and with the same structural weight, can lift 20 tons; an increase of 33 per cent in lifting capacity without requiring any structural alterations to the biulding in which the crane is located.

Travelling, traversing and hoisting speeds are suited to users' requirements. One crane was recently supplied with a travelling speed of 420 feet (128 metres) per minute. The speed of the 15-ton crane is 300 feet (91.44 metres) per minute, the traversing and hoisting speeds being respectively 100 feet (30.48 metres) and 20 feet (six metres) a minute. This particular crane is also fitted with a two-speed gearbox giving a two to one speed reduction and permitting a load of seven and a half tons to be hoisted at 40 feet (12.19 metres) a minute.

Control of the three motions is from a driver's cabin suspended below the main framework at one end and may be obtained in the form of what is termed "Microsen" creeping-speed crane control. This system enables such small movements to be made under power that they are scarcely noticeable, and it gives an extremely high degree of gentle and sensitive control. "Microsen" control may be fitted to any or all of the three motions, depending on the user's requirements.

•

**Four Plastics In Welding Torch.**—An argon arc welding torch, in the construction of which four plastics have been used, has recently been developed for a wide range of welding operations It is the "Actarc" made by the Arc Manufacturing Company, Ltd., of Actarc Works, Glasgow, Scotland, and of 50, Oxgate Lane, Cricklewood, London, N.W.2., England. It is intended for use in welding applications ranging from 16-gauge aluminium sheet to heavy plate requiring welding currents in the order of 300 amperes. Polyvinyl chloride, polythene, nylon and phenolic laminates have all been employed for varying purposes in order to reach the exact aim of the design.

The torch consists essentially of a detachable water-cooled nozzle, screwing into a single-piece head and body, the base of the body being attached to a long, hollow handle, through which the current lead, water and gas supplies run. The body and head are of high-conductivity copper alloy covered with black polythene to provide insulation and prevent corrosion, the hot components being simply dipped in polythene powder to obtain this coating. The water-cooled nozzle, which again consists of high-conductivity copper, is held on to the head by a ring of paper-based phenolic laminates; the cover which is mounted at the back of the head and which protects the tungsten electrode is also machined from similar phenolic laminate. These laminates provide good insulation and are readily machined to the required shape.

To carry cooling water from the body of the torch to the nozzle, there are two outside pipes for which polyvinyl chloride has been used to give the necessary electric insulation. These tubes are tightened to the body by knurled nylon nuts, employed because of the high mechanical and electrical strength of nylon and its low friction preventing twisting of the tubes when the nuts are tightened. The long hollow handle of the torch is machined from paper-based phenolic-bonded laminated rod and screws into the body of the torch by a brass ring pressed into the handle tube. The shield which fits over the handle is machined from similar laminated sheet. The use of laminate for the handle means that good insulation is provided for the welder, the handle also being shatter-proof.

RED FEATHER SERVICE

# EMPLOYMENT SERVICE

(*Continued from page 1147*)

construction, Canada; and one year experience with manufacturing concern. Seeks employment in the Montreal area preferably. Available for work at the beginning of September. File No. 4554-W.

ELECTRICAL AND MECHANICAL ENGINEER, B.A. (Eng.), A.M.I.E.E., British, aged 4?, family; seeks administrative, sales or consulting engineering post, any location not involving prolonged separation from family. Twenty-two years technical sales of heavy electrical plant, generation with all types of prime mover, distribution, application. Newly arrived from five years in Brazil as technical chief, selling and supervising diesel and diesel alternator installations. File No. 4555-W.

GEOLOGIST, SOILS ENGINEER and Surveyor, M.E.I.C., P.Eng., age 41, 18 years experience in geological and geophysical exploration (oil, coal, chromium, tin, iron), glacier research, soil mechanics (foundations, airports, hydrology, laboratory), diamond drilling, terrestrial and aerial photogrammetry, photogeological interpretation. 8 years consultant in Europe. Very experienced alpinist. Seeking responsible position with occasional field work in Western Canada, preferably Calgary. Permanently employed. File No. 4556-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1949, N.S.T.C., age 28, married with children, desires a responsible position with an energetic company. Experience in general mechanical design, standardization, cost reduction, shop supervision, personnel administration and manufacturing methods. Interested in manufacturing, sales or design. File No. 4557-W.

ELECTRICAL ENGINEER, Jr.E.I.C., N.S.T.C., 1952, age 23, single. Interested in all fields of electrical engineering activity and wiling to take responsibility and apply himself. Presently in second year of graduate student training course with large and reliable Canadian manufacturer of electrical equipment. Experience includes one year in transmisison and distribution departments of hydro-electric utility. Some accounting experience. Desires position in Canada and would give special consideration to Newfoundland as a location. File No. 4558-W.

MECHANICAL ENGINEER, Jr.E.I.C., graduate N.S.T. College 1951. Experience includes 1 year research work and 2 years mechanical design. Interested in position in plant engineering maintenance or design. Preferably located in Montreal area. File No. 4559-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc. (Maths. and Chem.), Acadia University, 1949, B.E. Nova Scotia Technical College 1952. Age 27, married. Experience: One year as engineer in distribution department of small electrical utility; presently taking Westinghouse Graduate Training Course. Desires position offering scope for learning and advancement with small company or utility. File No. 4560-W.

CONSTRUCTION ENGINEER, B.Sc. (1943), M.E.I.C., A.M.I.C.E., A.M.I. Struct. E., 11 years experience. Seeks responsible position. Has held the following positions: General superintendent, assistant project engineer, estimator. Experienced on light and heavy construction excavation, water mains, sewers, concrete, etc. Married, 33 years old, bilingual. File No. 4561-W.

CIVIL ENGINEER, B.E., 1953, U. of S., Jr E.I.C., seeks position in design and construction. Working at present with prominent Government engineering department. Interested in position with good possibilities for advancement. Willing to work hard. Single with car. Experience in surveys (all types), supervision of survey crews and construction crews, design in water and sewer lines, some concrete design. Was completely in charge of installation of many hydraulic structures, highway-type bridges, large culvert installations and a gravel contract. Has also had experience photoelastic analysis, soils studies and river studies. Has taken night classes in photography, welding and carpentry. Interview can possibly be arranged. File No. 4563-W.

GRADUATE CIVIL ENGINEER, D.R.T.C. (Glasgow), A.R.T.C. (Glasgow), San. Eng. (Glasgow), age 31 years, single, bilingual, willing to travel, desires senior position with responsibility in municipal engineering, contracting, concrete or structural steel installations. Experience: one year research work, 3 years general municipal engineering, 4 years drainage and irrigation experience in Malaya including supervision of earth moving plant, reinforced concrete design, estimating, surveying, office routines, design of irrigation schemes and structures, chief assistant on a $5,000,000 (Canadian) irrigation scheme. Experienced in Jungle clearing and swamp drainage. Available September 1st. File No. 4565-W.

MECHANICAL AND INDUSTRIAL ENGINEER, P.Eng., M.E.I.C., A.M.I.Mech.E., Junior executive, 10 years experience of industrial plant specifications, layout, design and erection, also specialized machine design and plant maintenance. Interested in entering consulting field in Southern Ontario. File No. 4568-W.

ELECTRICAL ENGINEER, B.A.Sc., M.E.I.C., P.Eng., age 40, married, three children, requires immediate employment preferably in consulting industrial or utility. C.G.E. test course, four years production engineering, eight years apparatus sales engineering. File No. 4576-W.

CIVIL ENGINEER, McGill, 1951, Jr.E.I.C., P.E.Q., married. Presently employed as area field engineer, on large project. Experience: 6 months drafting, 2½ years office engineer (quantities, costs, progress reports, etc.) and 1½ years varied field engineering in heavy construction. Seeks responsible and permanent position in Montreal with firm requiring above experience, or in design office. File No. 4579-W.

CHEMICAL ENGINEER, M.E.I.C., 1937 graduate, married, Canadian, would like to locate in the Toronto area. Experienced in pilot plant design, production and management phases of organic chemical plants both in Canada and the U.S. Interested in production and in sales in the field of chemical plant equipment or engineering services. File No. 4580-W.

ENGINEERING AND BUSINESS graduate, Jr.E.I.C., P.Eng. Ontario, B.A.Sc. Toronto (honours) 1953, age 24, single, C.G.E. test course graduate, tool design and sales experience. Desires position with small or medium sized company in Toronto or South Central Ontario area. Prefers manufacturing or industrial engineering position leading to supervision and management. File No. 4581-W.

A YOUNG CIVIL ENGINEER, 27, married, with Master's degree in hydro-electric structures from Columbia University, New York, and with 4½ years' practical experience in design and construction of hydro-electric projects and reinforced and steel structures in U.S.A., India, and Canada. Knows Eastern and Indian languages. Desires a suitable job with any concern working overseas in any part of the world, preferably in Eastern or Middle Eastern countries. Presently employed. File No. 4582-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng. (Que.), B.Eng. McGill 1951, single, age 26 1½ years experience technical assistant sales in rubber industry, assistant construction engineer for new pulp and paper mill in New Zealand, assistant power engineer pulp and paper mill in Australia. Desires position with small manufacturing company in Montreal. File No. 4584-W.

CIVIL ENGINEER, university graduate, P.Eng., age 38, married, one child, with practical experience in road construction, surveying, steel structures and reinforced concrete (industrial structures and heavy foundations for power stations, steel mills, etc.), both with contractors and with consulting engineers, used to work on own initiative and responsibility, attending to correspondence, site meetings and negotiations with clients, some knowledge of accounting and financial matters, at present with consulting firm. Desires responsible position with construction company, consulting engineers or investment organization requiring the services of a competent engineer, preferably but not exclusively in Toronto. Apply File No. 4586-W.

MECHANICAL ENGINEER (Polish University College, London. 1951), specializing in aero and thermodynamics. Three years' experience as designer and draftsman in pneumatic and electric equipment. One year in Canada. Interested in position in research or development. Age 35. Will go anywhere. File No. 4587-W.

CIVIL ENGINEER, McGill 1950, with five years excellent construction experience (design, supervision of construction, costing). Two and a half years on construction with Canada's largest textile company. Recent overseas experience in pulp and paper mill construction, oil refinery construction, building design. Desires position with company allied with the construction industry where there is a chance for responsibility and advancement. Willing to work anywhere but preferably in the Toronto-Montreal area. File No. 4588-W.

DIPLOMA ENGINEER — CIVIL, age 41, with 10 years of varied continental and British experience on the design of concrete buttress, gravity and arch dams, weirs, sluices, tanks, fishpasses, large steel welded pipe lines, and structural steelwork, reinforced concrete and prestressed concrete bridges and industrial structures with shell roofs. Seeks responsible position in British Columbia, Ontario or Quebec. File No. 4590-W.

## Attention, Members

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**Except in special cases all interviews will be arranged between the hours of 9 and 12.**

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*16,500 copies of this issue printed*

# CONTENTS



*Indexed in The Engineering Index*

# New Starter Scores on Toughest Job!

**EXOLON COMPANY DELIGHTED WITH AMAZING SERVICE OF NEW**

## Westinghouse *Life-Linestarter* MOTOR CONTROL

The Exolon Company of Thorold, Ontario, had a tough motor starter problem. A conveyor between primary and secondary crushers had to be stopped at least 20 times a minute for the hand selection of abrasive aggregate. Intense atmosphere of rock dust, plus excessive motor starter operations required new contacts once a month for ordinary starters. These production shut-downs were a costly nuisance!

On September 17th, 1952, Exolon installed a Westinghouse Life-Linestarter!

Since then, the Westinghouse Starter has operated continuously without attention — original contacts are as good as new! Maintenance costs in well over a year are zero!

There's good reason for this outstanding performance. Westinghouse Life-Linestarters are an entirely new motor control development. Patented De-ion Arc Quenchers do away with contact pitting, spring loaded, clapper-type breaker mechanism cannot foul. Straight-through wiring and pressure-type connectors make installation easy. Maintenance is simplified with all five sizes of Life-Linestarter of the exact same design—all parts are front removable with a screwdriver.

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200-42

# Instrumenting A Nylon Intermediates Plant

by
F. G. Carson
*Chief Supervisor, Maintenance-Instrumentation,*
*Canadian Industries Limited,*
*Maitland, Ontario*

The day of the automatic factory has not yet arrived, but it is on its way and nowhere more rapidly than in the chemical industry, where control of quantity, pressure and temperature, rather than of mechanical operations, is paramount.
Mr. Carson's paper describes the instrumentation and control installation in a very new plant, from its conception to its completion.
This paper was presented at the annual meeting of The Engineering Institute of Canada, at Quebec City, May, 1954.
On July 1, 1954, the Maitland Plant of Canadian Industries Limited came under the ownership and operation of Du Pont Company of Canada Limited. Mr. Carson now occupies the same position with Du Pont of Canada's Textile Fibres Division as he formerly held with Canadian Industries Limited.

With its many advantages in quality improvement and cost reduction, instrument control is becoming an increasingly important function in every industrial plant. As production throughputs have increased and the price of labour has risen, batch processes have become uneconomical and have been gradually replaced by continuous systems.

With new techniques, particularly in the field of centralized control, rapid progress has been made towards the concept of the automatic factory. One of the most modern of Canadian chemical plants is Canadian Industries Ltd.'s (C-I-L) Maitland Works, wherein are manufactured two complex chemicals, the raw materials required for the spinning of nylon staple and yarn. The plant is built on a 1,700 acre plot on the shores of the St. Lawrence River.

This paper outlines a number of the instrument problems and programs encountered in the design construction and operation of a complex plant of this type. The stages leading to the completion of this plant covered approximately a three-year period starting with design in October, 1950; construction in October, 1951; and final plant startup in August, 1953.

The solutions developed should not be considered the only, nor necessarily the best ones, but in each instance they suited the particular needs of the particular problem.

Before the reader can visualize the many difficulties encountered in a project of this type, he must have in mind a picture of the basic measuring instruments, centralized control, graphic panels and the many facilities required to link the components.

Fig. 1. Aerial view of the plant.

Fig. 2. Interior of a control room.

#### Centralized Control

Operations at Maitland are distributed through several separate buildings. The process variables, such as flow, temperature, pressure and liquid level, are measured by instruments and are transmitted to one of two control buildings where they are suitably and compactly displayed for observation by the few operators. For each controlled area one operator is located in the control room and up to two in the operating buildings. The control room operator observes process conditions, makes panel settings and advises the outside operator if field adjustments are required. Fig. 1 shows the plant area with the two control centres in the brick buildings at left center and right center of the process block.

Transmission of most messages concerning the operating process is done pneumatically by instruments. These measure the process variables and transmit air pressure signals which actuate pressure gauges on the control panel. These gauges are marked directly in terms of the process conditions being measured. Quarter-inch copper tubing acts as the nerve system linking a transmitter to a panel gauge.

To assist in communicating with the area, public address and telephone systems are provided for each process building. Automatic alarms are used to direct the operators' attention to critical conditions. Certain variables are recorded to indicate trends and to provide operational histories.

Each of these control centres contains approximately 80 feet of graphic panel and 30 feet of recorder panel. A typical graphic panel is laid out like a process flow diagram with symbols depicting process equipment, colour coded lines depicting process piping and miniature instruments indicating a process variable at the point in the process where that variable is measured. For example, the symbol which represents a hold-up tank may be surmounted by a dial. This dial indicates the level in the vessel. The operator, therefore, has a direct reading of the current liquid level in the hold-up tank.

Fig. 2 illustrates the graphic method of instrument presentation. Recorder panels are located to the right and left of the main panels. Fig. 3 shows the tubing runs used for transmitting the signals and located behind the panels.

Recent developments in miniature instruments for graphic presentation have made present day centralized control both feasible and practical. Miniature instruments have reduced what might have been 200 to 300 feet of panel to a more reasonable figure of 80 feet for this plant. One of the major advantages of this compact panel is that it assists the operator to observe and to interpret the many process variables under his jurisdiction. It leads to an easily and safely operated plant. The operator is required to adjust controls and to perform remote manual operations to maintain the process variables at those rates and values required for optimum quality and economy.

So far, panel gauges have been considered merely as indicators. Many of the instruments will automatically maintain the process at some preset value. The miniature panel control station, occupying approximately 5 x 5 in. of panel, is the main instrument in these control loops.

This versatile instrument, shown in Fig. 4, provides an indication of the process variable, an indication of the set point, a means of adjusting the set point, a means of taking over direct manual control of the automatic valve and a means of spot checking the valve position when on automatic control. The controllers themselves are separate from the transmitters and may be mounted at the panel, or near the transmitter and control valve in the process area.

Fig. 3. Backs of two instrument panels.

#### Statistics

There are approximately 2,000 instruments at Maitland including 350 control valves, 150 temperature transmitters, 100 pressure transmitters, 125 flow transmitters and 80 level transmitters. The control rooms house 160 feet of graphic panels, 60 feet of recorder panel and 125 feet of alarm and special interlock equipment. These numerous components are linked by some 100 miles of copper tubing.

When one considers, in addition to so many instruments, the feet of pipe and numerous hand valves for process connection, the plugging problems introduced by handling materials that solidify up to temperatures of 130°C., the corrosion problems resulting from the handling of strong acids, the high pressure problems resulting from operating pressures up to 7,000 p.s.i. and the general freezing problems encountered as a result of open operating areas, an overall picture of the instrumentation may be appreciated.

#### Design

After preliminary planning it was concluded that the design of the intermediates plant would be made by C-I-L engineers. Fully aware of the potential of modern instrumentation, they determined to take full advantage of continuous flow design and automatic operation.

Instrument application and project design techniques have been the subject of much study. In spite of this, the information needed to purchase suitable instruments and to lay out installation detail is not readily available in present day texts. The techniques of structural, electrical and piping design are only beginning to be paralleled in instrumentation. In addition, choice of control equipment has become more difficult as the numbers of available types have increased.

What is the significance of this condition when the design of a new automatic plant is being considered? It means, first, that the correct type of individual must be developed, one with the special skills required to cope with a new science. Little provision has been made for education in instrument matters in engineering schools.

The instrument application engineer is concerned with the size of vessels, pressure drop in lines and equipment, types of heat exchangers, location of valves, process reaction times and many other problems usually considered the exclusive domain of the process engineer. In addition, he must have the operating engineer's understanding of procedures and safety and, further, an intimate knowledge of instruments, maintenance problems and control techniques.

It means, second, that as each new program is launched, known techniques must be reviewed, their application to the problems at hand studied and revised where necessary to obtain the most up to date design.

To obtain a clearer picture of the specific phases through which any instrument process design will pass, the fundamental stages followed at Maitland are listed and outlined below. It will be recognized that the basic approach is similar to that used in attacking most design problems.

##### *a. Scheduling, organization and man-power predictions*

As in planning any program it is important to develop from the beginning a logical and systematic attack. Specific questions must be asked and answered. Although these questions may be many when detailed, they can be simply grouped as follows:

What is the problem? How much will it cost to solve it? How should it be solved? Who is going to supply and install the equipment? When should installation be finished?

Realizing the importance of co-ordinating instrument and process design, both programs were developed simultaneously starting in September, 1950.

After the major task of designing, constructing and operating a nylon intermediates plant, and program scheduling had been carefully defined, it was necessary to develop engineers to attack the instrument assignment. Since in most instances qualified persons were not available, engineers were put through a training program, including a chemistry review, a process study and visits to similar plants.

The training of engineers was sufficiently broad to cover the design, construction and operating programs. Since the process at Maitland is very similar to that used at E. I. du Pont de Nemours' Sabine River Works in Orange, Texas, engineers visited that plant for periods ranging from two to twelve months starting in January, 1951. The guidance and information obtained from instrument engineers at Sabine and from the E. I. du Pont de Nemours' engineering department in Wilmington, Delaware, were of particular value in preparing the C-I-L engineers for conducting their program.

Each instrument engineer was assigned to work with a project engineer on a specific area of the plant. Their responsibility included the selection and purchase of instruments and the preparation of sufficient drawings to enable the construction program to be completed. Instrument engineers reported to a central instrument authority, which assisted in maintaining uniform methods and choice of instruments.

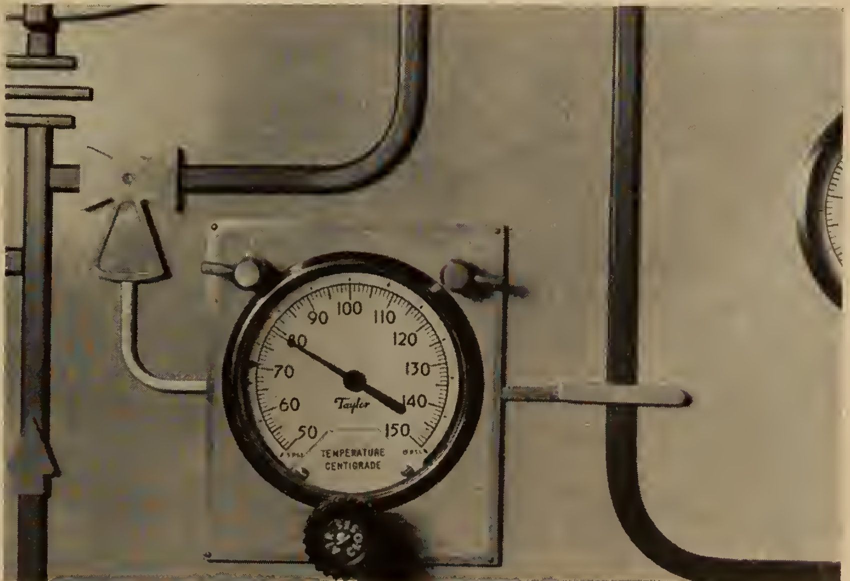

Fig. 4. Miniature panel control station.

*b. Preparation of control diagrams, estimates and techniques*

For a number of months the control of the process was studied in detail to determine what type of measurement and control was necessary. For reasons of safety and simplicity graphic type panels were chosen.

These studies led to the preparation of instrument control diagrams and panel layouts and finally to cost estimates. On the subject of costs it is interesting to note that, in a project of this type, the cost of installing an instrument is approximately the same as the purchase price.

To provide a uniformity of approach, the instrument engineers agreed on standard procedures for listing, specifying and recording basic data. Design techniques for control valve sizing, averaging liquid level control and orifice sizing were discussed and finalized. Space requirements, ease of maintenance and methods for connecting into vessels and process lines were carefully studied to provide the project engineer with information for building layouts and piping arrangements. To assist in instrument selection, required accuracies were discussed from both a process and an accounting point of view.

*c. Instrument study and specification*

Once the type of instrument was chosen and process conditions established, the actual make of instrument to perform the function with satisfaction was selected.

Instrument specifications must deal with accuracy, stability, operating range, type and size of connection, mounting arrangement and materials of construction. In specifying, an effort was made to purchase instruments constructed of materials as suitable as the materials of which the process equipment was to be fabricated. No one seems to question the detailed specification required for the construction and purchase of a process vessel. The same attention to instrument specification pays dividends by providing better and safer instruments. The specifications become more complicated to prepare when stainless steel instruments are required; the problems of low carbon and stabilized stainless steels are not generally appreciated by all instrument suppliers.

*d. Procurement*

The next stage covers the placing of orders and the finalizing of delivery dates. Most jobs will proceed towards completion at a rate in direct proportion to the amount of follow-up. The value of a fast moving expediting group to keep in touch with and assist the supplier cannot be over emphasized.

*e. Preparation of Drawings*

In preparation for a smooth running construction program, clear and accurate drawings must be made available at an early date. It is desirable to answer at the design stage every possible question that may arise during construction. The construction engineer is particularly grateful for this approach since it relieves him of the pressure of making many small decisions, when he is, at the best, operating under pressure.

Drawings must show what instruments are required; where they are to be located; how they are to be mounted; and how they are to be connected. In addition, numerous detail drawings are required to permit accurate shop fabrication of the many components required to fit the puzzle together. A draughting squad leader, supervising a group of between five and eighteen draughtsmen, over a fourteen-month period produced approximately 490 drawings to provide the necessary field detail.

*f. Procurement of miscellaneous parts*

In any construction program a small bolt may be as important as a major instrument; in fact, the instrument often cannot function until every last nut, bolt and valve is in place. The detail drawings were made to show all the small parts needed and therefore to facilitate accurate quantity take-offs. The procurement of

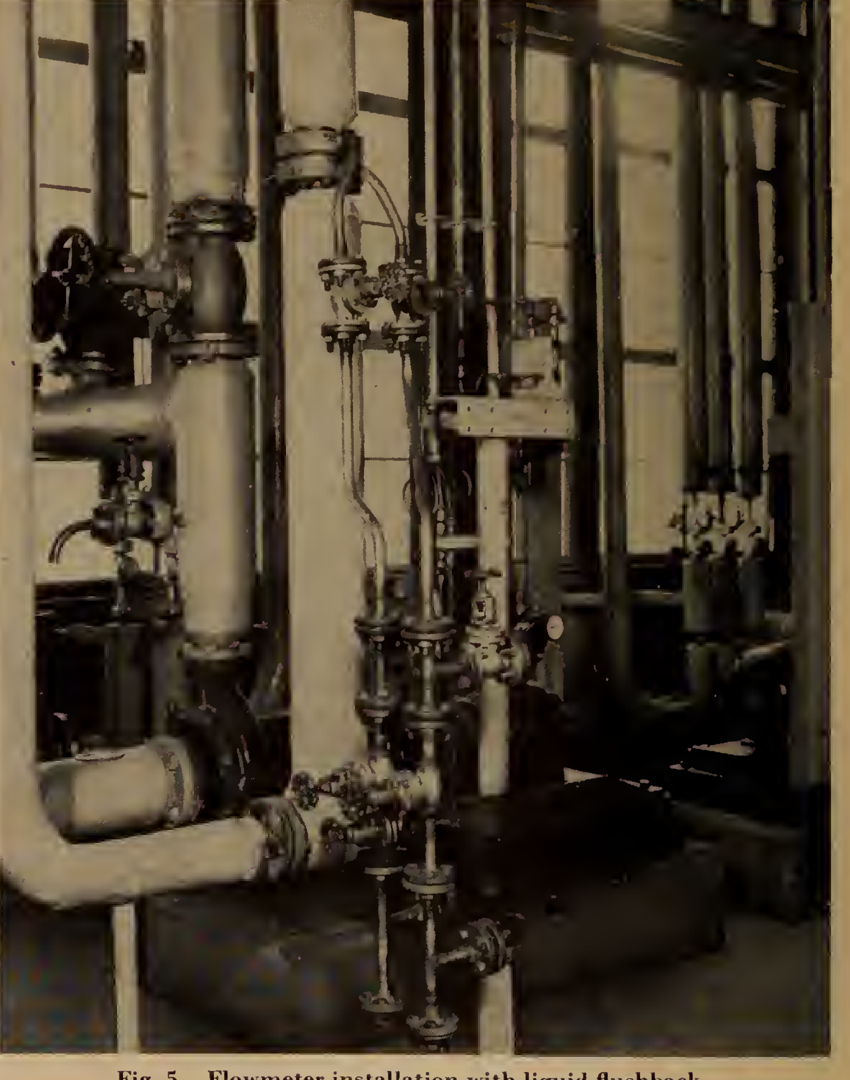

Fig. 5. Flowmeter installation with liquid flushback.

these many thousands of parts is a vital program not to be left until the last moment.

The design continued through to May, 1953, with a considerable portion of the later months devoted to answering field problems, expediting previously ordered items and ordering parts missed during the initial take-offs.

### Design Techniques

A few of the techniques used during the design of the plant may be of interest and are outlined below.

***a. Lane system***

To assist in sorting out and routing the maze of piping, tubing and conduit, an allocated lane system was used wherever possible. Instrumentation and electrical services were assigned an area extending down to approximately nine inches below the bottom of the ceiling beams. Instrument tubing, conduit, junction boxes and air and purge supply lines were all run in this well defined space and thus interference with other piping was considerably reduced.

***b. Instrument maintenance***

Each instrument installation was arranged to provide adequate space for maintenance purposes. Although control room space in the centralized system is reduced, additional room for mounting transmitters is required in the process buildings. The process engineer must consider these needs from the day he starts to lay out the building.

Control valves were in most instances lowered to a distance of approximately two feet from the floor. Instruments were mounted not higher than five feet. The general working area was made sufficiently clear to provide safe access to each unit.

***c. Instrument air***

Many of the small passages in instruments are of the order of a few thousandths of an inch in diameter. Even minute traces of oil or dirt will interfere with the operation of the pneumatic systems to a point where maintenance problems may be greatly increased. In addition, if freezing conditions are to be encountered, the air must be dried to a dew point below the lowest expected temperature. At Maitland this critical temperature was found to be −30°F.

To provide a satisfactory air supply two electrically driven Nash compressors, with chemical driers, were installed. Should the electric power fail, a stand-by steam-driven Nash compressor, with an automatic starting system, guarantees a continuous air supply.

***d. Prefabrication***

To provide positive, leak-proof process connections flanged joints were used throughout. Instruments were therefore purchased with flanges and linked to the process by special adapter and manifold assemblies. Every effort was made to design each of the assemblies to permit its fabrication in a pipe and welding shop.

Fig. 5 shows a typical flowmeter installation with liquid flushback. All assemblies, except the two between the valve at the orifice flange and the tee piece above the three-valve manifold, were prefabricated. Since slight strains on the instrument bodies will introduce appreciable error, it is important to construct these assemblies with sufficient accuracy to avoid stresses.

***e. Instrument mounting***

Mounting instruments on pipe lines and on process equipment was avoided by the use of the pipe stands shown in Fig. 5. This practice permitted instrument installation to parallel that of the piping and equipment.

Instruments were mounted on their stands in the central shops and connected with tubing to a pneumatic manifold which served in much the same way as a terminal strip in an electrical circuit. By transporting the entire assembly to the field, extensive tubing work in the construction area was avoided.

***f. Tubing installation***

Two widely differing methods of installing tubing are in use at present. One system involves the laying of tubes in a channel, so that each tube is exposed throughout its entire length and easily accessible for maintenance purposes. The other involves the installation of tubing in a completely enclosed pipe conduit. This latter scheme eliminates the accessibility feature, but provides protection for the tubes. This system was chosen at Maitland.

Tubing was bundled and pulled into electrical conduit as is done with cable, conduits being filled to a maximum of 75 per cent of their capacity.

One of the largest distributing boxes installed at Maitland is shown in Fig. 6. The tubing enters the box and forms a complete loop before leaving on its final conduit run to an instrument stand. For reasons of accessibility the tubing unions were installed at the bottom of the loop in the junction box.

Fig. 7 shows the tubing enclosed in conduit and carried to the instrument stands where it loops into the manifold. The largest installation consisted of pulling approximately 140 tubes into a 75-foot run of four-inch conduit containing two right-angled bends and a double offset. A three-ton pull was required.

***g. Steam tracing and lagging***

As a result of both the freezing characteristics of the process liquids and the outside winter temperature conditions, many of the instruments required special steam tracing.

Tracers of ⅜-in. tubing were installed parallel to the impulse lines and around the instruments. Fiberglas pipe insulation covered with roofing felt for outdoor installations or canvas for indoor installations was used to encircle the tracer and pipe. Irregular shapes were insulated with fiberglas and finished with an asphalt emulsion.

The two systems used for housing the instruments are illustrated in Fig. 8. One system involved the fabrication of compact metal boxes, insulated on the inside and

**Fig. 6. One of the largest distributing boxes at Maitland.**

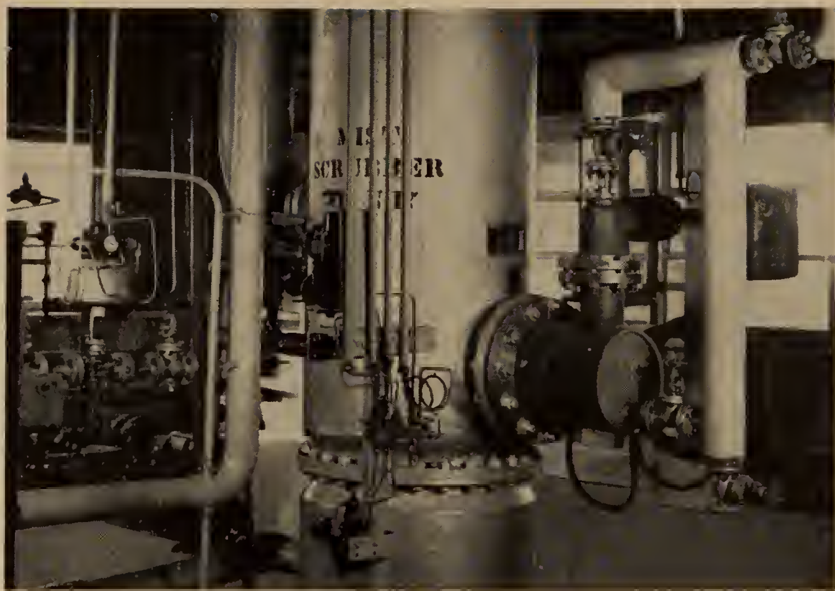

Fig. 7. Tubing enclosed in conduit.

completely enclosing the unit. The second scheme involved the use of asbestos canvas and Fiberglas to fabricate special blankets to be wrapped around the equipment. The blankets themselves are held in place with metal straps. Considering both cost and accessibility, the second method has proven superior.

*h. Spare parts*

One of the most important phases of instrumentation and one which is vital to plant start-up and operation, is the procurement and storing of spare parts. The need for these parts is usually accentuated during the startup period while many "bugs" are being gradually eliminated from the units. This in itself is a task involving several man months and requires the securing of accurate drawings and parts lists from each supplier, preferably including such requests as part of the order procedure.

### Mechanic Training

By March, 1951, difficulties in obtaining trained mechanics for the construction and maintenance programs had become apparent and it was concluded that a special training effort would be required.

One of the early ideas was to train mechanics by sending them to various instrument suppliers for short courses on specific instruments. In the light of scheduling and transportation problems this program was set aside in favour of a course to be conducted by C-I-L engineers and foremen and streamlined to cover those instruments to be used at Maitland. A six-month training program was subsequently launched.

The basic educational requirement for instrument mechanics at Maitland is junior matriculation or its equivalent. Each man must have an aptitude for working on precision equipment. He must be resourceful and be able to get along with people. Eventually, he is required to develop an understanding of the process and operating procedures so that he can work with operators and with other trades in trouble shooting. Since much of his work is done without direct supervision, he must be conscientious and reliable.

Applicants were carefully screened by the use of mathematical, mechanical comprehension and general knowledge tests and were interviewed by both personnel and technical representatives. The course curriculum included mathematics, physics, the chemistry of the process itself and the principles of measurement and control. Shop training on the major instruments to be used was provided, each unit being repeatedly torn down, assembled and calibrated. The class assisted in developing techniques that were later used during construction. At this stage, emphasis was placed on training all-around mechanics rather than specialists.

An incentive pay schedule was used to raise the mechanics from trainees' to mechanics' rates over an eighteen-month period, with increases every three or four months.

Since present demands for experienced mechanics far exceed the supply, every expanding chemical plant should be prepared to conduct its own mechanic training program.

### Construction

For approximately twelve months after the school training was completed, the mechanics assisted in the installation of instruments. This period provided each with a good grasp of the plant layout and of the mechanical problems of handling the equipment.

The construction period may be divided into the following phases:

*a. Receiving, shop calibration and storage*

On receipt, each unit was checked to make certain there was no mechanical damage. After

Fig. 8. Housing of instruments.

shop calibration to establish that instruments would function correctly and accurately, they were tagged and binned to make them readily accessible for scheduling into the field. A well organized and clean storage area is vital at this stage.

***b. Roughing-in***

The roughing-in stage included the installation of tubing, electrical runs, panels, instruments and instrument stands; prefabrication of the many piping assemblies, etc. Instrument stands were laid out and assembled by mechanics in the shop and transported complete to the field.

***c. Connecting***

This phase covered the connecting of the instruments on both the process and their pneumatic sides. The entire piping and tubing installation was then tested for leakage.

***d. Prestartup calibration***

No matter how careful the preinstallation shop check may be, it is vitally important to calibrate each instrument in the field, immediately prior to the plant startup. The bumping and thumping of a construction program can introduce intolerable errors. This includes not only a calibration, but a check to make certain that connections are correct, that controllers are acting properly, that valves are functioning and that air is turned on; the more checking there is at this stage, the smoother will be the startup period.

By July and August, 1953, the initial effort had reached its climax and the startup period had arrived. Operators had been given specific operational training on the instruments with which they were concerned. Instrument engineers and mechanics provided an around-the-clock coverage, working closely with operating personnel. A startup is, under the best of circumstances, a hectic period. It presents a real challenge to engineers and mechanics and each person's experience and initiative are utilized to the limit.

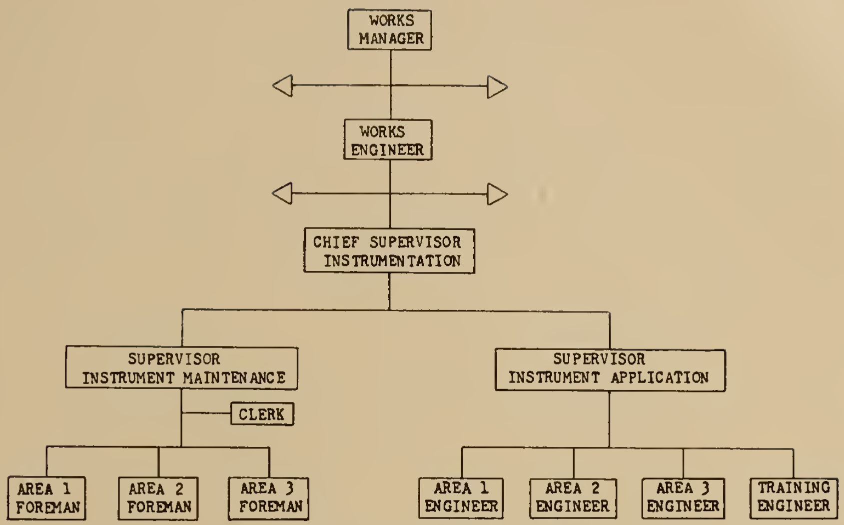


**Fig. 9.** Maitland Works instrument group organization.

### Operating Organization

Separate instrument organizations are relatively new in operating plants. Before establishing a group of this type, the scope of its work and its areas of responsibility must be carefully defined. At Maitland, the instrument group has a dual design and maintenance function. Not only must it be prepared to maintain and repair instruments, but it must select new equipment and design and develop new installations. In addition, the group must work closely with the operating and technical departments in assisting them in trouble shooting process systems and in developing process alterations.

Fig. 9 shows the Maitland Works instrument group organization. The chief supervisor (instrumentation) reports directly to the works engineer. The engineers, reporting to the supervisor (instrument application), are responsible for the selection and application of new instruments. They are located where they can assist operating personnel and instrument foremen on special problems arising out of day-to-day effort. These engineers have no direct responsibility for personnel administration. One engineer has been assigned to group training duties. In addition to keeping the present mechanics up-to-date on the process and instrumentation, he develops training programs for new mechanics. The maintenance organization is headed by a supervisor under whom are three foremen. Reporting to each foreman are between six and ten mechanics.

A decentralized maintenance system is used, with three shops—one in each of two operating areas and one in a central building. Most maintenance is carried out in the areas, with the central shops responsible for work requiring extensive space, specialized facilities or major expense for test equipment.

Mechanics rotate from shift work to various assignments throughout the plant, in an effort to broaden their experience with all instruments and with all phases of the process.

To assist in a preventive maintenance program, equipment record cards are being set up to provide a repair and cost history on each major unit. Preventive maintenance falls into bi-weekly visual checks, quarterly calibrations and yearly overhauls.

The foreman is responsible for scheduling his day-to-day work with the operating staff. Weekly and shutdown planning conferences are held each Thursday to plan the program for the following week. A maintenance control engineer assists in scheduling weekly and shutdown programs. Patrol, standing and work orders are used to control maintenance and alteration work and costs.

### Summary

In the last twenty years tremendous progress has been made in the application of automatic control. Viewing the process industries today, many new trends in instrumentation are noted. The popularity of electronic equipment in coping with difficult control problems is increasing. Continuous process analysis is becoming more and more a reality, as new types of instruments are developed and tested. Servo-mechanism techniques and analogue computors are every day providing more detailed and exacting knowledge that will eventually assist in removing a part of the guess work from instrument application and process control. Developments of even greater significance are being evolved in the minds of their creators and these will assist in extending the field of process control.

# Discussion

**J. J. Hillen**[1]

I would like to make a few remarks on F. G. Carson's paper which from the standpoint of The Engineering Institute and your general interest in this subject would seem to be timely.

The process at Maitland is without doubt a complex one. It is made so because continuous processing systems must be used in the chemical industry if products are to be manufactured which will sell in a competitive market. Because of such high speed processes, detection of off-quality products must be made quickly and accurately, if lost product or lost intermediates are to be minimized. In this industry particularly high quality is a "must", and off-quality a loss of accountable dollars.

In the days of low speed batch processes, an operator could take samples of the constituents at many separate stages. The operator was an artisan trained to thus control the process. His was the brain directing product quality from the first stage along to the final result.

The more complex the process the more equipment that was needed —and the more operators in attendance.

As through-puts came to be increased and cost of good labour rose so high, the continuous process was developed. In charge of the various steps along the way—instruments for measurement and control.

No matter how we centralize—no matter the number of instruments that are used—the brain is not there. The instruments can be the eyes, ears, arms and heart of the system but no inanimate control instrument can think. Only the human brain has this capacity.

It is necessary that we properly design processes to make the most effective use of the instruments or tools that are available to us. To properly apply automatic control, knowledge is a must. Chemical and process engineers and others must be trained in the fundamentals of measurement and control. Instrument people are needed who can specialize in this new branch of engineering: men who will keep abreast of developments, and co-operate with the process designer in applying new instruments to industry.

It is time for us to decide that the instrument engineer is an important person in the design group. Because of his importance, top management should be aware of his place in the business society and he should be given the stature and backing that his position deserves.

Groups such as the Instrument Society of America—of which there are four Canadian sections—are actively engaged in instrumentation as such. They have educational programs underway. Their influence has already been felt in the questions of standardization of instrument components.

A number of colleges and universities now have courses in industrial instrumentation and control as part of their curricula.

Mr. Carson has mentioned that the new concepts of automatic control augur well toward the completely automatic factory.

Let me say—as an instrument supplier—that many new developments are even now in the research laboratories of the leading instrument companies. They will be released as the market demands, but the time is not yet here. Altogether too few companies in the process industries are in a position to profit from advances in the science—for it is a science—as only these few have the qualified personnel available to absorb and apply the new techniques. A large number of concerns are not so fortunate, for they have so far not become aware of what instruments can do for them—have not yet become adept at using the tools which are now available.

I would commend your continued attentions to the science of instrumentation for measurement and control so that the automatic factory may become a reality.

[1]Peacock Brothers Limited, Montreal.

**H. L. Johnston, Jr. E.I.C.**[2]

Mr. Carson has spoken to you objectively about the instrumentation of a project that he was very close to for three or more years. As he was responsible for the design and installation of all of the instrumentation, and subsequently for its maintenance, his was truly an undivided responsibility, and just as truly goes to him the credit for a job well done.

Of particular interest is the use that was made of electrical conduit and junction boxes for supporting copper tubing. It was the first time that C-I-L had used large electrical conduit for this purpose and it was due to the unswerving conviction of Mr. Carson and his associates that large numbers of copper tubes could be pulled through a single conduit that this effective means of installing tubing was adopted. Most engineers would agree that one or two copper tubes could be pulled through a small conduit having one or possibly two very long radius bends but I for one was doubtful of the practicability of pulling 140 tubes through a four-inch conduit 75 feet long and containing two or more bends. This amounts to two miles of tubing in a four-inch pipe 75 feet in length. Needless to say, the use of the conduit and junction boxes contributed greatly to the unusually neat appearance of the tubing installation.

Another matter of interest referred to briefly by Mr. Carson was the mounting of instruments in the shops on prefabricated and standardized instrument stands and connecting them to standardized pneumatic manifolds. This procedure permitted instrumentation installation to proceed independently and at times in advance of the installation of the equipment to be controlled. Mounting the stands on the floor permitted great flexibility of location and the appearance of the instrumentation was enhanced in many areas by installing the instrument stands in line with one another and well away from any wall or other structural support. √

[2]Canadian Industries Limited, Montreal.

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The entire technical content of the November issue will be devoted to papers about the Kemano-Kitimat project. See page 1266 of this issue for details.

# Rational Design for Building Frames with Semirigid Connections

by

J. L. de Stein, M.E.I.C.

*Associate Professor,*
*Department of Civil Engineering,*
*McGill University,*
*Montreal*

In this Quebec annual meeting paper, Professor de Stein shows that there are methods for dealing with the design of framed structures with semirigid joints, the common type, which will lead to good balance and hence to economical use of materials. He deals only with structural steel, because the experimental data for it are available, but his methods are just as applicable to other materials, given the necessary data.

In the design of steel building frames a common method of analysis is to assume that, for vertical loads on the horizontal members of the frame, the joints or connections at the ends of the members are flexible and allow the members to rotate freely at their ends. For lateral loads on the frame the same connections are often expected to be relatively rigid, with a capacity to resist sizeable bending moments. In some frames the assumed flexible connection is counted upon to supply adequate stiffness to the building.

Connections can be classified as rigid, semi-rigid, or flexible, according to their behaviour in the frame. A rigid connection is one in which the angle between tangents to the elastic curves of a beam and a column remains virtually unchanged on loading the frame. A flexible connection is one which will allow free rotation between the two members, and semirigid is a condition intermediate between rigid and flexible. The differences in these three categories are indicated in Fig. 1. Common connections, such as web connections and top and bottom flange connections, may be classified as semirigid.

By ignoring the connection characteristics in the analysis of frames the final design often becomes unbalanced. The various components of the frame would fail under different loadings. The bending moment, due to vertical loads, acting on the column, the connection, and the end of the beam, and induced into the frame by the rigidity of the connection, is disregarded. If the column is to be properly designed, then the bending moment should be taken into account. If the connection and the column will supply some definite and reliable restraint to the end of the beam, then advantage might be taken of this restraint in the design of the beam. If the connection is to be counted on to supply lateral rigidity, or to carry an additional moment induced by lateral forces, the moment on the connection due to vertical loads should be known, in order to judge the adequacy of that particular connection for the lateral loading. It appears that for many building frames a design method, to be rational, should include the effect of the connection in the analysis of the frame and the

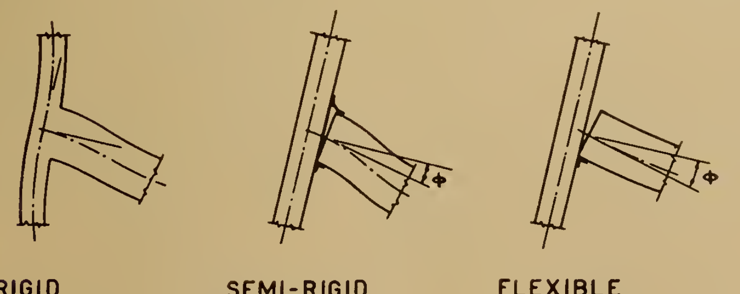


**Fig. 1. The three categories of connections.**

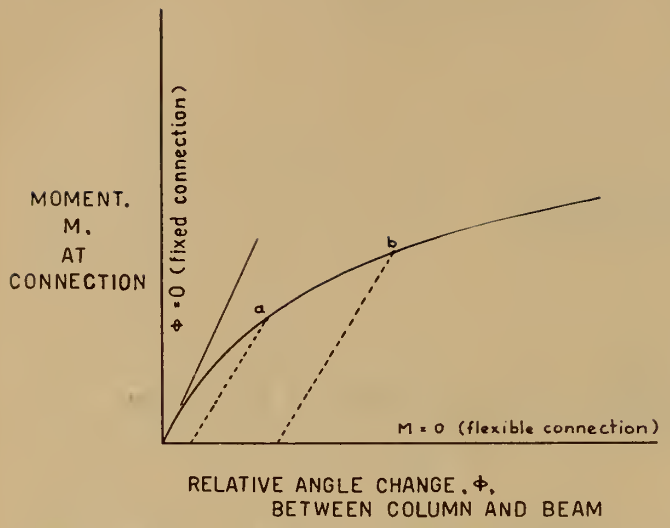


**Fig. 2.** $M{:}\phi$ **test results for a semi-rigid connection.**

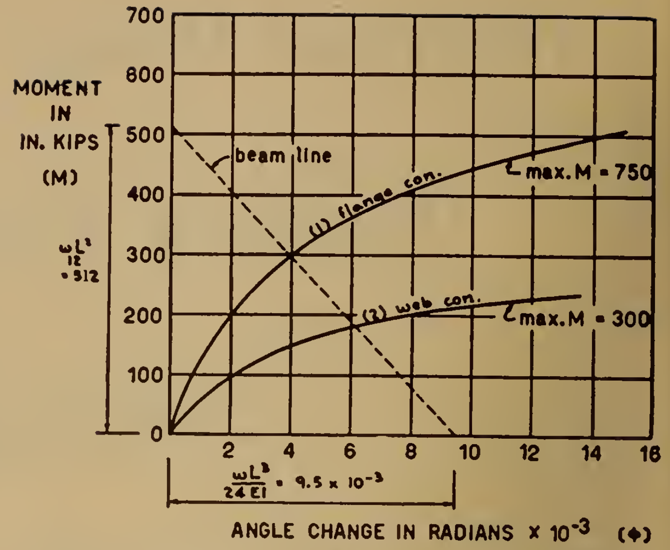


**Fig. 3. Experimental values of the** $M{:}\phi$ **relationship for two particular connections on a 12-in. I-beam.**

proportioning of the various components.

For some buildings the concrete encasement of beams, and columns; the diaphragm action of roofs and floors; the stiffness contributed by interior walls and partitions; and the restraint of exterior walls are indeterminate quantities which affect the building frame to a greater degree than the behaviour of connections. However, with modern architectural design demanding large and continuous areas of fenestration; exterior wall constructions of prefabricated, non-masonry and light materials; and open planning of floor areas, it appears that in many of to-day's buildings, the frame, wholly or in part, is resisting the applied loads.

In recent years several papers, notably those by Johnston and Hechtman (1), Lash (2), Johnston and Deits (3) and Hechtman and Johnston (4) have indicated how an economical advantage may be taken of connection restraint in the design of steel beams. In Great Britain a *Joint Committee of the Institution of Civil Engineers and the Institution of Structural Engineers* has recently recommended the reduction of simple span moment when using top and bottom flange angles. In Canada the C.S.A. *Committee on Steel Structures for Buildings,* in its recent specification (1954) allows a reduction in beam bending moments when the degree of restraint of the end connection is definitely known.

The amount of restraint offered by a connection at the end of a beam is related to the moment-rotation, $M{:}\phi$ characteristics of the connection. The relative rotation at a beam-to-column connection, between the end of the beam and the column, is a function of beam depth, of type of connection, of width, thickness and length of connection angles, of thickness of column web or flange, of size and extent of rivets or welds, of location of rivets or welds and of initial rivet tension. This $M{:}\phi$ relationship is highly indeterminate and accordingly is best obtained from actual tests. Considerable data are now available for a variety of beam-to-beam and beam-to-column connections, through experimental work reported by Wilson and Moore (5), Young and Jackson (6), Steel Structures Research Committee of Great Britain (7), Rathbun (8), Pippard and Baker (9), Hechtman and Johnston (4), and Lyse and Gibson (10). Most of the data are for beam depths of 12 to 18 inches. The test results for a certain semirigid connection might be as shown by the curved line in Fig. 2. This line indicates the relationship of the moment at the connection to the relative angle change between column and end of beam. The ratio of moment to angle change is not linear, indicating that the connection does not behave as an elastic member. This is characteristic of semirigid connections. If the connection is unloaded when it reaches the point *a*, the unloading would follow along the dotted line. The reloading curve would be approximately on the same dotted line to the point *a*, and then along the curve. The behaviour would be similar if it were unloaded at *b* and reloaded.

A graphical method, credited to Batho (7), can be used for determining the end moment which a given connection will develop for a given beam with definite span and load. The method can be readily used for those cases where there is little or no rotation of the column at the beam connection; that is, where the rotation of the end of the beam is due to the flexibility of the connection. This condition would exist for interior beams of a frame where spans are equal in length and have identical symmetrical loading. The condition could also be approached in the lower floors of a building when the column stiffness is considerably greater than the beam stiffness.

Batho's method can be appreciated best by the use of an example. Consider a 12-in. beam, with a moment of inertia of 216 in.$^4$, carrying a uniform load of 1,280 lb. per ft. on a span of 20 ft. and connected to rigid columns. For joining the beam to the columns either a standard web connection, or top and bottom flange connections might be used. Predetermined experimental values of the $M{:}\phi$ relations for these two particular connections on a 12-in. I-beam are shown in Fig. 3. Curve 1 is for the flange connections and Curve 2 is for the web connection. For a beam, which rotates an amount $\theta$ at each end, it can be shown that the moment at the end of the beam in terms of the rotation of the beam, for a uniformly distributed load $w$, is given by

$$M = \frac{2EI\,\theta}{L} - \frac{wL^2}{12}$$

The dotted line of Fig. 3 expresses

this equation for the given beam. When $\theta = 0$, a fixed beam condition, then $M = wL^2/12$, a fixed end moment. When $M = 0$, then $\theta = wL^3/24EI$, a simple beam rotation at the end. When the beam is joined to a column which does not rotate at the connection the relative angle change, $\phi$, between column and beam, is also the absolute rotation, $\theta$, of the end of the beam. Therefore, the actual rotation and the end moment on the beam, for any particular connection, is given by the intersection of the beam line with the $M{:}\phi$ curve for that particular connection. From Fig. 3 it can be seen that when the web connection is used the end moment on the beam is 180 in.-kips and the end rotation relative to the column is 0.006 radians. When the top and bottom flange connection is used the end moment is 300 in.-kips and the rotation is 0.004 radians. In designing the beam, the simple span moment of $wL^2/8$, or 768 in.-kips, might be reduced by the value of the end moment, either 180 or 300 in.-kips, depending on the connection being used. The magnitude of the true moment acting on the connection, relative to the ultimate strength of the connection, should also be considered in the overall design or analysis.

The moment-rotation characteristics of connections can be used to study the behaviour of beams, connections and frames, under the action of vertical and horizontal forces. These $M{:}\phi$ curves mightalso be used to determine the adequacy of a connection for a certain required rigidity. For example, assume that the connections for the previously analysed beam have to carry an additional moment, due to wind, of 120 in.-kips. If web connections were used, the moment on the connection would be 180 in.-kips from the vertical load, together with the additional 120 in.-kips, or a total of 300 in.-kips. It is obvious that this web connection should not be employed in this case, as the ultimate strength of the connection is only 300 in.-kips. If the top and bottom flange connections were used, then the moment on the connection would be 300 in.-kips from the vertical load, plus the 120 in.-kips ,or a total of 420 in.-kips. This latter condition is shown in Fig. 4. For this example, is has been assumed that the vertical load of 1,280 lb. per ft. is made up of a dead load of 640 lb. per ft. and a live load of 640 lb. per ft. The beam lines for dead load and dead and live load are marked on Fig. 4. The total moment of 420 in.-kips, acting on the connection, is noted on the curve by point *c*. The corresponding angle change between beam and column may be taken directly from the figure. From the relative angle change approximations might be made as to the movement of the frame. This would have to be compared to some permissible value, which would depend in part on the wall material and would probably bear some relation to column height. If a connection appeared inadequate for the required stiffness then a more rigid one might be tried, using the same procedure. The dotted lines in the figure indicate unloading and reloading, *b* to *d* and *d* to *b* being unloading and reloading of live load. Unloading of wind and live load would take place along line *ce;* any future loading on the connection would be along this line. If the action of the wind causes a change in the dead and live load moment on the connection, and thus a change in the restraining moment on the beam, then this should be allowed for in the design of the beam.

For many building frames an accurate analysis for moments need be made only for vertical loads, as the moments due to wind loads can be approximated without complex calculations. The wind moment on any connection is influenced considerably by the column size, but in many cases, is not significantly affected by the type of connection.

The analysis of a semirigid frame for vertical loading is not much more difficult than that for an equivalent rigid frame. Baker (7) and Johnston and Mount (11) have indicated how slope-deflection and moment-distribution methods can be used for the analysis of such frames. Moment-distribution is probably the simpler method for frames with more than three or four unknown moments. It should be noted that, before beginning an analysis, the connections have to be assumed for each joint, as well as beam and column sizes. The actual moment at each joint is related to the $M{:}\phi$ characteristics of connections as well as to beam and column stiffness. Batho's graphical procedure may be used to establish end moments for the vertical loads, considering the columns as initially held against rotation. The stiffness factors and carry-overs for each member can be found from fundamental principles. The mechanical procedure of releasing each joint,

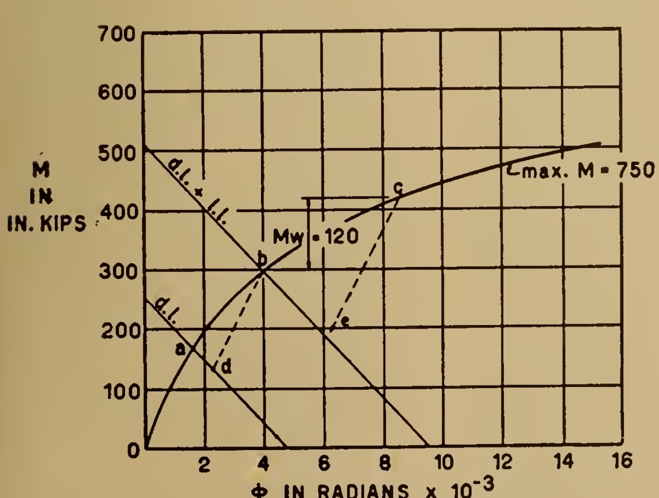


**Fig. 4. Beam lines for dead load and dead and live load.**

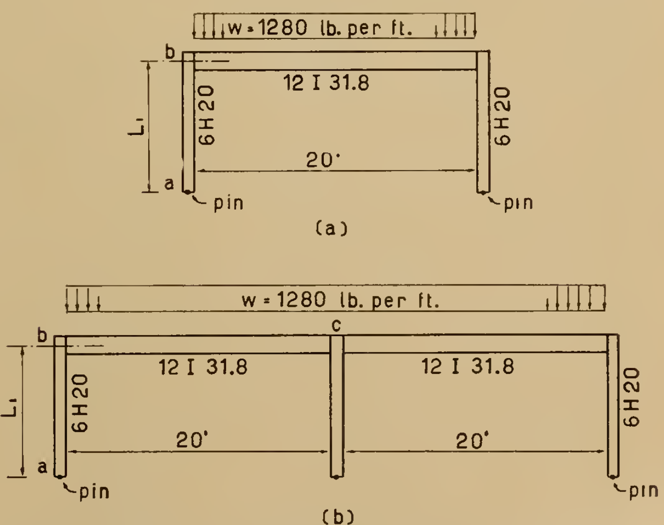


**Fig. 5. Single and double frames, with member sizes and load.**

**Table I. Calculated moment at connection for single-span frames (Fig. 5a)**

| Frame height, $L_1$, ft. | Column stiffness / beam stiffness | Rigid Connection. $Mb$, (in.-kips) | Top and bottom flange connection. $Mb$, (in.-kips) | Standard web connection. $Mb$, (in.-kips) |
|---|---|---|---|---|
| 0 | infinity | 512 | 300 | 180 |
| 5 | 0.72 | 265 | 204 | 147 |
| 10 | 0.36 | 180 | 152 | 120 |
| 15 | 0.27 | 136 | 121 | 101 |
| 20 | 0.18 | 109 | 100 | 87 |

**Table II. Calculated moments at connections for double-span frames (Fig. 5b)**

| Frame height $L_1$, ft. | Column stiffness / beam stiffness | Rigid connection. | | Top and bottom flange connection. | | Standard web connection. | |
|---|---|---|---|---|---|---|---|
| | | $Mb$, (in.-kips) | $Mc$, (in.-kips) | $Mb$, (in.-kips) | $Mc$, (in.-kips) | $Mb$, (in.-kips) | $Mc$, (in.-kips) |
| 0 | infinity | 512 | 512 | 300 | 300 | 180 | 180 |
| 5 | 0.72 | 180 | 680 | 185 | 340 | 142 | 196 |
| 10 | 0.36 | 106 | 720 | 130 | 350 | 113 | 199 |
| 15 | 0.27 | 78 | 730 | 105 | 355 | 94 | 202 |
| 20 | 0.18 | 61 | 740 | 85 | 360 | 81 | 204 |

distributing the unbalanced moment and inducing moments at opposite ends of members, is carried out in the same manner as for rigid frames.

Some single and double frames, with member sizes and load as indicated on Fig. 5, were analysed to observe the influence of connections on the moments induced in the frames. The beam taken for this study is the same as that previously analysed for end moments when connected to rigid columns (see Fig. 3). Calculations were made for frames with rigid connections, with top and bottom flange connections, and with standard web connections. The semirigid connections used for the examples were those with the $M{:}\phi$ relations indicated in Fig. 3. The calculated moments at the junctions of beam and column, for various proportions of frame, are shown in Tables I and II. In order to simplify the moment calculations, the $M{:}\phi$ curves were replaced with straight lines. As the straight lines were chosen to follow the curves closely, the calculated moments are reasonably correct. It is not suggested that the members for the various frames are well or properly designed. However, for the assumed components, a reasonably correct analysis has been made.

From Table I, for the single-span frames, it may be noted that when a standard web connection is used on frame heights of 10, 15 and 20 feet, the corner moments are 67, 74 and 80 per cent, respectively, of the rigid-frame moments. That is, a so-called flexible connection in some places has a performance approaching that of a rigid connection. Some of the data indicated in Table II, for double-span frames, are equally surprising, when considered in relation to conventional design methods. When a standard web connection is used on frame heights of 10 feet or more, the moment at the exterior column is greater than the equivalent rigid frame moment. It appears to be somewhat of a paradox that, when using web connections the moment is ignored, and when using rigid connections the moment is considered. For the 10-ft. single-span frame with standard web connections, the corner moment would cause a bending stress in excess of 9,000 lb. per sq. in. in the column. If moments are ignored, might not the resultant design be unbalanced ?

The procedure for analyzing and studying semirigid frames has been discussed only in reference to structural steel members, because steel connection characteristics are available. A similar procedure might be used for timber, precast concrete or composite frames, timber and steel, concrete and steel or timber and concrete. It is essential only that the moment-rotation relation of the proposed connection be known. In some cases where straps and brackets are used, it should be possible to establish an approximate behaviour from a theoretical study.

A rational analysis of frames with semirigid connections, taking into account connection behaviour, has certain advantages. The calculated behaviour parallels the actual behaviour; accordingly it should be possible to approach a balanced design where the various components reach their ultimate strength at the same time. A more nearly balanced design should result in a better use of material.

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# Telecommunications

# in

# Canada

*by*

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It is good occasionally to stop long enough to survey the past, examine the present and dream about the future, as Mr. Lester has done in this paper. Although it contains some technical data, it is not beyond the comprehension of any engineer and it ought to be required reading for all, for it concerns everybody. The paper gives an account of the steady and at times almost miraculous, but little publicized, progress being made in our communications, especially in telephone service and in the newer forms—facsimile, teletype and TV. The paper was presented to the 68th Annual Meeting of The Engineering Institute of Canada, May, 1954, Quebec City.

**Definition and Scope**

"Telecommunications" is really a coined word. The Greek prefix "tele"—"far off"—is used in designating instruments or practices, usually electrical, which control or accomplish action at a distance. Thus telecommunications can be defined as "far off communications". A more precise definition, contained in the Radio Regulations of the International Telecommunications Union (1) is

> "any transmission, emission, or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, visual, or other electro-magnetic means".

This definition is complete and all-embracing. However, in this paper certain types of telecommunications, such as radar, sonar, asdic, and individual broadcasting or telecasting stations are excluded. Consideration is given only to telecommunication systems, which, in general, are common carriers for public use in transmitting written, oral, or visual intelligence.

All telecommunication systems contain two broad categories of plant:—

(a) Instruments permitting the customer to originate or receive the transmitted intelligence.

(b) Network facilities to transmit intelligence between instruments. These facilities may be entirely within a building or a city, or they may be country-wide in scope, connecting cities and towns by wire line, carrier, or radio.

This paper deals particularly with long distance networks, although local instrumentalities will be brought into the picture where required for clarification. Developments described are those which have taken place in Canada, with those elsewhere covered only as they appear on the Canadian scene.

There are a number of major telecommunication agencies in Canada. First, there are the railway telegraph agencies, the communications department of the Canadian Pacific Railway Company and the Canadian National Telegraph Company. In each case the telegraph agency is a separate organization within the parent railway system.

The two telegraph systems unite in furnishing certain long haul teletype networks. These systems, and a number of smaller agencies, such as the Ontario Northland Railway and the Dominion Government Telegraph Service, furnish commercial telegraph service throughout Canada and also provide a number of privately-leased circuits, both telegraph and telephone.

On the telephone side there is the Trans-Canada Telephone System, furnishing long distance telephone service to the public across Canada and also providing privately-leased telephone and telegraph circuits. This is an association of the seven principal telephone systems in Canada:

| *System* | *Area of Operation* |
|---|---|
| Maritime Telegraph & Telephone Co. Ltd. | Nova Scotia |
| Island Telephone Co. | Prince Edward Isl'd |
| The New Brunswick Telephone Co. Ltd. | New Brunswick |
| The Bell Telephone Co. of Canada | Quebec and Ontario |
| Manitoba Telephone System | Manitoba |
| Saskatchewan Government Telephones | Saskatchewan |
| Alberta Government Telephones | Alberta |
| British Columbia Telephone Co. | British Columbia |

Each of these companies operates an extensive telephone network within its own territory and together they span the mainland of Canada. In Newfoundland, the Avalon Telephone Company and the Canadian National Telegraphs collaborate in furnishing telephone service, while in the Yukon and Northwest Territories, the Northern Communication System and the Army Northwest Territory and Yukon systems provide some facilities. In both cases circuits are connected to the main trunk lines of the Trans-Canada System.

In addition to these major systems there are hundreds of small, and some not so small, independent companies, from groups with about 25,000 telephones each to small farmers' lines of a dozen telephones. In practically all cases these small units connect with the major systems, making them part of the country-wide network. The Canadian telephone calling rate per telephone is the highest in the world, about 1,700 conversations per telephone per year.

Network facilities for radio and television purposes are furnished by both the telephone and telegraph companies.

How did these organizations and networks come about? What is their present scope? What kind of services and instrumentalities do they now provide and what of the future? This paper will try to answer these questions in broad outline.

### The Past

The telegraph came first. In Canada, the first telegraph line was built in 1846 from Toronto through Hamilton to Niagara Falls, followed shortly by a line from Montreal to Troy, N.Y. The Montreal Telegraph Co. formed in 1847, bought out the two earlier ventures in 1852, and proceeded to establish a network of lines and offices in central Canada. A number of competing companies grew up, the most important being the Dominion Telegraph Co., formed in 1868. By 1878 this company had extended its lines to the Maritime Provinces, where the New Brunswick Electric Telegraph Co. and the Nova Scotia Electric Telegraph Co. had been established in 1848 and 1851, respectively.

By 1880 the Montreal Telegraph Co. had over 20,000 miles of wire, connecting 1,200 offices, and the Dominion Telegraph was not far behind. Access to these lines became a problem, to which the first solution was telegraph call boxes, permitting a subscriber, by means of a code, to call for a messenger, the police, firemen, a doctor, etc. The telephone was obviously a better solution, but after a brief period when the telegraph companies operated telephone exchanges as parts of their networks, the telephone business was taken over by others. In 1881, the Great Northwestern Telegraph Co. leased the lines of both the Montreal and the Dominion companies, and embarked on extended expansion both in Eastern Canada and on the prairies, in "friendly alliance with the Western Union Telegraph Company". (2)

The Great Northwestern served the Canadian commercial telegraph field until 1915, although the Western Union had its own lines connecting the Maritime Provinces with the eastern United States. Great attention was paid to press service; the Great Northwestern for thirty years, until the formation of the Canadian Press in 1912 (3), was a news gathering agency for Canadian newspapers.

The Canadian Pacific transcontinental railway line was completed in 1885, the Canadian Northern was expanding, the Grand Trunk, the Intercolonial, and a number of other railways were operating. The railway telegraph poles marched beside the tracks. Telegraph circuits were required for train dispatch and control, still a vital role of railway communicationsal, though telephones are now used extensively. To meet public demand for telegraph service in new settlements, the railway companies expanded their facilities.

The C.P.R. formed a separate communications department initially to look after this telegraph and its associated leased-line business. In 1915, control of the Great Northwestern Telegraph Co. was acquired by the Canadian Northern Railway, which thus developed practically a Dominion-wide network. With the subsequent amalgamation of railways into the Canadian National system, what is now known as the Canadian National Telegraph Co. emerged. Since the early 1920's the railway telegraph agencies have been the principal telegraph common carriers in Canada.

### Technical Development

Technical development kept pace with the demand for more and better telegraph service. To the simple grounded telegraph circuit, limited in distance and quality, were added half- and full-duplex operation, full-metallic circuits, faster keys and faster operators. Then came carrier telegraph of various types, handling a number of telegraph channels on one pair of wires or radio circuit. Now there is voice-frequency carrier telegraph, permitting twelve and eighteen telegraph channels where there was only one channel before.

### International Scope

Transoceanic telegraphy became an accomplished fact in 1866, with the successful laying of the first trans-Atlantic cable. This brought to a halt the scheme of a land line telegraph connection to Europe by way of Alaska and Russia. Telegraph connection to Australia and New Zealand via the Pacific was set up in 1902. Canada's telegraph development was international in scope from its early days.

### The Teletypewriter

One of the most far-reaching developments in telegraphy has been the teletypewriter. Machines for transmitting telegraph signals began to appear early in the history of telegraphy. In fact, Morse himself experimented with apparatus for sending signals automatically. Two systems which became firmly established were the Crede system in Great Britain and Europe, and the Teletype Corporation system on this continent. Producing a written record at each end of a circuit, reliable, easy to operate and fast, this new medium caught on rapidly. Today practically all commercial telegraph business is on a teletype basis. Use of the teletype in private business has also grown.

Growth in telegraph business and facilities in Canada to 1939 is shown in Fig. 1. At the left is shown total telegraph messages per year at 10-year intervals from 1899 to 1939. The right side of the chart shows the number of wire miles in service through the same period. The climb in telegraph business was rapid and steady from its thriving state in 1899 to the boom days of 1929. The depression struck hard; even by 1939 message telegraph business had only partially recovered from the low 1933. However, leased private lines, particularly teletype, were increasing and this trend has continued.

### Telephony

Telephony is a direct descendant of telegraphy. Bell's original patent of March, 1876, described his invention as "an improvement in telegraphy". Telegraph lines were used to demonstrate the telephone's capacity to transmit and receive sound. In fact, the telegraph companies organized and operated most of the telephone exchanges in this country before 1880.

The telephone business was started in Canada in 1877, when Bell assigned 75 per cent of his Canadian patent rights to his father.

As already mentioned, the telegraph companies needed some means of local access to their intercity network, and had introduced the telegraph call box to this end. The telephone was obviously a better answer, so the call box system was changed to a telephone exchange in Hamilton in July, 1878, and in Toronto in April, 1879. The telegraph companies proceeded with this program in the ensuing few years. In May, 1878, the Montreal Telegraph Co. became agents for the Edison and Phelps telephone and in February, 1879, the Dominion Telegraph Co. contracted with Professor Bell to promote his telephone.

By 1880, there were two telephone exchanges in each of Montreal, Ottawa, Quebec and Halifax, operated by the rival telegraph companies, with no interconnection between the systems. In August, 1879, Bell's father had tried to sell his Canadian patent rights to the Dominion Telegraph Co. without success. Bell then sold the Canadian, as well as the American, rights to the American Bell Telephone Co.

This company sent Charles F. Sise to Montreal to try to bring together the conflicting telephone interests into one company, to be owned and operated entirely by Canadians. The result was The Bell Telephone Co. of Canada, established in April, 1880, by Dominion charter. It took over the telephone plant of the Montreal and Dominion companies, as well as local companies in Hamilton, Toronto, London and Windsor. Mr. Sise and his associates then actively pursued the organization of telephone branches right across Canada.

The company early disposed of its interests in the Maritime Provinces to local companies. The Prince Edward Island system was sold in 1885, that in Nova Scotia in 1888, and in New Brunswick in 1889. The New Brunswick Telephone Co. took over there. In Nova Scotia several smaller campanies had grown up, but the Maritime Telegraph & Telephone Co. was finally established as the province-wide agency, with the Island Telephone Co. as a subsidiary in Prince Edward Island.

In 1908 and 1909 The Bell Telephone Company disposed of its plant in the three prairie provinces to their provincial governments. Telephone service in British Columbia had begun with a number of companies, the principal one being the British Columbia Telegraph Co. Following growth and the absorption of small companies, the B.C. Telephone Co. was finally incorporated in 1916.

Growth in extent and in quality of service was steady. Automatic telephone operation for local calls, after a disappointing start in eastern Canada in 1893, was established in Whitehorse, Yukon territory, in 1901. Substantial increase in dial service followed in the western provinces in the 1905-1909 period, and small installations were made in the Maritimes and in Ontario in 1903-1905. Major dial installations did not start in eastern Canada until 1924.

### Long-Distance Service

Long-distance service lagged behind local service in quality during the early period. By 1881, long distance lines had been set up from Toronto to Hamilton, and for short distances at other points. Montreal-Toronto lines were established in 1885 and small networks within the three groups of cities in the Maritimes, the central provinces, and the prairies were established gradually. Progress was slow, however. The Pupin coil, antecedent to present day loading coils, had been invented in 1900 and De Forest's vacuum tube appeared in 1907. Mechanical repeaters were designed in the 1904-1912 period, but it was not until the development of the vacuum tube repeater in 1915 that long-distance had the technical tools to progress rapidly. The first transcontinental telephone line in the United States was established in 1915, and by February, 1916, Montreal could reach Vancouver over these lines.

In British Columbia, demands for service from the lumbering and the fishing industries, coupled with the difficult terrain, lent impetus to radio telephone development, and gradually an extensive network of radio communications, centred on Vancouver, was established up the west coast.

### Canadian Jubilee Broadcast

By 1927, developments had reached the point where the Canadian jubilee broadcast could be undertaken. Using all kinds of lines and equipment, an all-Canadian network was set up for that event on July 1, 1927. The telephone companies then decided that transcontinental service should also be developed on an all-Canadian basis, and planned accordingly. The Trans-Canada Telephone System was opened for service in January, 1932. Regular trans-Atlantic radio telephone service was inaugurated in 1927 via New York, and direct service was opened from Montreal to London in 1932.

### Telephone Development

Fig. 2 shows telephone development from 1899 to 1939 in terms of number of telephones. From a total of 50,000 at the turn of the century, telephones in service rose to 785,000 in 1919. By 1929, this had jumped to about 1.4 million. The depression struck hard—a net loss of 190,000 between 1929 and 1933—but by

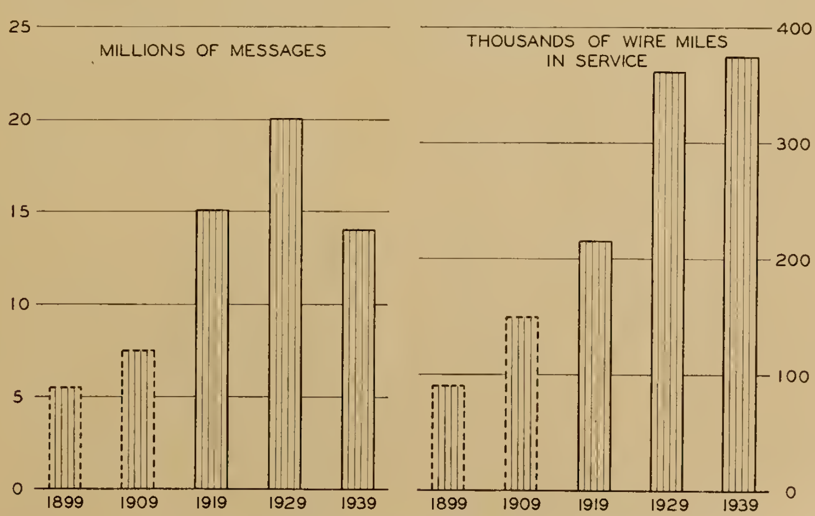


**Fig. 1. Telegraph Development — Canada 1899-1939.**

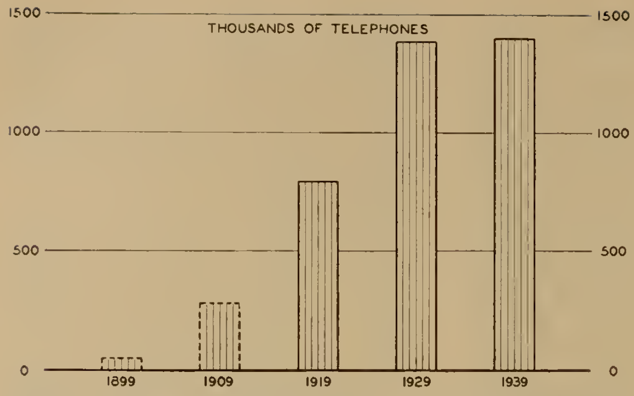


Fig. 2. **Telephone Development — Canada 1899-1939 (Telephones).**

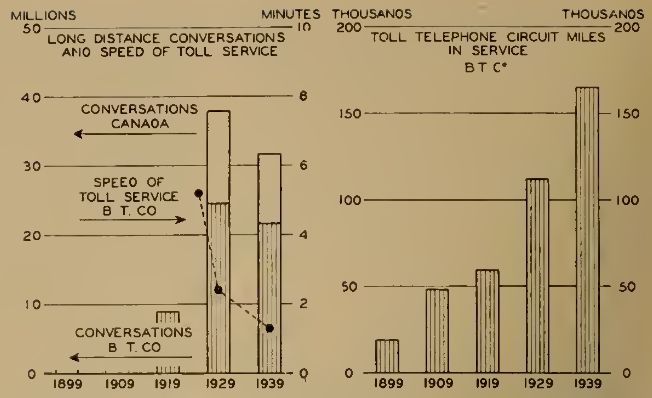


Fig. 3. **Telephone Development — Canada 1899-1939 (Toll).**

1939 development was slightly above the 1929 level.

Fig. 3 shows, at the left side, the number of long-distance conversations per year through this period, with the corresponding improvement in speed of service which took place. From a few thousand calls in 1899, which, of course, were for short distances only, total calls reached 9 million in 1919 and about 38 million in 1929. Long-distance calls follow the business cycles pretty closely. Consequently, the volume dropped to 24 million in 1933, but by 1939 was back to nearly 32 million calls.

Speed of service,—i.e., the interval from the time the customer originates the call until the first report of the called party—improved steadily from nearly 6 minutes in 1923 to less than two minutes in 1939. Circuit miles in service rose steadily until 1929, and in the late '30's, to reach an approximate total of 165,000 miles for the Bell Telephone Co. of Canada alone.

By 1939, both telephone and telegraph business appeared to have reached an even keel after the depression. World War II provided a tremendous impetus to long-distance traffic of all sorts. The phenomenal expansion in Canada's production, troop movements, continental defence,—all the myriad activities of war—strained the communications network to its limit. Materials, and therefore means for expansion, were restricted, service was slow, but the telegrams and telephone calls were handled.

Defence communication activities during World War II were extensive in terms of construction and maintenance, particularly on the east and west coasts, to the point where it was possible, using both defence and common carrier networks, to set up a telephone call from Alaska to St. John's, Nfld.

**Post-War Development**

With peace, some recession in business was expected, but, on the contrary, the growth in telephone business hit a pace which had never been equalled. Substantial increases also took place in telegraph business, particularly in leased-line business. A few figures will be useful. The data are shown in Table 1.

In the eight years since the war, then, the number of telephones in Canada has about doubled, long-distance telephone calls, having doubled during the war years, have doubled again since then, and toll telephone circuit mileage has doubled. Speed of service, having slipped due to overloaded facilities, has improved greatly during the past few years. Telegraph messages are up 19 per cent and telegraph channel mileage is also up substantially, reflecting the heavy growth in leased circuits. It might be interesting to note that the Trans-Canada part of this toll telephone business was over five times greater in 1945 than it was in 1939 and by 1953 was over double the 1945 figure.

There is, then, an impressive telecommunications network in Canada. In Fig. 4 are shown geographically the major routes now existing across the country. In the heavy industrial complex of Quebec and Ontario, twin telephone cables run from Quebec City to Windsor, from Toronto to Buffalo, and from Montreal to the United States border. These are now reinforced by radio relay facilities joining Buffalo, Toronto and Montreal, and Toronto and London, carrying telephone facilities in the Toronto-Montreal, and shortly in the Montreal-Quebec, sections, and the television network from Buffalo to Montreal and from Toronto to London.

Extending east and west from the central provinces to both coasts are extensive broadband carrier telephone and telegraph facilities, the former on the lines of the Trans-Canada System and the latter chiefly on the railway telegraph lines. There are now approximately 425 telephone circuits in the Montreal-Toronto section, roughly 95 west from Toronto to Winnipeg and Calgary, 70 east from Montreal to Saint John, N.B., 65 from Calgary to Vancouver and 100 from Saint John to Halifax. In 1939 there were nine circuits in the Toronto-Winni-

**Table I—Telecommunication Development—Canada**
**1939 - 1953**

| | 1939 | 1954 | 1952-1953 | Factor 1953 1945 |
|---|---|---|---|---|
| Telegraph Messages (Millions) | 14.0 | 19.9 | 23.5 * | 1.2 |
| Telegraph Circuit Miles (Thousands) | 447 | 752 | 1,383 * | 1.8 |
| Number o fTelephones (Millions) | 1.4 | 1.8 | 3.4 * | 1.9 |
| Long Distance Telephone Conversations (Millions) | 31.6 | 64.8 | 126.7 * | 2.0 |
| Speed of Toll Service (Minutes) (Bell of Canada territory) | 1.3 | 2.9 | 1.5 | 0.5 |
| Toll Telephone Circuit Miles (Thousands) (Bell of Canada) | 165 | 265 | 689 | 2.6 |
| Telephone Plant Construction (Millions) (Bell of Canada territory) | $14.0 | $18.0 | $98.4 | 5.5 |

*1952 data.

**Table 2:**

**Principal Types of Service Furnished Over Telegraph Facilities**

(a) Message Telegraph — Public Offices.

(b) Leased Wire Services:—

1. Normal commercial teletype networks.
2. Defence networks.
3. Weather reporting.
4. Wire photo and facsimile transmission.
5. Telemetering and similar control circuits.

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peg cross section. So much for the past.

### The Present

Under the heading of "The Present" the kinds of service now provided by the telecommunication networks, and the structures and intrumentalities used to provide that service will be described.

### Principal Services

The principal services furnished over telegraph facilities are listed in Table 2. Message telegraph service is available at public offices in nearly every town and village in Canada. Generally messages can be telephoned to the telegraph office. Full-rate, delayed, and night letter service is provided.

Leased wire services present considerable variety and complexity. These are all private circuits, provided for the exclusive use of a customer, usually a business firm. Practically all are operated by teletype. The simplest form is a point to point circuit with teletype machine at either end. The addition of other offices by bridging onto the circuit is comparatively simple, with all data passed to all machines on the network. As the length of circuit and number of machines increase, regenerative repeaters are necessary. Many of the leased networks, employ selective mechanisms usually actuated by dial or teletype pulses, by means of which a particular station or stations can be connected into the circuit automatically. Teletype systems such as this serve the major department stores across Canada, the press, the air lines and a number of large industrial firms.

Defence networks, although reaching into more remote parts of Canada than do the normal business leased lines, provide essentially the same kind of service, and are generally actuated by teletype.

Weather reporting can be linked with wire photo and facsimile transmission. An optical unit scans the picture to be transmitted, passing a frequency modulated signal over the circuit to the distant point. There the signal is received, amplified, and applied to sensitized paper. In some techniques, the paper is then developed to give the finished product; in others, the sensitized paper is moist when the signals are applied and dries as the finished picture.

**Table 3:**

**Principal Types of Service Furnished Over Long Distance Telephone Facilities**

(a) Message Toll Telephone — From all telephone instruments.

1. Person to person.
2. Station to station (anyone).

(b) Leased Wire Service — Full Period.

1. Normal commercial.
2. Right of way companies.
3. Defence networks.

(c) Leased Wire Service — Short Period.

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Then there is the growing variety of control circuits, that is becoming more important as time goes on. Control of oil or gas flow through pipe lines, remote control of power stations, fault-alarm circuits from unattended telephone or telegraph repeater stations—all of these use a basic telegraph circuit to carry pulsing codes which convey the necessary information.

In Table 3 are listed the principal varieties of long-distance telephone service. First and foremost, of course, there is message toll service available from virtually every telephone, including mobile telephones, and providing connection throughout Canada, the United States, and


**Fig. 4. Canada — Main Telecommunication Routes.**

to 101 other foreign countries, representing over 90 per cent of the world's telephones. In general, both person-to-person and the cheaper station-to-station service are available. Reduced rates are in effect at night and on Sundays. Canadians ran up a total of about 150 million toll telephone calls last year.

Telephone service is also available on a leased-circuit basis, either for short periods at stated intervals, i.e., short-period talking circuits, or on a full-time basis. Most of such circuit leases are from point to point. However, a number of more comprehensive telephone network leases are in existence, such as the air traffic control circuits and certain defence circuits.

Service to right-of-way companies covers telephone circuits associated with pipe lines, power company distribution systems, etc. Generally, the companies find they are better off from both service and economic standpoints if they lease facilities from the common carriers rather than "going it alone".

As in the case of telegraph service, comprehensive telephone networks for defence purposes have become decidedly necessary. The telephone and telegraph companies are collaborating in the furnishing of both types of facilities to meet the requirements of the armed forces.

#### Television

Television is comparatively new in Canada, but it is a voracious user of telecommunication facilities. Local pickup of a television program, where it is a "one shot" affair, is often carried from a mobile field radio terminal at the camera to the broadcasting studio over a direct radio channel. In other cases, usually at locations where TV programs originate regularly, e.g., major hockey rinks, special cable pairs, shielded by P.S.V. (polyethylene string video) are leased from the common carriers.

Long-distance network transmission of television programs is also provided by the telecommunications companies. In the United States by the end of 1953, some 50,000 channel miles of television circuit were available to the telecasters, an increase of 50 per cent in the year 1953 alone. In Canada at present, a television channel is provided by The Bell Telephone Co. from Buffalo through Toronto to Ottawa and Montreal, with a channel in the reverse direction available as required. From Toronto to London the railway telegraph systems are providing TV network services. The network service available is generally capable of carrying colour, as well as monochrome, television signals.

#### Basic Performance

The basic performance which must be provided by network facilities if these services are to be satisfactory are:

1. *Frequency space.* A 100-speed teletype circuit requires 170 cycles in which to operate. This allowance will take care of other telegraph uses except facsimile, which requires full-voice facility. An ordinary commercial-grade telephone circuit requires 3,400 cycles although somewhat narrower bands are reasonably satisfactory. A radio broadcasting circuit should pass 5,000 cycles and in some cases 8,000 cycles. High-fidelity transmission of music requires about 15,000 cycles. The nominal overall frequency bandwidth for a television signal, either black-and-white or coloured, is 4.2 megacycles, although reasonably satisfactory black-and-white signals can be transmitted over 2.8 megacycles.

2. *Strength and Quality of Signal.* Telegraph signals must be capable of actuating teletype machines or other devices at the distant end of the circuit without failure or distortion. This requires that overall loss shall not exceed 30 per cent. Telephone circuits must transmit intelligible speech with minimum distortion. Overall transmission loss to which the telephone network is now designed, including loss in instruments, switching systems, and circuits, is 20 decibels. Television transmission presents a number of additional problems. Almost uniform amplitude and delay response is required over the full frequency range. Amplitude distortion requirements are about ten times, and interference requirements three times, as severe as in telephone transmission, and delay distortion requirements are much more rigid. Requirements for colour transmission are more severe than for monochrome, particularly in the frequencies below 300 kilocycles, and in the colour subcarrier region (3.58 mc.)

3. *The telecommunications network must work as a system.* It is not enough that a piece of equipment work by itself, or a circuit provide reasonable transmission between two isolated points. The equipment and the circuits must be so designed and integrated within the whole network that they are completely balanced and compatible, and will continue to function as part of the system, ready to provide service to and from any part of the network, for many years. This means making haste slowly. It means continuous and thorough research on all parts of the network facilities, careful design of new equipment and extensive trials before any new item is made a permanent part of the system.

4. *Continuity of service is all important.* Circuits are no use to the public or to the owner when out of service. Thus every major telecommunications agency devotes great attention to maintenance operations, training and methods; to maintenance materials; and to design problems which may spell future maintenance difficulties. A new piece of equipment is good only if it can be maintained in service satisfactorily.

#### Network Facilities

Present day telecommunication network facilities can be considered under the three headings of basic structures, multiplex systems and switching arrangements. This assumes as common the requirement of instruments and local distribution facilities at either end of any long distance network.

##### *Basic Structures*

First in point of time, and still providing a substantial part of long-haul circuit facilities in Canada, is the open wire pole line, equipped with copper wire and, for many years now, with superimposed carrier systems. Modern open-wire carrier systems demand great precision of wire spacing and transposition. A line fully transposed for a 12-channel carrier should have wire spaced at 8 inches between wires of the same pair, with 24 inches between pairs on a crossarm. Wire must be uniformly sagged, and precise adherence to a laid down pattern of point transpositions is required to secure inductive balance. This involves an average of about 18 transpositions per pair mile.

Toll cable, originally used only for entrance facilities to the large towns and cities, now forms the backbone of storm-proof plant in the heavy traffic areas of the country. Most circuits over inter-city cables are now on cable carrier. The basic structure may be twin cables, usually buried, or it may be a single cable, with, in both cases, superimposed broadband cable carrier systems of various types. Cables are brought to repeater points at intervals dictated by the requirement of their carrier systems, where the pairs are balanced out to ensure minimum noise and cross-talk.

Coaxial cable has not been used as yet in Canada for intercity purposes, although it is used extensively in both the United States and in Europe. The basic unit is a copper tube, in the two U.S. designs 3/8 in. or 1/4 in. in diameter, with a centrally positioned copper wire. The tube is suitable for telephone, telegraph, and television network circuits. The whole assembly is shielded and a number of the tubes are incorporated in a cable.

The proposed Trans-Atlantic telephone cable, on which planning and engineering are now actively under way, will be of the coaxial type with polyethylene insulation. In the main trans-oceanic section between Newfoundland and Scotland, it will consist of twin coaxial cables of American design, with repeaters enclosed within the cable sheath at 40-mile intervals. In the shorter Newfoundland-Nova Scotia section, a single coaxial cable of British design will be used. Power will be fed to the repeaters from the shore terminals through the central conductor.

The most recent addition to basic structures is the radio-relay system. Although some few systems in the very high frequency (V.H.F.) range have been used, most systems are in the ultra high frequency (U.H.F.) band. A number of systems with limited numbers of channels operate in the neighbourhood of 400, 500, and 900 megacycles. Generally speaking, such systems have been used, in this country, on branch routes for purposes of voice and telegraph channels only. For major routes with television and/or multiple telephone and telegraph requirements, the Bell Telephone TD2 system and the Standard Telephones & Cables system are being used.

The S.T. & C. system has been used extensively in the United Kingdom and an installation has recently been made by the railway telegraph companies between Toronto and London. The system operates in the 4,000 megacycle band and is capable of accommodating 14 one-way radio frequency (RF) channels. Each of these RF channels will provide a one-way television channel, and a pair, with present techniques, will take care of a maximum of 600 voice telephone channels. Operation of television and voice over separate RF channels of the same system is feasible, but has not been used extensively to date. Table 4 and Fig. 5 will give some idea of the physical appearance of this system.

The TD2 system was designed by the Bell Telephone Laboratories and is used throughout the United States, along with coaxial cables, to carry the trunk television network and the large cross sections of telephone circuits. The system is designed to give balanced performance over a 4,000-mile route, and operation on a transcontinental basis has proven the design to be satisfactory. Over 10,000 route miles of the system are now in use.

This system also operates in the 4,000 megacycle band. Twelve one-way RF channels may be developed. RF channels are 40 megacycles apart, with an effective channel band width in the order of 8 megacycles. Each is capable of handling a TV channel, either black and white or colour. Each pair of RF channels when equipped with L-I carrier, will accommodate 480 voice channels at present, and plans are established to increase this to 600 voice channels. Thus a fully equipped TD2 system can now handle two one-way TV channels, a guard channel in either direction, and 1,920 telephone channels (2,400 channels on the 600 cct. per RF channel basis). Alternatively, and still assuming the guard channel reserved, the remaining ten one-way or five two-way RF paths could carry ten TV programs simultaneously or 2,900 telephone circuits. The new L-3 carrier system will permit further expansion of capacity in the TD2 system.

Repeaters are located on a line-of-sight basis, average spacing

**Table 4:**

**Standard Telephones and Cables Microwave Relay Equipment System Frequency Allocations**

*Standard Frequency*

| *Chan. No.* | *Midband Frequency* |
|---|---|
| 1 | 3650 Mc/S |
| 2 | 3690 " |
| 3 | 3730 " |
| 4 | 3770 " |
| 5 | 3810 " |
| 6 | 3850 " |
| 7 | 3890 " |
| 8 | 3930 " |
| 9 | 3970 " |
| 10 | 4010 " |
| 11 | 4050 " |
| 12 | 4090 " |
| 13 | 4130 " |
| 14 | 4170 " |

*Slot Frequency*

| *Chan. No.* | *Midband Frequency* |
|---|---|
| 1 S | 3630 Mc/S |
| 2 S | 3670 " |
| 3 S | 3710 " |
| 4 S | 3750 " |
| 5 S | 3790 " |
| 6 S | 3830 " |
| 7 S | 3870 " |
| 8 S | 3910 " |
| 9 S | 3950 " |
| 10 S | 3990 " |
| 11 S | 4030 " |
| 12 S | 4070 " |
| 13 S | 4110 " |
| 14 S | 4150 " |

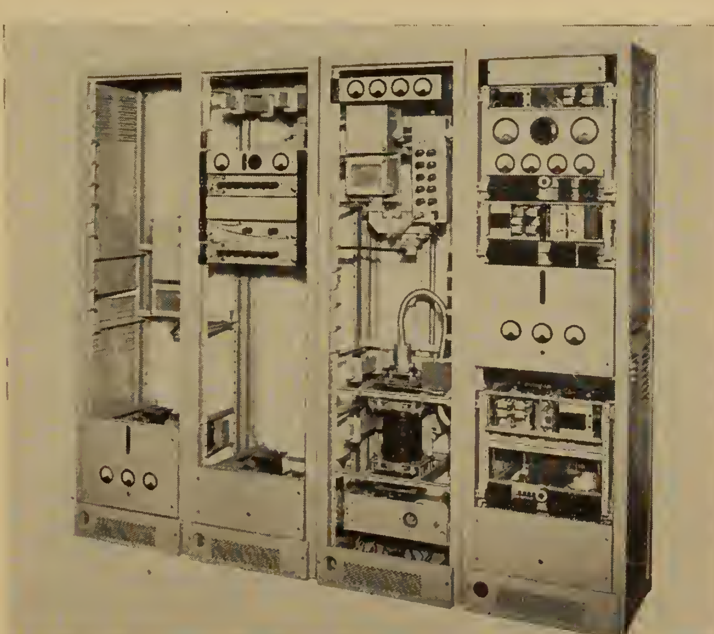

**Fig. 5. Standard telephones and cables microwave equipment — partially equipped repeater cubicles.**

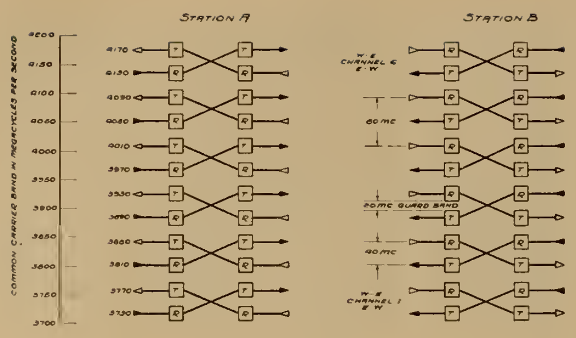


**Fig. 6. Bell telephone TD2 microwave equipment-radio frequency allocation plan.**

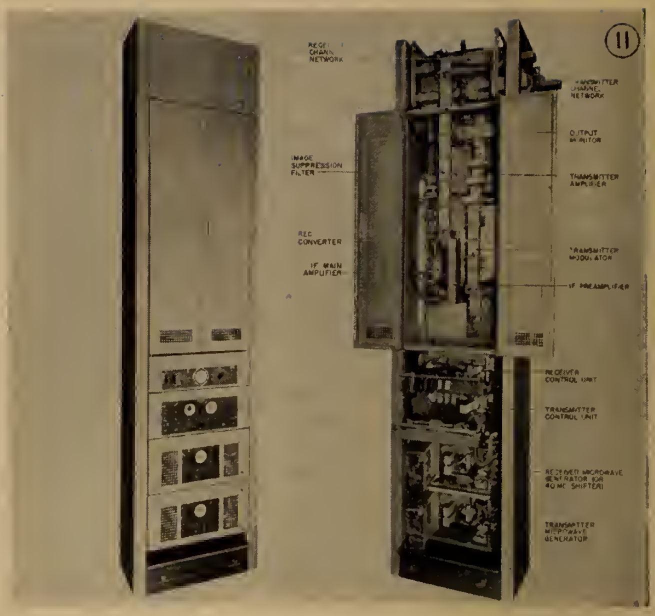

**Fig. 7. (Right) Bell telephone TD2 microwave equipment — radio transmitter-receiver bay.**

between relay points being about 30 miles. Between Buffalo and Montreal, a route distance of 410 miles, there are 14 relay points or 15 sections, an average spacing of 27 miles. A few figures will serve to indicate some of the features of the system, and of the Buffalo-Montreal TD2 route. Fig. 6 shows channel frequency assignments, in pairs of one transmitting and one receiving frequency 40 mc. apart. Frequencies are transposed between channels at each repeater station. Fig. 7 gives some idea of the type of equipment mounting, in this case the transmitter-receiver bay. Fig. 8 shows the route of Montreal-Toronto-Buffalo.

The company is now extending the TD2 network to Quebec, and engineering is actively underway on a Toronto-Winnipeg TD2 system.

Developments now underway will permit the addition of RF channels above the frequency range of the TD2 system, but using the same physical route and basic structures, thus providing for further expansion of television and telephone facilities on main trunk routes.

At the other end of the scale, a number of systems are under development in Canada, in the United States and in Europe, to cover requirements for 12, 24 and 36 voice channels, or equivalent telegraph capacity on "thin" routes. These systems should prove useful in the less populated areas of Canada.

Although not strictly a toll telephone network facility, mobile telephone facilities should be included here. Using VHF. frequencies in the 150-160 and 35-45 megacycle bands, the company now has a network of fixed transmitters and receivers to serve mobile telephones in the cities of Toronto and Montreal, and over the main highway system from Windsor to Montreal and from Toronto to Huntsville.

*Multiplex Systems*

Physical circuits can, of course, be derived from pairs of wires by using proper terminating networks, composite sets, phantom coils and voice repeaters. However, the majority of circuits are now derived by means of multiplex, or carrier systems of various types. Except for open wire, and in some cases even there, the physical pair or radio channel is used as a vehicle only, all voice or telegraph channels being on a superimposed multiplex system.

Starting with the four-channel "Type A" carrier system in 1918, the Bell Telephone Laboratories have designed others running from A to O. Other designers have also established many different multiplex systems. A look at the frequency spectrum occupancy of these various systems will be useful. Fig. 9 shows this for most of the carrier systems now in use in Canada.

Of the narrow band equipment, the "Type C" three-channel system, with pilot wire regulation, has for many years been widely used for long circuits. Its range of operation is well over 1,000 miles for one system, and several systems can be operated in tandem. The other narrow band systems, H, G, M, Lenkurt 33, etc., are used for shorter distances. Lenkurt and some other recently designed systems in this bracket have a built-in signalling channel, which is useful for toll dialing.

Of the Bell-designed broad-band systems, the "J" and "K" are 12-channel, basically alike, for use on open wire and twin non-loaded cable pairs respectively. Systems may be connected in tandem through a 4,000 mile network. The "N" 12-channel system is used on non-loaded pairs of single cables, and is generally confined to systems under 300 miles in length. Repeaters are spaced a maximum of 8 miles apart, compared with 16 miles for "K" carrier. Repeaters may be pole-mounted except at power supply points, which generally are at every third repeater location.

The "O" and "ON" are recent developments. The "O" design includes a basic 4-circuit unit, with 4 such units stacked (OA, OB, OC, and OD) covering the overall frequency range of 2 to 156 kc. In the cable "ON" version, 20 channels may be derived on two cable pairs, or one quad, with repeater spacing the same as for "N" systems. Single-side band operation is used for both "O" and "ON" systems.

Lenkurt broad-band carrier in the "45" series is now available, again using the 4-channel basic unit arrangement, with application to open wire, cable and radio. Lynch, Federal, C.G.E. and others are in the field as well, with systems which are being used at suitable locations in the Canadian networks.

The L-1 carrier system is used on both coaxial cable and TD2 radio relay in the United States. In Canada, it is in use on the Toronto-

Ottawa-Montreal TD2 route of the Bell Telephone Co. Total capacity of this system is 600 telephone channels. Circuit provision is made in units of 12 channels, which are stacked in groups of five to form supergroups of 60.

One of the most recent additions to the series of broad band systems is the L-3 carrier system. This system is applicable to coaxial cable and is also expected to be used on radio relay facilities. The L-3 system will provide 1,800 telephone channels over a pair of coaxial conductors, or it may be used to provide up to 600 telephone circuits and a 4.2 megacycle television channel simultaneously.

On the telegraph side, there are a number of carrier systems. Probably the most extensively used now is the 40-C-1 system, providing up to 18 telegraph channels of 170 cycle width, over a voice channel. The 43A-1 system, a newcomer, is considerably less expensive and more flexible than the older systems. A number of frequency modulated systems are also in use. Frequency shift telegraph, using different frequencies for marks and spaces, has been used chiefly over radio facilities where its characteristic of transmitting a readable signal with low power is advantageous.

***Switching Arrangements***

Some of the most spectacular advances in telecommunications in recent years have been in switching. For many years, while local calls advanced from operator handling to automatic switching of various types—step-by-step, rotary switch, panel, and crossbar—long-distance calls continued to be operated on a manual basis. The extensive information required for call completion and the personalized nature of a considerable portion of the traffic tended to delay mechanization.

Manual switching systems developed steadily in quality and speed. Today, toll telephone switchboards in most of the major cities are of the Bell System No. 3 type. Circuits terminate in switching pads, which are kept in the circuit on a terminal call, but cut out automatically on through switches, to ensure satisfactory transmission. The boards can be equipped for dialing, either with a position dial or a keyset.

There are, of course, a number of other types of switchboards providing similar features.

Operator dialing of calls over short distances has been done in various parts of Canada since the early thirties, using, in general, step by step switches of the same type as is used for local dial switching. By 1950, substantial short-haul networks had been established around a number of the principal cities. In the last few years, there has been extensive use of step equipment for toll purposes in Bell of Canada territory, to handle terminal traffic to and between Montreal, Toronto and Ottawa.

Elsewhere in Canada, Siemens-type auto-toll boards and associated automatic switching equipment have been installed in Halifax, Winnipeg, Edmonton and Brandon, permitting operator dialing of a substantial proportion of both terminal and switched traffic at these points. As opposed to the Bell cord-type boards, the Siemens board is key operated, with rotary type switches. Two-tone signalling is employed on long-distance circuits. This system is used extensively in the United Kingdom and in Australia. It requires certain modifications, however, to permit full integration in a network as extensive as that in North America. Approximately 35 per cent of Canadian toll telephone traffic is now operator dialed, and plans are underway for a substantial increase.

Extensive private teletype switching systems are in operation by the armed forces, and, on a leased basis, for department store chains, manufacturing companies, news agencies, etc. For a number of these, switching is on a selector code basis. For the largest systems, however, there are switching centres where reperforator transmitters, multiple routing of tape, etc., greatly facilitate the handling of heavy traffic.

The telegraph companies operate similar switching centres for commercial telegrams, for minimum of handling and maximum speed. The so-called "T.W.X." service has not yet been introduced in Canada. Under this arrangement, teletype subscribers may have their machines connected to any other on the network in the same general manner as for a telephone long-distance call.

**The Future**

Anyone who would make categorical statements about the future of either telegraphy or telephony must have a much clearer crystal ball than this writer.

**Telegraphy**

In telegraphy, a fuller development of the special uses of telegraph circuits appears to be indicated. Telemetering and control circuits will grow in number and complexity with the expansion of power, pipe line and railway activities. There is a growing demand for this type of facility and the telecommunication companies are preparing to meet it.

**Facsimile Transmission**

The use of facsimile transmission is also increasing. New and im-


**Fig. 8. Montreal-Toronto-Buffalo radio relay route.**

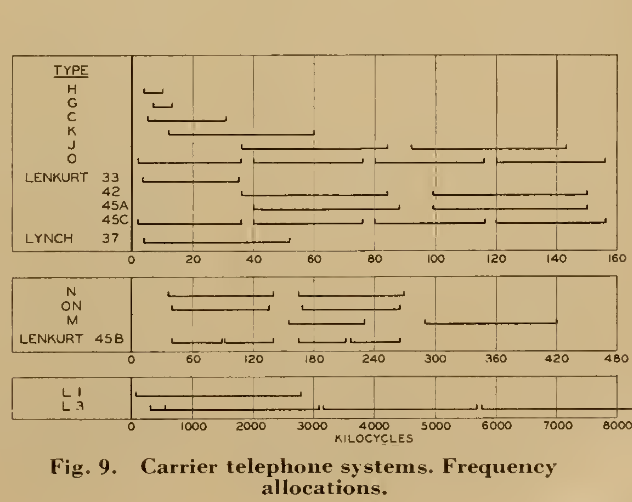


**Fig. 9. Carrier telephone systems. Frequency allocations.**

Fig. 10. Numbering plan areas with codes — U.S. and Canada.

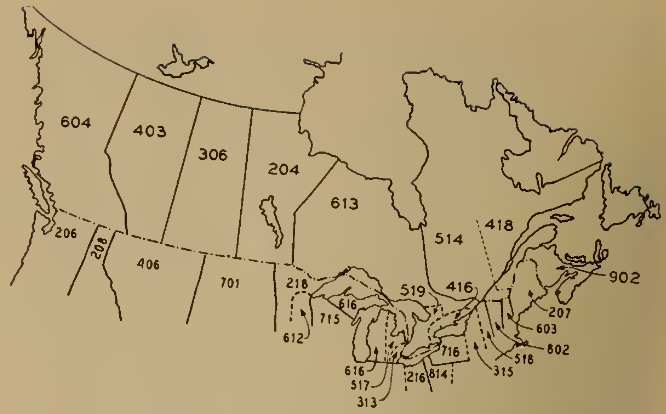


Fig. 11. Numbering plan areas with codes — Canada.

proved apparatus, both of European and American design, is coming into the market, bringing with it better performance and wider use. Facsimile transmission of printed matter is now possible in some degree and such transmission of commercial telegrams may prove economically attractive.

### Teletype

Teletype switching systems for private networks will undoubtedly grow in number and complexity. It also seems likely that some random switching system will come into use in this country, to fill the need of business houses which deal with a number of other companies, but do not have sufficient traffic with them to warrant full-time connections.

As to volume of business, growth will probably be chiefly in leased line business, following the trend of the past few years.

### Television

Coming to television networks, the future appears easier to forecast. Television transmitting stations are now operating in Montreal, Toronto, Ottawa, London, Kitchener and Hamilton and plans are underway for stations at most of the other major cities in Canada. Our growing sense of national consciousness, the need of cultural bonds urged in the Massey Report, and the announced plans of the Canadian Broadcasting Corporation, point to the early completion of a nationwide television network.

The next three to six years will probably see the establishment of a trunk television network on radio relay facilities from Vancouver to Halifax and Sydney, and ultimately to St. John's, Newfoundland. Key cities located away from this trunk line will be fed by branch routes, also on a radio relay basis. Colour television, when it comes, will use the same type network facilities as black-and-white transmission.

### Telephone Network

As to the future of the telephone network, the figures show the tremendous growth which has taken place in toll calling over the past 15 years. The pace has slackened somewhat during the last year in the Maritime provinces, but traffic in central and western Canada is continuing to grow rapidly. Trans-Canada calls today are 10 per cent higher than a year ago. Lack of adequate local facilities still prevents realization of the full potential of toll calling in places such as the Alberta oil fields and Newfoundland. The improvement in service inherent in dialing should help to sustain growth over the next few years, given reasonably stable business conditions. The telephone companies are forecasting a continuation of the present trend through 1954, with some tapering in the rate of growth through 1955 and 1956. A further increase in traffic at a somewhat slower pace beyond that date also seems to be indicated.

The concept of the kind of toll telephone service available in the future is a broad one. Ten years into the future, it is expected that:

1. About 60 per cent of all calls will be dialed direct by the subscriber without the aid of operators. The remaining 40 per cent, representing person-to-person traffic, calls where the called telephone number is not known, etc., may continue to be dialed by the operator.

2. The circuit and switching network will be arranged in such a way as to provide virtually no delay service on all calls.

3. Transmission quality for most calls will be within the present overall limit of 20 db, and a considerable proportion will be well within this limit.

The goal is really a continent-wide exchange, with faster, better service, largely under control of the subscriber himself. Plans have been laid to obtain this goal and the techniques to accomplish it are known. The whole plan centres around a continent-wide numbering and switching scheme.

In order to permit continent-wide dialing, every subscriber must have a telephone number which does not conflict with that of any other subscriber. To provide enough numbers within the local calling area of a large city, it has been found necessary to adopt a numbering plan consisting of the first two letters of the office name, followed by five numbers. The two letters and the first number designate the central office unit and the last four digits the subscriber's number in that unit. A maximum of about 500 central office codes are thus available.

In planning continent-wide dialing, this scheme of local numbering was adopted and the continent was divided into numbering plan areas, each estimated to contain no more than 500 central office units at the ultimate date. There are some 93 of these numbering plan areas, and each area has been assigned a three-figure code of its own. Fig. 10 shows the numbering plan areas for the United States and Canada, and Fig. 11 gives a little fuller picture of the Canadian areas. Within each area, each telephone central office will have its own code, for example UN6 (for UNiversity 6) in Montreal or JA8 (for JAckson 8) in Hamilton in the "416" area. Thus a man with the number "JA8-1234" will be reached by dialing that number from any office in the 416 area.

From offices outside that area, he would be reached by dialing "416-JA8-1234.

With the numbering plan fully established each subscriber will have a 10-digit number (in a few cases 11 digit) which is not repeated anywhere on the continent. The total capacity of the system is about 500 million telephone numbers, which leaves room to grow.

The next, and perhaps the most important, feature of the scheme, is the toll switching plan. The continental toll switching plan follows a tree-like pattern. There are, in the United States and Canada, some 2,600 offices at which the handling of long-distance telephone traffic is concentrated. These are called "toll centres" and each one is surrounded by a cluster of tributary offices which feed calls into it. These satellites may be local offices in a large city or they may be small towns surrounding the larger centre.

Under the general toll switching plan, these 2,600 toll centres are divided into five categories, depending on their size and strategic location with respect to cross-roads in the continental circuit network.

Fig. 12. Switching regions — U.S. and Canada.

### National Centre

This will be St. Louis, Missouri, which should more truly be called a "continental centre." It will be the final clearing house, from a traffic routing standpoint, for calls between any two points on the continent.

### Regional Centres

These will be nine major switching centres in the United States; St. Louis, White Plains, Pittsburgh, Chicago, Denver, Sacramento, Atlanta, Dallas and Los Angeles. In Canada present plans indicate that Montreal and Regina will also be regional centres.

These regional centres will be interconnected by circuit groups which are engineered on a so-called "high-usage" basis. They will also connect with the continental centre.

Each regional centre will be the focal point for traffic within its own region. Fig 12 shows the switching regions and the corresponding regional centres as contemplated. It will be noted that Regina, based on present plans, will serve a region extending from the head of the Lakes to the Pacific coast, with Montreal serving the eastern half of Canada.

### Sectional Centres

These will number approximately 35 and in turn will be the centres of groups of offices within the regional area. They will be connected by liberally engineered final groups to their regional centre. Figs. 13 and 14 show for Canada the present view of sectional centres. Calgary, Winnipeg, Toronto and Saint John, as well as Regina and Montreal, are included in present plans.

Fig. 13. Western Canada switching region.

Fig. 14. Eastern Canada switching region.

### Primary Centres

There will be approximately 125 of these, each forming the focal point for traffic from a cluster of toll centres within a sectional area. Each primary centre will be connected by a liberally engineered or "final" circuit group to its sectional or regional centre.

### Ordinary Toll Centres

These are the remaining 2,400 toll centres on the continent. In each case they will be connected by liberally engineered equipment to a nearby switching centre of greater magnitude. Each toll centre will handle the traffic for its own cluster of tributary points, called "end offices".

Offices coming under categories 1 to 3, inclusive, are classified as "control switching points". The equipment functions of these offices are vital to the whole switching system.

1. The equipment must have the ability to test alternate routes automatically and to select an available circuit.

2. It must be able to recognize and analyse the area and office code on any telephone call, i.e., the first six digits, to determine the proper routing for the call, to pass on the necessary code information to the next office in the chain—which may involve a change in code from what is received—and finally to determine the type of pulsing required.

3. Because of the number of possible links in the total connection, switching at the control switching points is on a four-wire basis, to avoid unbalance and to keep transmission loss in the switching process to a minimum.

4. In the interests of speed and accuracy, multi-frequency signalling will be used, employing five tones, two of which are used to represent each digit.

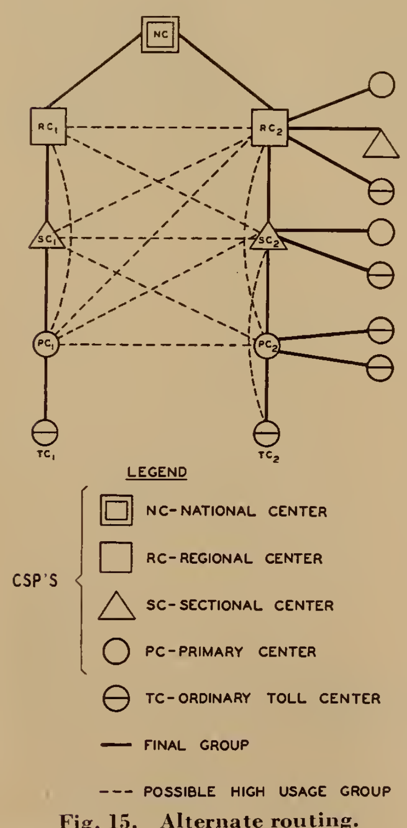


**Fig. 15. Alternate routing.**

Throughout the Bell System crossbar toll switching equipment is being used for this purpose. However, other equipments such as Siemens and Automatic Electric step equipment can be adapted to provide at least some of these functions.

So far as circuit provision is concerned, so-called "high usage" groups of circuits are established on the basis of need between any pair of offices. In these groups, the number of circuits provided is less than the total number required to handle all the traffic offered in the busy hour. Thus these circuits carry all the traffic for most of the day, but during the busy periods, using automatic alternate routing, they overflow into "final" groups. This arrangement, in addition to ensuring no-delay service, is important from the economic standpoint, because it results in a lower overall investment in circuit plant than would be the case if each circuit group were made to carry full-peak load traffic.

Fig. 15 illustrates the alternate routing principle on which the whole circuit arrangement is based. The crossbar toll switching equipment has the facility of testing a first route and up to five alternate routes in a very short time. Therefore, on traffic originating at a toll centre the operator can first test a high-usage group and, if this is busy, will dial the call into the machine at the adjacent control switching point. From here on the process is entirely automatic. The machine will test high-usage groups in a predetermined order, and if all are busy will unload the call over the final group to the next higher switching office. This process of search takes place at all offices along the route until the connection is finally established. The overall time required to establish a connection through the eight links shown on the diagram, from the start of dialing to ringing on the final connection, would be about 35 seconds. Most calls would have fewer links and therefore be set up even more rapidly.

The general pattern of final routes can be observed in Fig. 16. This indicates in diagramatic form the series of office clusters already described, with final liberally engineered groups established throughout the network.

Customer toll dialing has been in operation in parts of Europe for some years. In Belgium and Switzerland, for example, this type of dialing has been available for at least 15 years, and extends over distances of 150 miles or so. However, on this continent, customer dialing had, up to recently, been confined to local or very short haul toll traffic.

On November 10, 1951, nationwide or "foreign area customer dialing" was introduced in the United States when the Mayor of Englewood, N.J., dialed a ten-digit number and reached the Mayor of Alameda, California. At the present time, three offices in the United States—Englewood, N.J., Birmingham, Minn. and East Pittsburgh, Pa., are equipped for customer dialing. Subscribers at these points have direct access to 13 million telephones in the United States—and they like it.

The essential additional requirement for customer toll dialing is a recording mechanism to provide details of the call for charging purposes. For short-haul calls, generally between distant parts of large cities, a system of unit charges has been used, following the pattern of ordinary message rate service. For the longer haul traffic, a number of systems are available, but the principal one which will be followed in the continental plan is "centralized automatic message accounting". Under this system details of the calling and called number, the time of the call and the charges, will be recorded on a punched tape at the central operating point. These tapes will later be processed through a mechanism from which individual statements for each call, and finally for all calls, from the one telephone number will be provided. Initially, the calling number will be punched into the tape record by an operator, but plans are underway to eliminate this feature later.

Fig. 17 gives a picture of a fully manual connection followed by the gradual mechanization of the call, first in the local office, then at the distant end and intermediate switching offices and finally, with the adoption of customer dialing, at the originating toll office.

A "toll fundamental plan" for Canada incorporating a long-range program of establishing major switching centres and routes across the country was adopted by the Trans-Canada Telephone System in March, 1953. This plan will be closely integrated with the American plan. Under it, Regina and Montreal will probably be regional centres, and will probably have final connection with the continental centre of St. Louis. They will also have a liberally engineered circuit group between these two points so that all Canadian traffic may be routed completely through Canada. Calgary, Winnipeg, Toronto and Saint John will be sectional centres. Vancouver, Lethbridge, and Edmonton will be primary centres out of Calgary, Saskatoon out of Regina, Brandon out of Winnipeg, North Bay and London will be primary centres out of Toronto, Ottawa and Quebec out of Montreal, Halifax and ultimately St. John's, Nfld., out of Saint John, N.B. Behind each of these major cities, of course, will be the cluster of toll centres and tributaries which have already been mentioned.

Implementation of this plan, so far as operator dialing is concerned, has been under way in Winnipeg, Brandon, Edmonton and Halifax, using Siemens equipment, for several years. A considerable amount of direct circuit dialing has been done in Bell of Canada territory for some years. Crossbar toll dialing equipment will be placed in service in Toronto in 1955 and in Montreal in 1956, thus permitting the dialing of approximately 85 per cent of Bell of Canada traffic, as compared with the present 40 per cent. Plans are going ahead for equipment installation through the 1955 to 1958 period in Regina, Calgary, Vancouver and Saint John. It would therefore appear that the nation-wide network on an operator-dialing basis should be well established within the next four or five years.

Customer dialing may overlap this somewhat, and will probably appear first on the shorter haul traffic surrounding the large cities. Its progress will, of course, be dependent both on technical and economic factors, but it does not seem too unrealistic to say that within the next ten years a very substantial portion of all toll telephone traffic in Canada will be dialed by customers.

The future of telecommunications in Canada is one of growth, of constant change and of modification to incorporate new techniques and to improve equipment. Most important is the need for continued planning for an integrated system, so that all the new things may fit into the network and thus meet the requirements of the public in the most satisfactory manner.

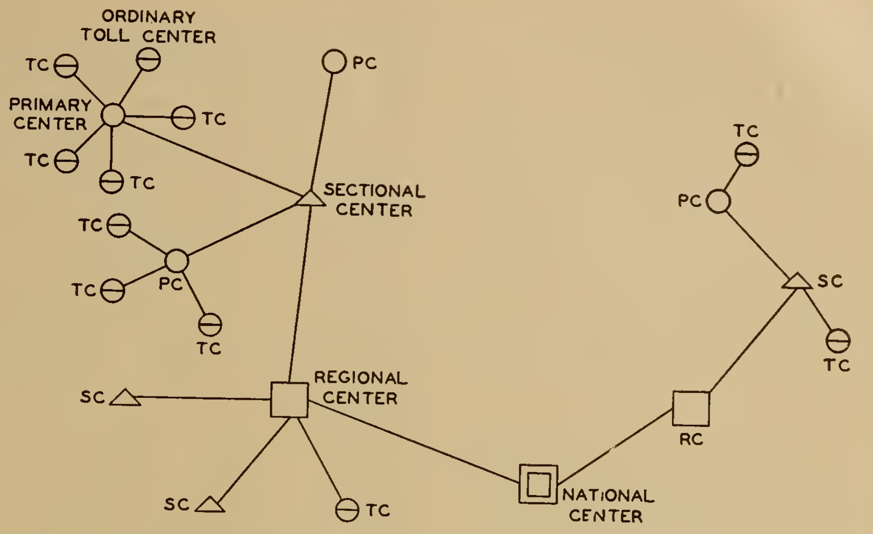

Fig. 16. Prepared general toll switching plan (basic principle).

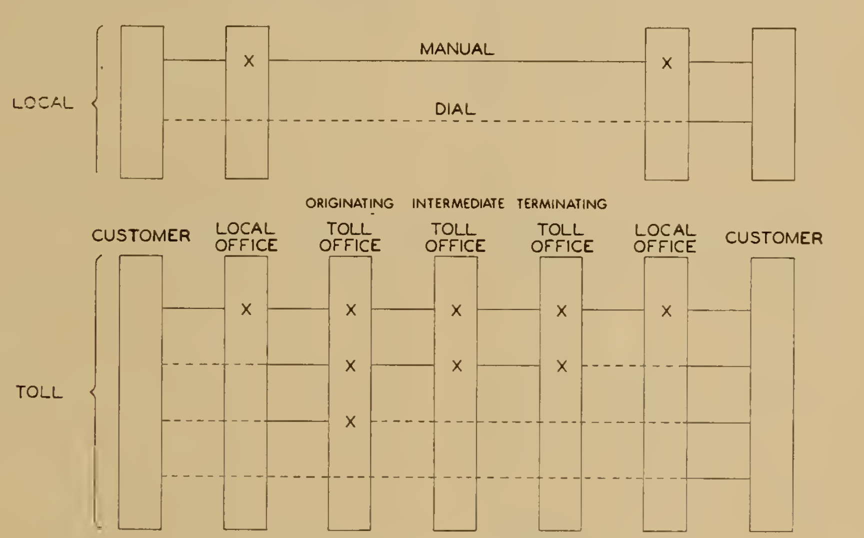

Fig. 17. Progress in mechanization.


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(2) A. M. Mackay. "The Telegraph in America," John Polhemus, N.Y., 1886.

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# Discussion

**R. B. Steele**[1]

Mr. Lester has presented to you today a very fine paper on his chosen subject. He is to be commended for preparing a paper which reviews in considerable detail, and with great accuracy, not only the history of the inception and growth of communication facilities, but also the scope of communication facilities and services available to Canadians today. He goes still further and discusses probable developments for the future.

The discussion of a technical paper usually deals with some portion of the paper with respect to which the author of the discussion and the author of the paper disagree. I am in agreement with the things that the author of the paper has said, and, therefore, find myself restricted to a discussion on a number of things he did not say,

[1]Chief Engineer, Canadian National Telegraphs, Toronto.

but which are pertinent to the sketching of a picture of communications in Canada.

In introducing the historical portion of his paper the author points out that the telegraph came first with a telegraph line which was built in 1846 from Toronto to Hamilton and Niagara Falls. This was a single wire line on poles cut from the nearby bush, but you may be interested to know that the company which built it operated under the grand name of Toronto, Hamilton, Niagara and St. Catharines Electro-Magnetic Telegraph Company. This communication route, but obviously not the original line, is today a part of the communications plant of Canadian National Telegraphs. The author traces the development of the telegraph business from this humble beginning to the present time, where the villages and settlements without telegraph service (and this applies even to Newfoundland) are very few in number.

In the slide presented as Table 2 of the paper, the author lists the principal services furnished over telegraph facilities, and, similarly, in Table 3 the principal varieties of long distance telephone service. The classifications as listed are acceptable for descriptive purposes, but the titles should not be taken to imply that all the telegraph facilities are furnished by the telegraph companies, or that all the telephone facilities are furnished by the telephone companies. The author subscribes to this at a number of points in his paper but the inclusion of these tables gives me the opportunity to point out that the Canadian Pacific Communications and the Canadian National Telegraphs are designated as "communications departments" in their company families, and this designation recognizes the fact that they are both engaged in all kinds and types of overland communications with open wire, cable, and radio facilities, and providing telegraph, ticker, telephone, facsimile, sound broadcasting, video broadcasting, and other similar services.

As I have already had the privilege of pointing out in a paper given before another professional society, network sound broadcasting in Canada dates from Christmas Day 1923, when experimental radio stations "OA" in Ottawa was connected to station "CHYC" in Montreal by means of a pair of railway telephone wires. The network broadcast was sponsored by the then recently organized, Canadian National Railways, and the principal speaker was its president, Sir Henry Thornton. This successful venture into network broadcasting encouraged the Canadian National to organize a radio department as a part of its public relations activities, and to sponsor network broadcasting from a number of stations across Canada, including a station at Moncton and one at Vancouver. These broadcasts were handled through modified telephone facilities comprising a part of the railways' communications plant. Some experience in this type of communications service had already been acquired when the Jubilee Broadcast mentioned in the paper was organized. The communications departments of the railways collaborated with the other major communication companies of Canada in providing this network, and contributed approximately 4,000 miles of program channel to it.

On May 26, 1932, the Canadian Radio Broadcasting Commission was created by parliament for the purpose of improving program service to the Canadian public. Each of the railway companies was by then operating trans-Canada program distribution service, and they were selected by the commission to provide with co-ordinated facilities the national program transmission service. Except for limited sections they have continued to provide this service to the C.B.C. and with continually increasing volume of plant assigned to serve a continually increasing number of radio broadcasting stations. The program transmission network used in this service today comprises more than 20,000 miles of program circuit and over 78 repeaters.

In his paper the author makes a number of references to the use of radio beams for telecommunications, including the transmission of TV programs between cities. As noted, the railway communications systems are presently providing the TV network service between Toronto and London. This service includes connections to intermediate stations at Hamilton and Kitchener and is being extended from London to Windsor and from Montreal to Quebec.

For general communications purposes, the railways have used radio facilities to extend or supplement their communications networks as circumstances warranted. Perhaps the first instance of such a radio facility was the establishment in 1936 of a radio telegraph channel between Amos and Val d'Or in Northern Quebec to extend telegraphic communications into Val d'Or, prior to the construction of the railway line. Since World War II, and with the availability of V.H.F. radio equipment suitable for multiplexing, other radio facilities have been added to the plants of both the railways, including a number in Ontario and Quebec, one between Vancouver and Vancouver Island, and two wide band beams from Nova Scotia to Newfoundland. These V.H.F. beams are channelized to meet local needs and contribute to the communication plants additional telegraph, telephone, and program transmission channels.

The author mentions in his paper the communications operations carried out by the communications department of Canadian National along the Alaska Highway and in Newfoundland. In both these areas communications are provided by conventional methods, but the character of the country, the weather conditions met with, and the requirements for further and rapid expansion to meet national needs have given them unusual prominence amongst our activities. The Newfoundland operation is unique in that in addition to wire lines, and to a substantial use of V.H.F. radio beams, single channel radio telephone and telegraph facilities are operated to give residents of coastal villages, accessible only by boat, contact with centres of population.

In his discussion of future developments, the author of the paper presents a fascinating picture of the volume and character of communication facilities which will be necessary to meet the demands of our increasing population and our rapidly expanding business activity. It may well be that the facilities in use some years hence will outstrip his prophecies, but in any event they are valuable to us today for an appreciation of an activity essential to our everyday life but not too well known by most of us.

**L. A. W. East, M.E.I.C.**[2]

I think Mr. Lester is to be congratulated for an excellent paper which gives so comprehensive an outline of telecommunications development in Canada. In addition to engaging your immediate interest, his paper is a valuable contribution to the records of this development. Certainly this must have been

[2]Chief Engineer, Communication Department, Canadian Pacific Railway Company, Montreal.

prepared with great care and I find no reason to differ with the facts he has presented. My remarks will, therefore, be limited to some additional information bearing on the subject which I think may be of general interest.

Under historical events, reference is made to the handling of press by the Great Northwestern Telegraph Company prior to 1912. In this connection, it may be mentioned that the Canadian Pacific Telegraphs also handled press wire service during the period 1907 to 1912 and since the latter date has provided all communications facilities for the Canadian Press Association to date. For the benefit of those who may be unaware of the fact, it may be mentioned that the two major railway systems in Canada as distinct from other countries, occupy a unique position in furnishing a variety of leased wire services in addition to the handling of railway and commercial telegraph messages. For example, they have provided coast to coast broadcast service for the Canadian Broadcasting Corporation since its formation in May 1932. At present, this involves over 20,000 channel miles of network operating 16 hrs. per day.

Other services include Meteorological teletype and Airways Traffic Control telephone facilities linking all of the principal airports throughout the country. During the past year a Weatherfax network linking the various meteorological offices has been added for the facsimile transmission of 24″ by 18″ weather-maps, involving some 3,500 miles of voice circuit and approximately 30 offices. At this writing, Canadian National and Canadian Pacific are together making initial installations of Deskfax Facsimile equipment at Montreal for local service to industrial and business offices. In the field of special leased wire teletype services, one of the largest networks furnished to a single industrial user connects offices in all principal cities from coast to coast and handles approximately 50,000 messages per month.

In the rapidly growing field of television network transmission, the two major railway systems have a contract with the Canadian Broadcasting Corporation for provision of regular network service between Toronto-London-Windsor and Montreal-Quebec. These installations are now in the course of construction with temporary service having been established since the first of the year between Toronto and London, with subsequent extensions to Kitchener and Hamilton. The permanent installations will, of course, be suitable for both television and general communications. At the present rate at which television stations are coming into existence, it may well be that Mr. Lester's prediction of 3 to 6 years will see the establishment of an all-Canadian coast to coast television network.

The spectacular growth in long distance telephone service in Canada during the past 8 to 10 years as indicated in Mr. Lester's Table I, seems to indicate the excellent organization and working relations of the various independent systems through the Trans-Canada Telephone Association. This, I think, is further exemplified by the long range plans of the association for national and continental operator toll dialing and eventually customer toll dialing.

Certainly it seems that development of telecommunications in Canada is keeping pace with its growth as a great nation of which all of us may well be proud. √

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# Filing for Engineering Departments

The classic department problem of unravelling its filing systems of reference data is solved in many cases by adopting a basic classification system and applying its classification and indexing methods to the file drawer or bookshelf.

The manufacturers' catalogs in a Plant Engineering and Product Design File can be divided into seven and four major product classifications, respectively. The sub-classifications in the plant engineering file total 36; those in the product design file total 23. Yet these simplified ramifications of product data embrace nearly every area of engineering interest.

The detail for general plant engineering departments is as follows:

1. Mechanical Equipment
   a. material handling
   b. vertical transportation
   c. power transmission
   d. pumps and compressors
   e. plate construction, tanks
   f. pipe, fittings, strainers
   g. valves and traps.
   h. instruments and controls
   i. lubrication
   j. finishing
   k. production equipment
   l. miscellaneous equipment and supplies
2. Electrical Equipment
   a. distribution
   b. panelboards, motors, controls
   c. power tubes
3. Materials
   a. metals
   b. glass, plastics
   c. masonry
   d. wood and wood preservatives
   e. roofing and siding
   f. gratings, grids, floor plates
   g. flooring, wall covering
   h. masonry, treatments, waterproofing
   i. paints, finishes, protective coatings
4. Thermal Insulation, Sound Control
   a. thermal insulation, refractories
   b. sound control, vibration isolation
5. Structural Equipment.
   a. structural system
   b. doors and hardware
   c. skylights, ventilators
   d. partitions, fences, guards
6. Plant Utilities
   a. power generation
   b. water conditioning
   c. air conditioning, heating, refrigeration.
   d. lighting
   e. protection
7. Service Equipment, Services
   a. service equipment
   b. services

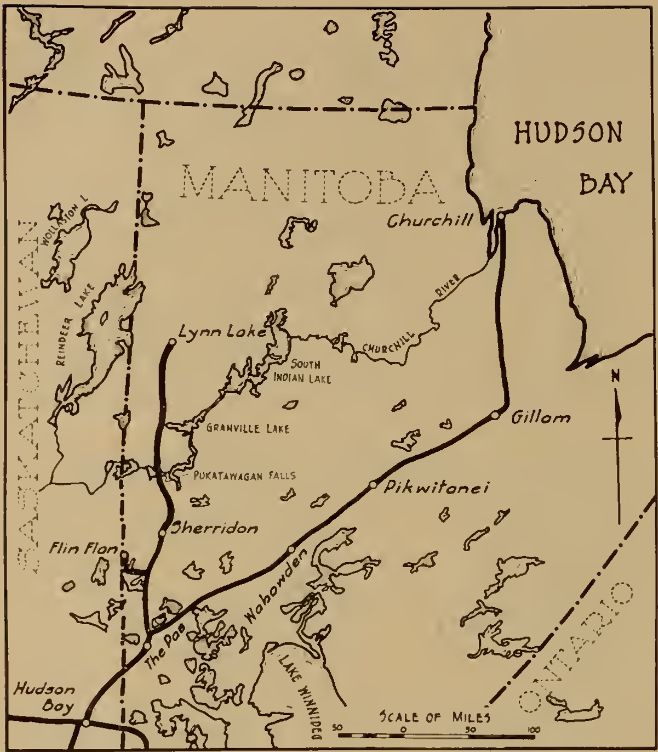
This is the classification for literature of interest to product designers:

1. Materials
   a. metals
   b. metal fabricators
   c. plastics
   d. plastic processors and fabricators
   e. rubber
   f. wood
   g. glass
   h. other materials
2. Electrical Parts
   a. motors and generators
   b. controls
   c. other electrical parts
3. Mechanical Parts
   a. transmission
   b. flexible shafts
   c. bearings
   d. hydraulic and pneumatic equipment
   e. pumps and compressors
   f. fittings and valves
   g. flexible tubing and hose
   h. gaskets, packing and oil seals
   i. instruments and controls
   j. lubricating systems
   k. fastening devices
   l. other mechanical parts
4. Techniques and Services

These classifications are not static and may be easily adjusted to information requirements.

Under each subsection, arrange the literature in alphabetical sequence by manufacturers' names. A convenient fractional indicator to identify each piece of literature consists of three parts: in the numerator, the major section number followed by the subsection letter; in the denominator the first two letters of the manufacturer's name in upper and lower case. This allows discarding of obsolete data without having to revamp the indicators.

Information supplied by Harry W. Smith Incorporated, New York.




# Location and Construction of C.N.R.'s Extension

**Fig. 1. C.N.R. lines in Northern Manitoba.**

The development of Canada has been influenced to a great extent by the engineers who located our railways. They were men having a strong pioneer spirit, who desired to see "what is on the other side of the mountain"; they had the vision and appreciation to open and build up our vast new territories. It was their privilege to work to a great extent on their own personal initiatives.

Location was, and is yet, interesting work. After hard periods of pushing through undeveloped country on foot, there is considerable satisfaction and reward in viewing, from the comfort of a passenger train, the farms and industries which have grown up to make Canada.

### Mining Activities

The depression of 1930 brought railway location to a halt and it became almost a lost art, until renewed mining activities again drew attention to the vast fields of the North.

During 1941, Sherritt-Gordon Mines, Limited, discovered nickel-copper ore at Lynn Lake, but they did not commence active development until 1945. By the fall of 1946 results indicated an ore body of such potential value that it was expected a mine would be brought into production within a few years. For this to be practical, heavy transportation facilities would be necessary and the Canadian National Railways were informed that before long they would probably be requested to construct a railway to the new mine.

Drilling and development works were prosecuted with energy by the Sherritt-Gordon Mine officials, and they established a definite program to bring the new mine into production during October, 1953. As a result of negotiations between the mine and the railway, reconnaissance to select a general route from existing Canadian National Railways was commenced in February, 1951.

Examination of available maps showed the position of Lynn Lake to be Latitude 56° 50′ North, and Longitude 101° 03′ West, 500 miles northwesterly from Winnipeg and 260 miles southwesterly from Port Churchill. (Fig. 1). The nearest existing railhead was at Sherridon.

During summer the only practical means of transportation to Lynn Lake was by aircraft, a distance of 120 miles due north from Sherridon; therefore all heavy materials, equipment and supplies had to be hauled in over a winter tractor trail, 167 miles long, via Pukatawagan and Granville Lake. This winter road also served for the haul of all materials and equipment for construction of the power plant at Laurie River and for erection of the transmission line, approximately 44 miles, to Lynn Lake.

Alternative turnoffs for the proposed railway from existing rail lines were considered—from Flin Flon and from two points on the Hudson Bay Railway, one just north of Wekusko and one south of Thicket Portage.

### The Route

The principal obstacle to be overcome was the crossing of the Churchill River. The Churchill is a typical northern river, having long comparatively level and wide reaches, which are virtually lakes, with narrows and rapids between them; therefore there are few practical bridging sites. Two promising ones were:

(a) Bloodstone Falls and Pukatawagan Falls on an extension from either Flin Flon or Sherridon.

(b) Twin Falls and Granville Falls on a turnoff from the Hudson Bay Railway.

After reconnaissance from aircraft, landing to examine some of the principal features on the ground and study of comparative factors—distance, topography, formation, ruling gradients, rise and fall, curvature, construction costs, maintenance costs and operating features—it was decided to extend the Sherridon Subdivision northerly, crossing the Churchill River at Pukatawagan Falls.

Except for the Indian settlement at Pukatawagan, the territory between Sherridon and Lynn Lake is entirely without habitation. In the summer, ground transportation is confined to canoe routes; unfortunately these were not convenient to the proposed railway route.

Starting from scratch, the time

The Sherridon-Lynn Lake extension of the Canadian National Railways is another example of the railway man following the miner. This 144-mile line was built in about 25 months through rock and muskeg and where surface transportation was impossible except in the winter. This paper, which has been presented before the Lakehead and Winnipeg Branches, gives a brief description of the work, featured by the use of an efficient track laying machine.

# from Sherridon to Lynn Lake


by

J. L. Charles, M.E.I.C.

*Regional Chief Engineer, Canadian National Railways, Western Region, Winnipeg*


available was only 32 months to locate and construct approximately 150 miles of railway from a single base railhead, through virgin country of rock, clay, sand, muskeg and lakes; the percentage of water area is remarkably high. Time was the essence of the project.

### Location Survey

The first step was to carry out a survey to establish a location for the line. As aerial methods, especially photogrammetry, are developed to such a high degree, and as two companies, one Canadian and one American, engaged in aerial surveys, were keen to make a survey, consideration was given to working from the air. However, after consulting the Department of Mines and Technical Surveys and after careful study, it was decided to employ ground survey parties to be aided by observation from aircraft and by examination of aerial photographs in stereoscopic pairs, and also to move camps and to transport supplies by aircraft.

The reasons for this decision were that a ground survey would be necessary to establish both lateral and vertical controls on which to base the photogrammetric contour maps, and then, after projecting the line on these maps it would be necessary to run it on the ground. The only saving in ground work with an aerial survey would be the cost of one topographer and helpers —three men in a party of twenty— and further, it was necessary to commence the work during the winter season. Two parties were employed. All mapping and estimating of quantities and costs were carried out in the field, as the surveys proceeded.

After deciding upon the route by observation from aircraft and by study of aerial photographs, preliminary lines were run and maps plotted (scale 200 ft. to 1 in., with contours at 5-foot intervals)—of the country from 500 to 1,000 feet each side of the line; through the more difficult areas one or more alternative lines were run and compared.

The location was then projected on these maps and run in on the ground. After further study revisions were run where improvements in alignment or reduction in construction costs or both could be effected.

In relation to initial traffic expected, the ruling gradient was established in both directions at 1.75 per cent, compensated for curvature by a reduction of 0.04 per cent per degree. Lighter grades would necessitate either increased distance or heavier grading, either of which would require additional capital investment.

Although there are no great differences in elevation on the line, there are many intermediate valleys and ridges, up to say 200 feet high, mostly solid rock, running in an east-west direction, which cause considerable rise and fall. However, the 1.75 per cent maximum gradient permitted surmounting these obstacles without too much increase in distance.

Comparatively heavy curvature, up to a rate of 15 degrees, was introduced to keep capital cost to a minimum in relation to traffic, maintenance, operating costs and prospective revenues.

In addition to the principal commodities, 90,000 tons of nickel and 15,000 tons of copper concentrates, to be hauled out annually, fish is handled from Reindeer and other large northern lakes and perhaps pulpwood will be cut in this area for outward shipment. Inbound traffic will be all supplies, fuels and equipment required to serve the mine and the town of Lynn Lake and the trading posts in the territory.

However, the location is based upon the principle that, if other new mines are developed as a result of more intensive prospecting further into the North, which will now be possible from the new railhead, and heavier tonnage is to be transported, then betterments—reduction of gradients and curvature —will be practicable.

The length of the line as finally located is 144 miles, which, considering the obstacles of large areas of water, muskeg and rock, is not greatly in excess of the air line distance of 120 miles.

### Muskeg, Permafrost and Solid Rock

By careful location, the percentage of the line on muskeg was kept comparatively low, and, of the total quantities excavated, not more than ten per cent were solid rock. This was favourable both in relation to cost and to time required for completion of the job. It is much better than would be expected from a general reconnaissance of this territory, the formation of which is largely solid rock ridges with muskegs between, excepting northerly from the Chruchill River, where there are some low ridges of sand and fine gravel. The balance of the material is clay, some of which, as is typical of these latitudes, is fine grained and grey in colour and very difficult to handle when wet.

Permafrost occurs at some locations on the line where there is a heavy insulating layer of moss and muskeg, but the percentage of permafrost in the total excavation was not large. However, owing to the short summer season, some of the clay areas are not free of frost until July, and commence to freeze again early in October; to complete the job within the limited time available it was necessary to concentrate more equipment on the job and to excavate more frozen material than would be necessary under normal conditions.

Tenders were advertised for in July, 1951, on a unit price basis for clearing, grading, installation of culverts and timber bridges, also for the concrete substructures for steel bridges, and a contract was awarded in August. Actual grading was commenced September 29, 1951.

### Materials and Supplies

It was then necessary to make preparations to haul from Sherridon by winter tractor road all camps, materials, supplies, fuels and equipment required for 1952 operations, into positions ahead prior to the spring break-up. No omissions could be permitted as, during the summer, there would be no means of correcting mistakes or supplementing supplies except by aircraft.

For clearing the right of way—2,100 acres—power machines were tried out, but owing to the difficulty of piling the debris so that it could be burned, the use of machines was abandoned and this work was let to subcontractors who carried it out by hand.

There are 55 timber bridges on the line. These were all constructed ahead of grading, during winter seasons when materials and pile driving equipment could be moved over frozen ground and swamps from site to site.

Rock drilling was done with drilling machines, wagon drills and jack hammers. Power shovels and draglines ¾ to 1½ cubic yard capacity, carryall scrapers and bulldozers were the principal grading machines used.

Grading quantities of all classifications—solid rock, loose rock, hard pan, permafrost and all other materials—totalled 3,381,000 cu. yd.

### Crossing the Churchill

The crossing of the Churchill River required spanning three channels. There was no delay in obtaining the steel required, through truss spans 201 ft. 4 in.; 155 ft. 10 in. and 201 ft. 4 in. respectively—as a number of such spans had been fabricated in Canada for shipment to the Chinese National Government, but delivery was cancelled and consequently these bridges were available for purchase. (Fig. 2).

Aggregate required for the 964 cu. yd. of concrete in the six abutments was obtained from an island about 10 miles upstream from the crossing and hauled to the sites with trucks over the ice early in 1952; the abutments were built during the following summer.

Normally, steel bridges are hauled by rail to the site after track has been laid to the near bank of the river, but to reduce overall construction time to the minimum, the steel members were hauled from Sherridon to the Churchill River over the winter trail, approximately 70 miles, during the tractor freighting season of 1951-52. This permitted erection of the three spans, during the summer and fall of 1952. Thus when the track was laid to the Churchill River there was no delay in crossing it and in establishing a material yard on the north bank for transfer of bridge and culvert materials, fuels and supplies, etc., from railway cars to sleighs for further haul ahead by tractors during the winter season of 1952-53, as required to complete the grading and bridging between the Churchill River and Lynn Lake by October, 1953.

### "Pioneer" and "Bull Moose"

Track was laid by the railway's own forces, using a self-propelled machine termed the "Pioneer" (Fig. 3). This is a standard flat car, on which two gasoline engines are mounted and geared to the axles. There are also air compressors to operate an overhead crane used to handle rails into place and to operate brakes and a spike hammer. This machine hauls sufficient materials—ties, rails and fastenings—for half a day's work.

The centres of the Pioneer car and of the cars immediately behind it are left clear to allow passage of a forked lift truck, termed the "Bull

Fig. 2. 201 ft. 4 in. through truss crossing north channel of Churchill River.

Fig. 3. Front view of "Pioneer" showing ties rolling forward and rail being lowered into position.

Moose", which is used to haul ties over the decks of the flat cars to the Pioneer, where the ties are placed on a conveyor to roll down to the front and then into position on the roadbed.

The rails are also hauled up by the Bull Moose and then handled by the overhead crane to the front and lowered into position on the ties. Splice bars are half bolted on and rails quarter spiked and the Pioneer moves slowly ahead as the track is laid. One man operates the controls to propel the machine and for the overhead crane to place the rails. Men operating power machines follow the Pioneer to complete spiking and bolting.

The total tracklaying gang did not exceed fifty men; an average of 3,600 feet of track was laid in 10 hours, including travelling to and from the camp cars, etc. If it had been necessary to do so, by working two shifts 1.4 miles of track could have been laid daily. The only work train attendance required was to switch up material at the commencement of the working day and at noon.

#### Trainfilling, Ballasting and a Good Eye

Trainfilling and ballasting, a total of 950,000 cubic yards, were carried out by railway forces. Power shovels of 2 cu. yd. capacity were used for excavation and loading into cars; length of haul was up to 30 miles; unloading was done by use of specially equipped bulldozers, which are run over aprons from car to car as they are unloaded. Power jacks and power tamping machines were operated to place the ballast and surface the track to stakes set to the correct top-of-rail elevation.

The final operation, to line the track to the centre stakes was the only phase of the operation which was done entirely by men, who worked with steel lining bars, and were directed by a foreman with an exceptionally good eye.

Track was laid to the mine plant on October 23, and the first revenue carload of freight—building materials for Sherritt-Gordon Mines, Limited—was delivered to Lynn Lake October 26, 1953, one week ahead of schedule.

Terminal and plant tracks were then laid and the last spike, solid nickel from the mine, was presented by Mr. Eldon Brown, President, Sherritt-Gordon Mines, Limited, to Mr. Donald Gordon, C.M.G., President, Canadian National Railways, and was driven by Mr. Gordon at Lynn Lake on November 9, 1953. This ceremony was followed by the Sherritt-Gordon Mines loading the first car of nickel concentrates for shipment to their refinery at Fort Saskatchewan, near Edmonton, Alberta.

Special covered hopper cars have been provided for the transportation of the nickel concentrates, a very fine powder which must be well protected against the weather. The line is being operated with 1,200 hp. diesel electric locomotives, double-headed; they haul up to 1,600 gross tons per train on the maximum gradients. Three to four round trips weekly are required to handle the present production from the mine, other freight, express and passengers.


#### Acknowledgments

The contract for clearing, grading, installation of culverts and timber bridges, also for the concrete substructures for steel bridges was awarded to C. A. Pitts General Contractor Ltd. and Associates, Toronto; winter hauling from Sherridon to the Churchill River was done by the Patricia Transportation Co., Ltd., and the three spans across the Churchill River were erected by the Dominion Bridge Co., Ltd.

The writer wishes to express his appreciation of the hard work carried out by the men actually on the job, particularly those on the location surveys, under all conditions, summer and winter. √

# The Resistance of Aluminum

to

# Some Alkaline Building Materials


*by*

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EDITOR'S NOTE

The increasing use of aluminum in building construction and the prospect that this will expand in future, raises the question of the action on it of other building materials, especially of those of an alkaline nature. The authors have been experimenting along these lines for the past ten years. This paper presents a description of their work and a summary of their results, which should go far to allay the fears of those who have perhaps had some doubts as to the durability of aluminum.


Aluminum in many forms is being used in increasingly large quantities as an architectural and structural metal. It is used in both urban and rural settings for such building applications as roofing and siding, flashings, window frames and sash, doors, door sills and mouldings, trim of all kinds, store fronts, marquees, copings and parapets, foil vapour barriers and reflective insulation, industrial and domestic duct work, electrical conduit, cables and wiring, nails, rivets and screws and many others. As a structural material, it is used for roof trusses and joists, purlins, girts, transmission towers, substation parts, for many applications in shipbuilding and for bridges of all types.

Many of these uses involve contact of the metal with alkaline building materials such as concrete, brick mortar, stucco and plaster. The literature contains numerous references on this subject (1-6). However, the behaviour of materials is often affected by their origin and it was therefore desirable to test aluminum in contact with building materials available on the Canadian market. A program to acquire this information was initiated at Aluminium Laboratories Limited, Kingston, in 1945, and is still continuing.

### Aluminum in Concrete

***Test Plan***

In the initial project, a number of uncoated tubes of 57S alloy[1] were embedded in small blocks of concrete and exposed to the atmosphere on the roof of the laboratory. Specimen tubes were broken out of the blocks at yearly intervals up to five years. The tubes were cleaned and the amount of corrosion estimated visually and by measurement of the tube diameter with a micrometer.

In the second phase of the experiment, sets of unweighed specimens of 3S sheet and tubing, 50S extruded bar and 65S extruded bar in both the unprotected condition and with three types of coating — clear lacquer, zinc chromate primer and bituminous paint — were partially embedded in blocks of concrete dummy brick walls, stucco and hardwall plaster. These were stored under three conditions: (1) in the atmosphere on the laboratory roof, (2) dry, indoors, (3) immersed in a tank of water within the building (some mortars and plasters excepted). Sets of specimens were removed and cleaned after periods of eight days, six months and eighteen months and examined visually. One group remains for inspection after ten years. (See Figs. 1A, B and C).

In the third section of the experiment, duplicate weighed specimens of 3S sheet were partially embedded in blocks of concrete prepared from portland cement obtained from nine major Canadian cement plants, to check the influence of the source of supply. At the same time, several blocks were made varying the concrete mix, using two brands of cement. In both series duplicate blocks were made and exposed to the weather. After one year the specimens were removed from one set, cleaned and reweighed, while the other set remains on exposure.

***Description of materials***

The nominal composition of the aluminum alloys used, is given in Table 1. The description and source of the ingredients used for the "aluminum in concrete" program is given in Table II.

***57S Tubing in concrete exposed to weather***

6″ lengths of 2″ diameter 57S tubing (wall thickness ⅛″) were embedded to a depth of 4″ in 6″ x 6″ x 5″ blocks of concrete (1:2:4 mix). A number of variables were studied: (a) concrete inside the tube up to the block level, (b) no concrete inside the tube, (c) concrete-tube (outside) interface concave to collect rain, (d) interface convex to shed rain, (e) tubes stoppered, (f) tubes open.

After varying time periods up to five years, specimens were broken out, cleaned, as will be described later, and examined visually. The diameter and wall thicknesses were then checked.

Tubes removed after one, two and

[1]All alloys mentioned in this paper are Alcan alloys produced by the Aluminum Company of Canada, Limited.

**Fig. 1. Alcan 3S, 50S and 65S specimens exposed on the roof of the laboratory embedded in (a) concrete blocks (b) two types of mortar in "dummy brick walls" (c) plaster on "mocked-up" wall sections.**

five years had the same appearance and showed a mild surface etch. There was no measurable loss in thickness of the tube walls. The variables in block type and stoppering had no measurable effect on the results, although, of course, some specimens were etched only on the outside. Figure 2 shows two specimens which were embedded for two and five years respectively.

***3S, 50S, 65S alloys in dry, wet and weathered concrete***

***Preparation of test blocks***

The 3S sheet specimens were 2″ x 6″ x 0.064″. The 3S conduit specimens were 6″ lengths, of 1¼″ I.P.S. The extruded bars of 50S and 65S were 6″ lengths, 1⅛″ by ⅜″ in cross section.

The coatings were applied by dipping. The clear lacquer (Roxalin No. 3455, believed to be a methacrylate type) dried in about an hour and gave an average film thickness of 1.0 mils[2] (range 0.6 — 1.5 mils). The zinc chromate primer dried rapidly with a film thickness of about 2.3 mils (range 1.8 — 2.6 mils). The bituminous coatings dried to the touch in about an hour, but remained soft for as long as a week. The film thickness was approximately 5 mils.

Batches of concrete (1:3:3 mix) were prepared in a small 4 cu. ft. power-driven mixer, holding the water-cement ratio to a maximum of 0.60. The concrete was poured into 9″ x 9″ x 6″ forms and the specimens inserted to a depth of 4″, separated from each other and from the edges of the block by about 2″. Four specimens, one of each alloy type, were embedded in each block, all either unprotected or with a given coating.

A set of blocks for one time period was prepared with concrete containing calcium chloride[3] to the amount of 2 per cent of the cement content or 125 grams per block.

After pouring, the blocks were kept moist for a week; some were then placed in the weather, some in a dry location in the basement while another group was immersed in a tank of water which was changed at monthly intervals.

At the end of the test period the blocks were broken up with hammer and cold chisel and the specimens removed. The coatings were removed by suspending the specimens in trichlorethylene vapor. The specimens were then treated in an inhibited acid bath (A.S.T.M. B137-45) to remove residual concrete film. Light scrubbing with soap-impregnated steel wool pads (S.O.S.) completed the cleaning treatment.

**Observations**

***General***

For the first thirty minutes, until

[2] 1 mil = 0.001 in.

[3] The chloride was added as it is sometimes used in cold weather to accelerate setting and to depress the freezing point of the concrete slightly. Its advantages are doubtful, but it was tried because it represents a condition sometimes found in practice.

**Table I—Nominal Composition of Aluminum Alloys Tested**

| Alcan Alloy | Form | Per cent | | | | | |
|---|---|---|---|---|---|---|---|
| | | Cu | Fe | Mg | Mn | Si | Cr |
| 57S-H | Tubing, 2-1/8″ x 1/8″ | — | 0.20 | 0.25 | — | 0.10 | 0.25 |
| 3S-1/2H | Sheet, thickness 0.064″ | — | 0.40 | — | 1.20 | 0.25 | — |
| 3S-F | Conduit 1¼″ I.P.S. | — | 0.40 | — | 1.20 | 0.25 | — |
| 50S-A33 | Extruded bar 1-1/8″ x 3/8″ | — | 0.30 | 0.65 | — | 0.40 | |
| 65S-T | Extruded bar 1-1/8″ x 3/8″ | 0.30 | 0.35 | 0.95 | — | 0.60 | 0.25 |

The description and source of the ingredients used for the "aluminum in concrete" program is given in Table II.

**Table II—Materials for Concrete Mixes and Their Origin**

| Material | Origin; Company and Specific Plant |
|---|---|
| Standard portland cement | Canada Cement Co., Montreal, Quebec. |
| High early strength cement | Canada Cement Co., Montreal, Quebec. |
| Standard portland cement | Canada Cement Co., Hull, Quebec. |
| Standard portland cement | Canada Cement Co., Belleville, Ontario. |
| Kali-crete cement | Canada Cement Co., Port Colborne, Ontario. |
| Standard portland cement | Canada Cement Co., Port Colborne, Ontario. |
| Kali-crete cement | Canada Cement Co., Fort Whyte, Manitoba. |
| Standard portland cement | Canada Cement Co., Fort Whyte, Manitoba. |
| Standard portland cement | Canada Cement Co., Exshaw, Alberta. |
| Medusa white portland cement | Medusa Products Company, Paris, Ontario. |
| Portland cement | British Columbia Cement Co., Victoria, B.C. |
| Portland cement | St. Mary's Cement Co., St. Mary's, Ontario. |
| Dry sand (—8 mesh) | Kingston Sand & Gravel Co., Kingston, Ontario. |
| Crushed limestone (1″ size) | Frontenac Quarries, Ltd., Kingston, Ontario. |

the concrete began to solidify, bubbles of hydrogen gas were noticed emerging from the concrete around the bare aluminum specimens; this was taken as evidence of attack. No gas was evolved from the coated specimens.

*After eight days*

This set included only four blocks which were exposed outdoors. None of these blocks cracked. The lacquered specimens removed from the blocks were practically unaffected, as was also the case with the bituminous coated specimens. Some of the zinc chromate primed specimens showed patches of superficial etching, while the bare samples showed general etching.

*After six months*

This set included twelve blocks. Before the six months were up, the blocks on the roof showed a tendency to crack, with the cracks radiating from the specimens. The cracking was not influenced by the coatings. However, the blocks stored in the basement, both dry and under water, did not develop cracks in the same period. This strongly suggests that cracking in the atmosphere was due to temperature changes and the difference in coefficients of expansion of aluminum and concrete.

The specimens from blocks stored indoors were almost completely unaffected and the amount of superficial corrosion was no more than those examined after eight days. The specimens from blocks exposed outdoors showed slightly more corrosion, but it was still of a superficial nature. On all specimens, except those with the bituminous coating, which were unaffected, there was a thin adherent coating of hard scale. In the case of the sheet specimens, the coating spalled off when they were flexed and, in all cases, the scale was readily removed by abrasion with wire brush and steel wool. After separation of the scale from the specimens, it was found to be relatively insoluble in warm concentrated nitric acid and in sodium hydroxide. The cleaned specimens showed no loss of thickness.

The appearance of specimens taken from blocks stored in water were similar to that of the preceding group, although there was more of the adherent scale. The bare samples showed the most corrosion, but even these had received only a superficial etching and, again, there was no measurable thinning. Among the coatings, the zinc chromate primer had given the least protection and had led to a patchy distribution of superficial etching. The lacquer had not given full protection, but the bituminous coatings gave almost complete protection. There was no difference in behaviour among the three alloys and no measurable loss of thickness in any of the specimens.

*After eighteen months*

This set included 16 blocks, four of which had added calcium chloride. In general, these specimens were similar to those exposed for six months, and there was little evidence of continued corrosion. There was still no measurable loss of thickness in any of the specimens.

Again, there was no difference in behaviour among the alloys. The bituminous coatings gave almost

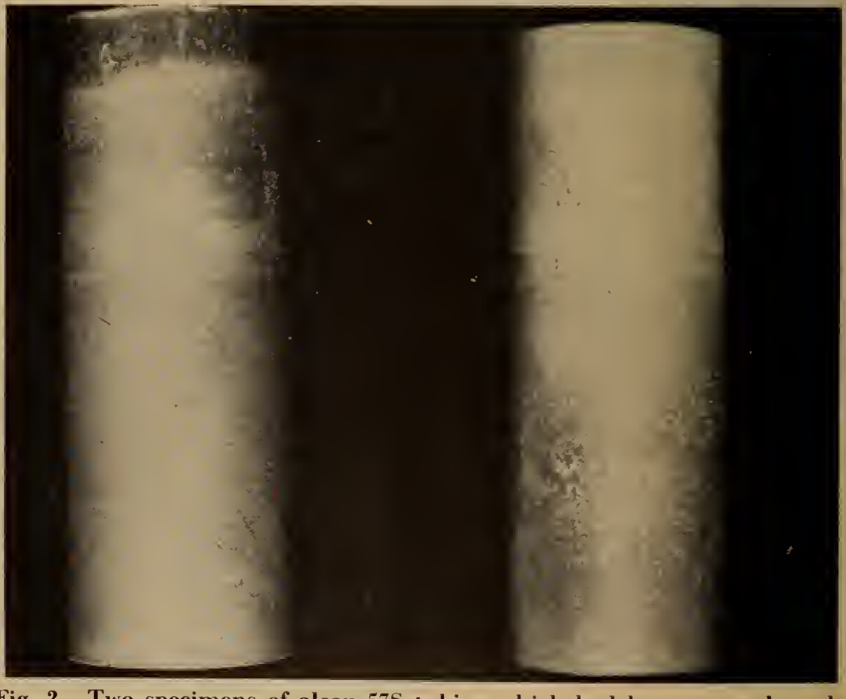

Fig. 2. Two specimens of alcan 57S tubing which had been exposed to the atmosphere while embedded in concrete for (a) 2 years (b) 5 years. Note only light superficial etching.

complete protection, even under water, and the metal surface beneath was smooth and shiny. The lacquer gave less protection under wet conditions, but was fairly satisfactory on the dry and atmospheric specimens. As before, the zinc chromate primed specimens were etched in patches, to a depth greater than with the bare specimens.

The atmospheric specimens from concrete with added calcium chloride were not corroded any more severely than those from the standard mix.

Figure 3 shows the most corroded 3S sheet specimens removed from the submerged blocks. These are typical of the group and show only mild attack.

***Weighed 3S Sheet in different concretes in weather***

***Preparation of test blocks***

For the experiments to determine the effect of the source of cement and variation of cement mixes, two blocks measuring 6″ x 6″ x 6″ were made up with each of twelve bags of cement, the sources of which are listed in Table II. The mix used was 1:3:3, with the water-cement ratio 0.60. The concrete was mixed by hand. Duplicate 2″ x 6″ degreased and weighed aluminum specimens were embedded in each block and the blocks were exposed to the atmosphere on the roof of the laboratory. Also, using standard portland cement from two sources, that from two blocks were made up as above, using each of the following mixes: 1:3:3, 1:3:5, 1:2:4, 1:1:2 and 1:3:0. Sheet specimens measuring 2″ x 6″ which had been degreased and weighed, were embedded in each block and the blocks were then exposed on the laboratory roof.

**Observations**

***General***

Cracks were noticed in some of the blocks within a week of pouring and even before they had been placed on the roof for atmospheric exposure. Duplicate blocks in each set behaved the same way so far as this tendency to cracking is concerned. A typical cracked block is shown in Figure 4. At the end of a year, those blocks which had cracked within a week were much more severely cracked; those which had not cracked on exposure, after a week indoors while kept wet, were either unaffected or showed only hairline cracks.

Table III shows the weight losses of the 3S specimens after one year in 1:3:3 concrete.

In all cases corrosion took the form of a uniform surface etch.

**Table III—Weight Losses After One Year of Aluminum in 1:3:3 Mixes Using Cement from Main Sources in Canada**

| Source | Type | Condition of block | | Weight losses (gm) | | | Calculated loss of thickness (mils per side) |
|---|---|---|---|---|---|---|---|
| | | When exposed | After exposure | 1 | 2 | Av. | |
| Canada cement: | Portland | | | | | | |
| Hull, Que. | ,, | NC | NC | 0.83 | 0.92 | 0.88 | 1.0 |
| Belleville, Ont. | ,, | C | C | 3.23 | 3.58 | 3.40 | 4.0 |
| Exshaw, Alta. | ,, | NC | NC | 0.47 | 0.51 | 0.49 | 0.6 |
| Montreal, Que. | ,, | C | C | 2.23 | 1.83 | 2.03 | 2.4 |
| Port Colborne, Ont. | ,, | NC | NC | 0.57 | 0.63 | 0.60 | 0.7 |
| Fort Whyte, Man. | ,, | NC | NC | 0.75 | 0.58 | 0.64 | 0.7 |
| St. Mary's cement | | | | | | | |
| St. Mary's, Ont. | ,, | NC | NC | 1.46 | 1.10 | 1.28 | 1.5 |
| Medusa cement: | | | | | | | |
| Paris, Ont. | ,, | NC | NC | 0.34 | 0.33 | 0.34 | 0.4 |
| British Columbia cement: | | | | | | | |
| Victoria, B.C. | ,, | HLC | C | 1.32 | 1.19 | 1.25 | 1.5 |
| Canada cement: | | | | | | | |
| Fort Whyte, Man., | High early Strength | NC | NC | 0.42 | 0.38 | 0.40 | 0.5 |
| Montreal, Que. | ,, | NC | C | 1.21 | 1.46 | 1.33 | 1.5 |
| Port Colborne, Ont. | ,, | NC | NC | 0.50 | 0.50 | 0.50 | 0.6 |

C—Cracked NC—Not Cracked HLC—Hairline Cracks

*Loss of thickness calculated rather than measured because the corrosion was of the superficial etching or pitting type.

**Table IV—Weight Losses After One Year of Aluminum Specimens in Different Concrete Mixes**

| Source | Type | Mix | Condition | | Weight losses (gm) | | | Calculated loss of thickness (mils per side) |
|---|---|---|---|---|---|---|---|---|
| | | | Before exposure | After exposure | 1 | 2 | Av. | |
| Canada cement, Montreal | Portland | 1:3:0 | C | C | 4.20 | 3.42 | 3.81 | 4.4 |
| | | 1:1:2 | C | C | 3.26 | 4.05 | 3.65 | 4.2 |
| | | 1:3:3 | C | C | 2.23 | 1.83 | 2.03 | 2.4 |
| | | 1:2:4 | NC | C | 1.58 | 1.73 | 1.65 | 1.9 |
| | | 1:3:5 | NC | NC | 1.00 | 1.12 | 1.06 | 1.2 |
| St. Mary's Cement | Portland | 1:3:0 | C | C | 3.40 | 2.07 | 2.73 | 3.2 |
| | | 1:1:2 | C | C | 1.79 | 1.62 | 1.70 | 2.0 |
| | | 1:3:3 | NC | C | 1.49 | 1.11 | 1.28 | 1.51 |
| | | 1:2:4 | NC | NC | 1.03 | 1.10 | 1.06 | 1.2 |
| | | 1:3:5 | NC | NC | 0.65 | 0.67 | 0.66 | 0.8 |

C—Cracked NC—Not Cracked

*Loss of thickness calculated rather than measured because the corrosion was of the superficial etching or pitting type.

**Table V—Description of Building Materials Used**

| Material | Origin; Company and specific plant | Remarks |
|---|---|---|
| Lime | Gypsum Lime & Alabastine Company of Canada, Ltd., Paris, Ont. | Green Stripe finishing lime |
| Plaster | Gpsum Lime & Alabastine Company of Canada, Ltd., Paris, Ont | Paristone hardwall plaster |
| Gyproc lath | Gypsum Lime & Alabastine Company of Canada, Ltd., Paris, Ont. | Standard building lath |
| Metal lath | ——— | 24-gauge, diamond mesh, galvanized steel. |

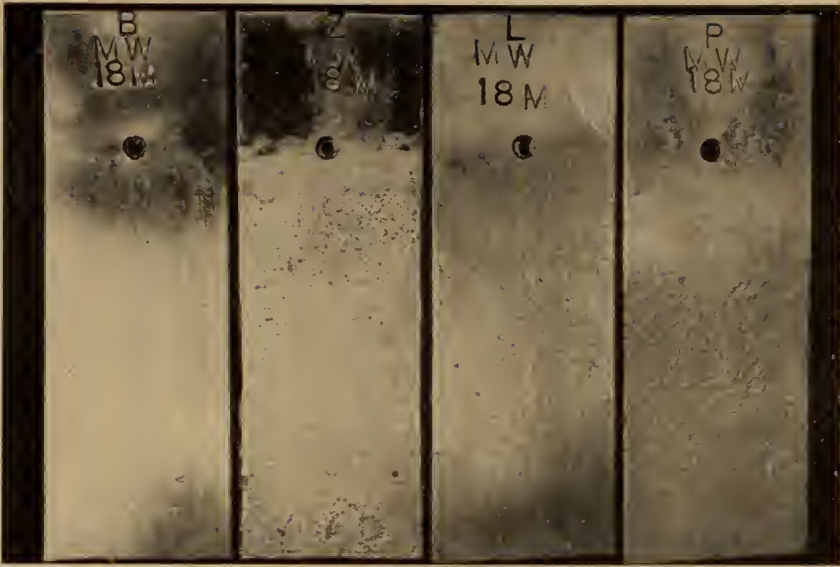

**Fig. 3. Alcan 3S sheet specimens removed from concrete blocks submerged 18 months. These are typical of the group. Note B=Bare; Z=zinc chromate; L=lacquer; P=bituminous paint.**

There was good agreement between the duplicate specimens. A relationship was apparent between the tendency to crack and the amount of corrosion.

Table IV shows the weight losses for the different concrete mixes with two brands of cement.

It is apparent that the amount of corrosion increases with the richness of the mix, but even the maximum loss (4.2 grams for 1:3:0 mix) is equivalent to a thickness loss per side of only 4.4 mils. If the metal cross section is adequate, this can be tolerated since attack occurs mainly during setting and further corrosion is slow, as shown in the preceding sections.

### Aluminum in Brick Mortars, Stucco and Plasters

***Test plan***

This work was done at the same time as the second concrete series and involved the same alloys (3S sheet and conduit and 50S and 65S extruded rod), and the same coatings (clear lacquer, zinc chromate primer and bituminous paint).

Bare and coated specimens were embedded in standard portland cement brick mortar and in lime brick mortar in small dummy sections of brick walls. Wall sections were exposed on the roof and in the basement, some dry and some immersed in water. At intervals of eight days, six months and eighteen months, sets of specimens were broken out, cleaned and examined visually for corrosion. Thickness measurements were also made.

Similar specimens were embedded in a wall section of portland cement stucco, built upon metal lath, both exposed on the roof and stored dry in the basement. Sets were examined at the same time intervals as above.

Other bare and coated specimens were embedded in a wall section of hardwall plaster built upon Gyproc lath. These were stored dry in the basement and sets examined after the same time intervals.

***Description of materials***

The aluminum alloys and specimens have already been described in the section describing the experiments with concrete.

The additional building materials are described in Table V.

Brick mortars:

Two types of brick mortar were investigated:

(a) Lime brick mortar, made as follows:
  - Lime putty, 1 part by volume.
  - Sand, dry, passing No. 8 mesh, 3 parts by volume.
  - Water, to suit.

(b) Standard brick mortar, made as follows:
  - Standard portland cement, 1 part by volume.
  - Hydrated lime putty, 1 part by volume.
  - Sand, dry, passing No. 8 mesh, 6 parts by volume.
  - Water, to suit.

The lime putty was made up one or more days in advance. Lime brick mortar contains no cement and is used less frequently than in the past. It is said that the setting time is a matter of months for midsections of masonry using this mortar.

Standard brick mortar is used extensively for present day construction and as the recipe indicates, contains cement. The setting time is

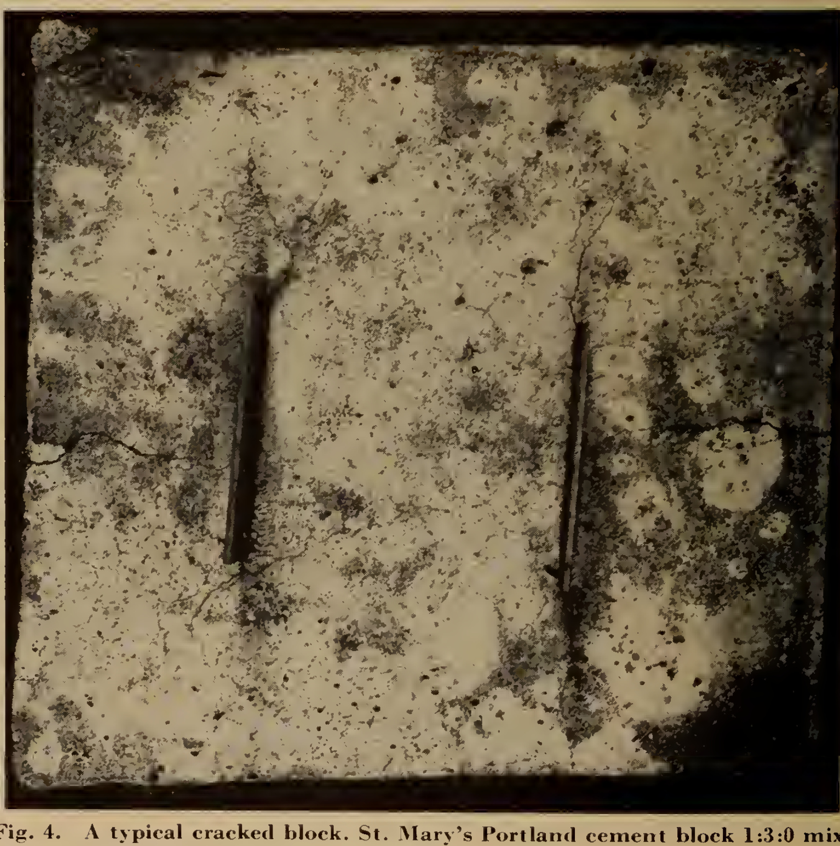

**Fig. 4. A typical cracked block. St. Mary's Portland cement block 1:3:0 mix.**

shorter and the compressive strength is greater than for lime mortar. The quick setting time makes it necessary to add the cement to the lime putty just before use.

Brick piers were made four bricks high, four bricks long and two bricks thick, as shown in Figure 1B. The piers were covered by forming a sheet of aluminum into a suitable flashing. Each pier contained 16 specimens consisting of a bare, a lacquered, a zinc chromate and a bitumen coated specimen of each of the four test materials — 3S sheet, 3S conduit, 50S bar and 65S bar. It was necessary to chip the brick to set the conduit in the mortar in the pier. All specimens passed through the pier.

One pier was made of standard brick mortar with 250 grams of calcium chloride, approximately 2 per cent of the cement content by weight, added and exposed on the roof. It was broken open after six months to determine whether the calcium chloride had had any harmful effect. This was also done with a similar pier for an eighteen-month period.

#### Observations

After eight days, a standard mortar brick pier was broken open. The bare specimens had suffered slight uniform corrosion, but the coated specimens were practically unaffected.

After six months, three more piers were broken up, one of which had been exposed on the roof, one in water and one in a dry indoor location. No cracks were noticed in the mortar prior to breaking the piers. The specimens from the pier on the roof and in the dry location were much like the eight-day specimens already described. The bare specimens were slightly more corroded, while the coated specimens were in excellent condition.

The specimens from the pier stored in water were much like the specimens from concrete stored under water. The marked superiority of the bituminous coating could be seen. The 3S sheet specimens looked slightly worse than the other alloy specimens, but once again the attack was considered superficial.

The various specimens removed from the standard brick mortar after eighteen months were remarkably similar to those removed after six months, for locations in the dry, in atmospheric exposure and under water. Standard brick mortar showed approximately the same degree of corrosive action as concrete; however, no serious corrosion occurred, as will be seen from Figure 5, which shows the 3S conduit specimens removed from the pier which had been immersed for the 18-month period in water. It will be noticed that the bituminous coatings offered effective protection, and also that the zinc chromate coated specimen was pitted, rather than uniformly corroded, as was the bare specimen. At 18 months, the lacquer on the various lacquered specimens was flaking seriously, and this coating is not considered effective protection after 18 months.

Specimens from piers containing calcium chloride, showed no more corrosive effect than was apparent at the same time period without this additive.

When the specimens were removed from the lime brick mortar pier after eight days, it was found that the coated specimens were unaffected and that the bare specimens were slightly etched in places. The general appearance was better than that of specimens from the standard mortar piers.

After six months, similar piers from the roof and the basement (dry) were broken open. The roof pier was already badly cracked in many places, but the pier from the basement was in good condition. All specimens were in good condition; the lacquered and bituminous coated specimens were unaffected.

The 18-month lime mortar specimens, removed from piers stored in the basement and under atmospheric conditions, were similar to the standard mortar specimens exposed under the same conditions, although on the whole, the attack was somewhat less. Figure 6 shows the 50S-A33 specimen from the dry block and demonstrates the effectiveness of bituminous paint in preventing corrosion. Note that the bare specimen was uniformly corroded, whereas the lacquered and zinc chromate coated specimens were protected over some areas by the coatings.

#### Wall plaster and stucco:

Two types of plaster were investigated:

(1) Hardwall plaster such as is used on walls and ceilings of rooms in houses where conditions are not damp, made up as follows:
    Hardwall plaster, 1 part by weight.
    Plastering sand, dry, screened through fly screen (16 mesh) — 1st coat, 2 parts by weight. 2nd coat, 3 parts by weight.
    Water, as required.

(2) Portland cement plaster such as that used for exterior stucco and for damp locations, as in basements, made up as follows:
    Standard portland cement, 1 part by volume.
    Plastering sand, 3 parts by volume.
    Hydrated lime putty, 10

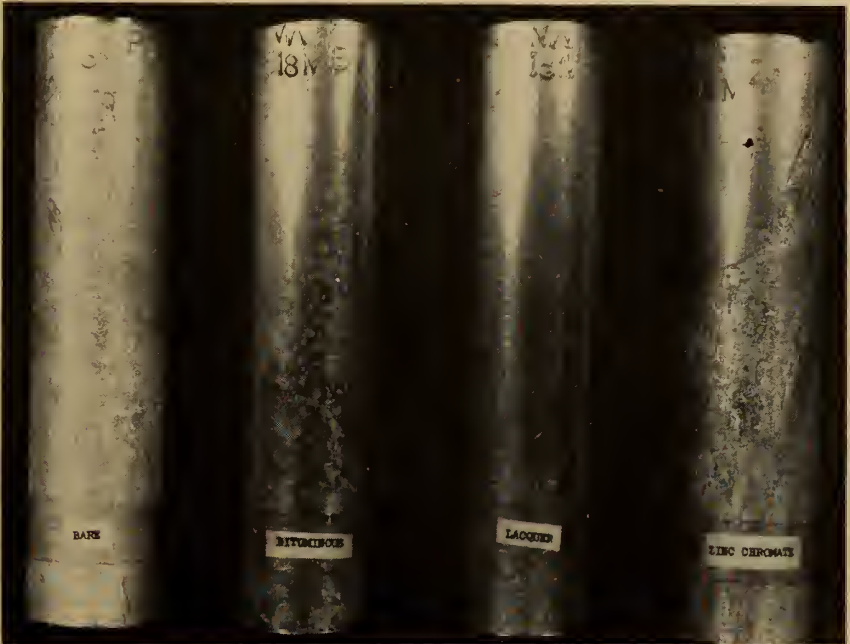


**Fig. 5. Alcan 3S conduit specimens removed from standard brick mortar pier submerged 18 months.**

per cent by weight of cement.

Water, as required.

For the hardwall plaster tests, frames about 36″ wide x 48″ high were made up of 2″ x 4″ scantlings placed at 16″ centres. Both sides of this frame were covered with Gyproc lath and the frames were edged with a ¾″ beading strip to provide a stop for the plaster around the perimeter. The specimens were embedded in such a way that they ran through the plaster on the frame, with approximately ¾″ in contact with the plaster.

The portland cement plaster (stucco) wall sections were made up in a similar way to the hardwall plaster frames, except that they were 48″ x 48″, with 16″ between centres of the uprights, and that these frames were covered with 24-gauge diamond mesh galvanized steel lath. (See Figure 1C.)

**Observations**

At the end of eight days, this group of specimens was removed from the hardwall and portland plaster frames on the roof and from the hardwall plaster frame stored in the basement. The eight-day specimens showed no corrosion whatever, except on the bare specimens which had been embedded in the portland cement plaster and left outdoors. With the 18-month specimens, both for hardwall and portland plaster, no corrosion was apparent except in the case of portland plaster specimens exposed to the atmosphere. These showed some slight superficial corrosion over the ¾″ band which had been in direct contact with the plaster. (See Figure 7.)

Notice the mild etch attack on the bare specimen. The bituminous coating offered good protection to this specimen, but the lacquered coating offered only partial protection. The zinc chromate coating offered little protection and thus some pitting occurred in the affected area.


**Fig. 7. Alcan 3S sheet specimens removed from a portland plaster (stucco) wall section exposed outdoors for 18 months. Notice only slight superficial attack confined to the ¾″ band of contact with the stucco.**

Aluminum nails were used in one frame to fasten the metal lath to the frame work. Part of the shank was bent over with the result that approximately ½″ of the shank and the head were embedded in Portland plaster. Upon removal of these nails, it was observed that although some slight superficial attack had taken place, the nails were essentially in good condition.

Keene's cement — Since Keene's cement is a frequently used building product, a brief test with this product was carried out, even though it is acid in reaction. A complete set of specimens was placed in neat Keene's cement in an 8″ x 10″ porcelain tray. The fast-drying cement set in a few minutes and the tray was stored in a dry location for six months. At the end of this period, the specimens were in absolutely perfect condition in every case.


**Fig. 6. 50S-A33 specimens from the dry lime brick mortar pier after 18 months. Note the effectiveness of the bituminous paint coating.**

**Discussion**

The results of these experiments indicate that:

(1) Aluminum alloys are not seriously corroded by contact with concrete, standard brick-mortar, lime brick-mortar, hardwall plaster and stucco over extended periods. Slight, superficial etching takes place during the period when concretes, mortars, plasters or stucco are setting; unless there is frequent intermittent wetting and drying, no appreciable corrosion takes place. The amount of attack is not sufficiently great to cause deterioration in the properties of the aluminum in other than thin sections.

(2) Even under continuously wet conditions, aluminum alloys embedded in concrete are only slightly attacked.

(3) Increasing the cement content of concretes (enriching the mix), increases the amount of attack[4]. The relative corrosive action of common Canadian alkaline building materials to aluminum, in decreasing order, is as follows: concrete, standard brick-mortar[5], lime brick-mortar, stucco, hardwall plasters.

(4) All the aluminum alloys tested (Alcan 3S, 50S, 65S, 57S) perform similarly.

(5) The effectiveness of a single coat of bituminous paint in preventing corrosion of aluminum embedded in various building materials has been well demonstrated by its consistently good performance over the various time periods tested in this program. Clear lacquer is less protective. Thus, where aluminum may be in contact with damp concrete or mortar, or with intermittently wet and dry alkaline materials of this type, it is recommended practice to paint the contact surfaces with bituminous paints.

(6) Calcium chloride additions to concrete mixes do not cause an increase in the corrosion rate. However, some work recently completed, indicates that if stray electric currents are present, corrosion may be greatly increased. Also, where aluminum is embedded in concrete containing calcium chloride and is in contact with steel similarly embedded in concrete, appreciable

[4]Also, depending on the origin of the cement, the free alkali content may vary slightly; the amount of attack would then vary in direct proportion.

[5]Actually, concrete and standard brick-mortar show approximately the same degree of corrosivity toward aluminum.

(*Continued on page 1260*)

# The National Significance of Two Decades of Engineering Research in Canada

*by*

Dr. C. J. Mackenzie, Hon.M.E.I.C.
*President*
*Atomic Energy Control Board*

**The following address was delivered at a meeting held at the Institution of Mechanical Engineers, London, on Wednesday, June 2, 1954 by Dr. Mackenzie who had the same day been presented with the Kelvin Medal by Field Marshal the Right Honourable Earl Alexander of Tunis, K.G., G.C.B., G.C.M.G., G.S.I., D.S.O., M.C., on behalf of the Councils of the institutions participating in the award. Dr. R. W. Bailey, president of the Institution of Mechanical Engineers, was in the chair.**

**Dr. Mackenzie was the banquet speaker at the annual meeting of the Engineering Institute in Quebec in May 1954. His subject at that time was the same as that used in his London address. It was agreed between the two organizations that the same manuscript would be used in both publications.**

In Canada, as elsewhere, there has been notable progress in recent years in the art of engineering in all its many phases, but it is of the science and not of the art that I wish to speak this evening. Further, I shall not talk of scientific matters in detail, but of what the intensification of the scientific base of Canadian engineering has meant to our national industrial economy and outlook.

Since the end of the 1939-45 war we in Canada have been almost embarrassed by the many favourable comments which have come from Britain and elsewhere about our progress, our resources and our prospects. Certain present and indisputable facts can be marshalled, but what these facts really mean for the future is, of course, the important question. Does the present undoubted prosperity of Canada rest on the shifting sands of an ephemeral post-war boom, or does it represent real progress of a permanent character based on a firm foundation? These are the questions which we in Canada have been asking ourselves very seriously.

My thesis this evening is that great and fundamental changes have taken place over twenty-five years quietly and without the sounding of trumpets, and that they have changed the basic industrial and economic structure of our country and laid a sound basis for steady and permanent growth, and that, as a consequence, Canada is now entering a period of normal and healthy expansion and not facing collapse due to an unstable post-war boom.

Before outlining in detail some of the things which have been happening I should like to tell you a true story, which I think dramatizes in a general way what has occurred. I shall go back to one of the real crises of the 1914-18 war. It had to do with one of the many critical shortages which occurred, the munitions shortage in France in 1914-15. The demands for cordite could not be met, and the situation was desperate. One of the most urgently needed chemicals was acetone. In the search for new sources, Lloyd George heard of the work of a quiet, modest research professor of chemistry at Manchester, who in an attempt to make butadiene had found a fermentation method by which, unfortunately, (as he saw it) there was also produced acetone in quantity. The professor's failure was great news for Lloyd George, who wanted

Dr. C. J. Mackenzie, Hon.M.E.I.C.

acetone above all things. He immediately got in touch with the professor, pilot plants were initiated, and before long plants were being built in the United Kingdom, in Canada, and, later in the war, in the United States; but it is not unfair to say that the most successful plant was that in Toronto, Canada. It was successful because it was well operated and because the plants in Britain could not afford to bring grain across the ocean to make acetone, whereas we had the grain for making it to hand in Canada. The fact that the professor, Chaim Weizmann, 30 years later, became the first President of Israel may not be purely coincidental, but neither has it anything to do with my central theme this afternoon.

What I wish to point out is what happened at the end of World War I. In Canada, the operations ceased immediately. We dismantled our plant and the doors were closed; but in the United States the similar plants were not dismantled but became the nucleus of a great industrial development on the American continent. The 'surplus' butyl alcohol became the raw material of the nitro-cellulose industry, which grew very rapidly and parallel with the growth of the motor industry.

What happened in the case of the acetone factory in Canada happened also with our aircraft, chemical and the other war industries. We just stopped. My point is that the opportunities were there and the United States seized them; but Canada, the country to whom this twentieth century was to belong (in the words of a famous politician), was not scientifically ready in 1918.

Now to 1940, another world war and again shortages of which rubber was one of the most critical. Incidentally, one of the key components of artificial rubber was the same butadiene that Weizmann had been looking for in 1914 when he discovered a new method of making acetone. It is interesting to speculate that Weizmann in England might have developed artificial rubber twenty years before the Germans did, had he not been deflected from his research. That is a not uncommon experience in Britain, where great fundamental researches have paid handsome dividends in other countries.

But what did Canada do about this shortage in 1940? Again in cooperation with her allies, she built and put into operation with speed and efficiency a most intricate artificial rubber plant, based on scientific technique which we formerly thought was practicable only in research laboratories. The significant difference, however, is that at the end of the 1939-45 war this factory was not dismantled as was the acetone plant in 1918 but was kept going, and today is one of the essential components of a young, rapidly growing and vital chemical industry, which is so essential to any country.

Again I have used this story of our artificial rubber factory not because of its special importance, though it is important, but to illustrate what happened to most of our war and other plants and to indicate the significant changes which have taken place, in the scientific approach and outlook of our engineers and industrialists.

The question is, how did this change come about? What was the fundamental difference between Canada in 1918 and Canada in 1945 which accounted for this change in procedure and outlook? In 1918 we did have enterprising industrialists and reasonable skills, judged not on a 1945 basis but on a 1918 basis. We had no dearth of industrial resources. We had a few research scientists in the universities, and ten years before 1918 had one of the first aeronautical research associations in the world operating in Nova Scotia, where the first aeroplane flight in the British Empire was made. We had plenty of competent and resourceful design and construction and operating engineers, but we had very few real applied scientists and development engineers. There was no definite public recognition of the vital national need for co-ordinated and vigorous research. In 1918 we were still 'Colonial minded' in the realm of applied science.

In 1945 the situation was very different. By 1939 we had created a sizable corps of highly qualified and experienced research scientists and scientific engineers. We had strengthened immeasurably all our Government establishments and our universities and our industries everywhere had become interested in the application of science. We had resources of men of experience and competence to organize quickly extensive research and scientific services for our industries, without which no such operations can remain permanently successful. In addition, however, there had developed by 1945 a strong public conviction that Canada's economic future must rest on a strong and progressive Canadian applied science and technology. These changes in outlook and potential may seem to have appeared suddenly, but in fact the results apparent today are based on the unspectacular work of twenty years, during which our fundamental scientific forces and facilities have been slowly but soundly built up.

Before outlining how that scientific build-up developed, I should like to give you a more general picture by mentioning a few facts which will help to illustrate broadly the recent economic and industrial growth of Canada. Since 1939 our population has increased from 11 million to 15 million, or by about 35 per cent in 15 years, which is well above the average but not really spectacular. During the same period, however, our national income and output have increased, in terms of constant 1939 dollars (I am not using inflated figures), by over 150 per cent. To put that in another way, our national income per head of population is about twice as great today as it was before the war, which means that our 1954 population, man for man, is producing in goods and services approximately twice as much as in 1939. That, I think, is very significant in terms of effective productivity and on the standard of living. Our Government revenues and expenditures have also doubled, as measured in constant dollars, but our scientific research expenditures—and I want to emphasize this point—have increased fourfold. The value of our foreign trade in 1953 was also four times what it was in 1939, and today Canada, with her relatively small population of 15 million, less than 0.5 per cent of the world population, has a volume of import and export trade exceeded only by that of Britain and of the United States.

Since the 1939-45 war Canada has been able to operate on a balanced budget. Our national debt has been decreased by over 15 per cent, and when all the controls on our currency were removed the Canadian dollar rose *vis-a-vis* the United States dollar and now stands at a premium of two or three per cent. All these things are indisputable and, I think, significant facts. It is also true that since the 1939-45 war a great deal of capital from Britain and from the United States has sought profitable investment in Canadian enterprizes which is the surest indication that many people of experience throughout the world believe that Canada has a sound and attractive future. That Canadians share this confidence is evidenced by the fact that the extraordinarily large capital investments made in Canada during the past decade have come in the main from Canadian and not from foreign sources; 86 per cent of all the capital investment in Canada in the last few years has come from Canadian sources, and only 14 per cent has come from the outside world. At the same time, the Canadian people have invested more than 14 per cent in other countries.

All this makes for confidence in the soundness of our economic position, but it does not explain what has happened to bring about this situation. I do not, of course, suggest that there is any one answer or reason to account for what has happened; national development is far more complex than that, and there are many factors. Current events and a measure of good luck have all played a part. We hear a great deal about Canada's recently discovered and abundant natural resources, and that picture is impressive. It seems reasonably clear that in Western Canada there will be found oil reserves comparable with those of Texas, and in the vast pre-Cambrian Shield there are indications of great reserves of nickel, copper, zinc, titanium, and asbestos, to say nothing of uranium, and that is very important in a world where the reserves are dwindling very rapidly in relation to the demand.

The point is, however, that Canada has always had rich resources, and has known of them for a long time. While the oil and iron deposits have only recently been proved we always believed that they would be found. Great as these resources are, they do not dwarf or equal our great agricultural resources, our existing mining industries, our hydro-electric power or our forest industry of lumber, pulp and paper. We have had all these things for many years, so that our natural resources, while they are a major asset, have not just been discovered, and the reason for Canadian prosperity is not primarily the recent discovery of oil and iron. Many other factors, national and international, have played major roles, only a few of which I can mention.

Canada's history has been greatly influenced by world events and the actions of other people. The 1914-18 war made Canada conscious nationally in the military, diplomatic and international sense and had a profound effect on our industrial and financial economy. It contributed little, however, towards the development of an indigenous, scientifically-based secondary industry. In Canada the years between 1919 and 1939 saw the growth of a quite considerable amount of secondary industry, but, with the significantly important exceptions based on exploitation of our hydro-electric resources and forestry, it was largely a growth of branch factories. The basic activities of research, development, design and direction were done elsewhere, outside our borders, in the United States or the United Kingdom.

Between 1919 and 1939, however, a very important thing happened which had a far-reaching effect: the slow, gradual but sure building up across Canada of research facilities and the training of scientists and scientific engineers. We are all familiar with the developments in low-cost hydro-electric power which made possible the great pulp and paper industry, and also the building of electro-chemical and metallurgical enterprises such as the Aluminium Company. Cheap power also stimulated the growth of many smaller industries and assisted in opening up remote areas which in turn provided new resources and market demand. But significant as such developments were, I am convinced, as I have already said, that the creation of the Canadian scientific and industrial research potential during that period has been the major factor in shaping the real character of our economic expansion since 1939.

From 1918 to 1939, owing largely to the branch factory type of development which I have mentioned, the great expansion in industrial research laboratories which occurred in the United States and in Britain simply did not take place. Fortunately, however, Canadian Governments did recognize that a country must have adequate industrial research facilities within its borders if its industries are to meet successfully all challenges. This was proven very well in Canada during the 1939-45 war, when most of Canada's branch industries were completely cut off from the military research of their parent companies in the United States on account of security and other reasons, and Canada in her military and atomic energy activities received no assistance whatever from these large American research laboratories. Research laboratories beyond your borders can be of some assistance in peace-time, but when an emergency occurs they are of no value at all. That is our experience.

Now for a little history. In 1916, as a result of a suggestion from the Government of the United Kingdom, the Canadian Government, as did those of other countries, formally established a National Research Council, which did not, however, really start operation until 1918. This Research Council was set up, like your Department of Scientific and Industrial Research, to promote, stimulate and co-ordinate industrial research, but, contrary to your experience, our Research Council discovered that there were no industrial research activities to co-ordinate; found that universities' research facilities were sadly limited, and that there were only a few well-trained research scientists in the whole country. I do not talk of quality but quantity. This was only 21 years before the outbreak of the 1939-45 war.

The governing body of the National Research Council of that date was a very wise body, made up of university people who understood the fundamentals of science and technology, and they in their wisdom set about training a body of research scientists by providing scholarships and creating the necessary facilities for such training by making grants in aid of research to universities. Both these programs have continued and grown greatly since 1919.

The result was that when war broke out the wisdom of these programs became apparent, and the consequences have been profound. Even in 1939 there were few private industrial research laboratories where development contracts could be placed, and our Government laboratories were sparsely staffed. When I took over the Presidency of the Research Council in 1939 the total staff was 300 and the budget 750,000 dollars; but we had just completed large and well-equipped laboratories and there was, for the first time in our history, a sizable reservoir of young, well-trained research scientists and engineers who were not in profitable employment at that time. This reservoir made it possible for the Council to recruit and to put to work about 2,000 within a relatively short time.

Since 1946, separate agencies have been organized to take over defence research and atomic energy responsibilities and today the combined establishments which grew out of the Research Council now employ 6,000 people. The 300 staff of 1934 have increased to 6,000. The money expenditure is, in proportion even greater.

With the National Research Council as the nucleus, Canada in 1939, for the first time was able to enter the field of development engineering and scientific industry. The result was revolutionary. In an amazingly short time we built, equipped and were able to operate a line of specialized industries. From secret information supplied by British establishments before the war broke out we built and installed radar equipment in Halifax in 1940. Subsequently, we built large radar laboratories and factories which immediately after the attack on Pearl Harbour supplied radar equipment to help protect the Panama Canal and other parts of the United States. We built factories to make aircraft, tanks, ships, optical glass, artificial rubber, electronic equipment and metallurgical and chemical plant of various kinds. In the field of atomic energy, in joint partnership with you in Britain, we built the first reactors to operate outside the United States and our contributions and activities in this field have been and are acknowledged everywhere.

In brief, then, Canada came out of the 1939-45 war a very different country, technologically and industrially and, since 1946, further advances, not retreats, have been the order of the day. Therefore, when thinking of the present status of Canada and her future role, it is necessary to realize that the 1939-45 war not only strengthened Canada in her political, diplomatic and autonomous position but changed her economic and industrial framework from the 1939 model, based largely on the production of primary products and branch factory manufacture, to a 1950 model, based on science, advanced technology and industrial know-how. This is of primary importance in appraising the future of Canada as an industrial and trading nation of the first rank.

To summarize, then, the Canadian economy has, during the past few years, expanded rapidly. The reasons are many and complex, and no one factor is solely responsible. I do claim, however, that, because the scientific base of our engineering and industry has been strengthened and broadened, we are justified in concluding that our economy has been and is going through a period of rapid but well-balanced and soundly-based development rather than through a violent and narrowly-based boom.

I would also emphasize the fact that it is a transition which is still taking place. Our scientific facilities are by no means adequate as yet and, particularly in the fields of pure research and development engineering, we are very far behind Britain. The significant fact is not, however, where we are today but where we are going. I submit very seriously that during the past two decades a real revolution has taken place not only in our outlook towards industrial research but in the magnitude and quality of our scientific activities, and this change means that the current expansion of our national economy rests on the only firm foundation which can support such an economy.

I do not want, however, to give you the idea that we in Canada either desire or expect to become a completely integrated, self-sufficient isolated industrial State. That is certainly not so. We are a country blessed with an abundance of raw materials, but we have no wish to hoard these selfishly, because it would be a false selfishness anyway. We are and must remain a trading nation of the first rank. I do not know whether or not you realize it, but 25 per cent of Canada's national production goes into export trade. That is a very large percentage, and compares with 5 per cent in the case of the United States. This means that we, like you, must exchange with other countries reasonable quantities of raw materials as well as finished manufactured products. We are, by virtue of these factors, internationally minded, and we believe that the hope of the free world depends in a very great measure on international trade and co-operation. As an engineer, I feel that these desirable ends can best be achieved if we all build and expand our economies, whatever they may be, on a sound foundation of science and its applications, and this we in Canada are attempting to do. √

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## THE RESISTANCE OF ALUMINUM TO SOME ALKALINE BUILDING MATERIALS

(*Continued from page 1256*)

galvanic corrosion of the aluminum may occur, especially under damp conditions.

(7) There are occasions in construction work where it may be necessary to place aluminum conduit or structural sections in contact with concrete or mortar surfaces. To avoid a line of contact which may trap and hold water and eventually lead to corrosion, clearance should be arranged between the aluminum member and the structure proper or, if this is not possible, the aluminum should receive an adequate coating of bituminous paint.

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The technical content of our November issue will be devoted entirely to the engineering aspects of the Kemano-Kitimat development. The subjects will include everything from the design and construction of the foundations to the design and construction of the transmission lines.

For complete details see page 1266 of this issue.

# Abstracts of Current Literature

Abstracts of articles appearing in current technical periodicals

### CARGO HANDLING AT PORTS
#### The Benefits of Mechanization

James Steel, *The Duck and Harbour Authority*, v. 35, n. 403, May 1954, pp. 15-17.

James Steel, *The Dock and Harbour Authority*, v. 35, n. 403, May 1954, pp. 15-17.

The chief aim of every port is to load and discharge ships with maximum speed and economy. Outdated methods of cargo clearance means longer delays and increasing costs. Mechanization is the key to this problem. In many ports the speed of turn-round is governed by the handling on board ship and not by the shore operation, but in others the flow of cargo through the port is not sufficiently smooth and exports are not brought forward or imports cleared fast enough to keep pace with work at the ship's side.

To obtain the full benefits of mechanising general cargo handling it is necessary:

(1) To provide ships with ideal facilities for cargo to come inboard and ashore and to permit the best use of mechanical handling aids.

(2) To improve road conditions in the port area for mobile plant; to plan the layout to prevent congestion of increasing road traffic; to provide modern sheds with easy access for cranes, lift trucks and tractor trailers. To improve the road approaches to the port area, which are often much inferior to the rail approaches.

(3) To have a full knowledge of all the many available mechanical aids to cargo handling; to understand the advantages and limitations of each; and to know how to integrate selected plant into a general scheme of cargo handling.

If the flow of cargo through the port is interrupted from any cause, there will be a delay in clearing ships. Therefore the movement of traffic through the port area and in its immediate vicinity is of vital importance. The approach to these problems should be one of progress rather than tradition, and the correct selection and use of mobile mechanical aids is not the least of these three essentials.

A wider adoption of unit loads designed for modern handling methods would be a great advance. A sack of cement or a bag of nails is certainly a unit load, but the size and weight were fixed long ago to suit the strength of a man. New units should be adopted to suit the power of the crane or truck, which has relieved the human muscle of its load. The palletised load and the container are excellent examples of this progressive outlook, but they cannot bring their full benefits until modern handling methods are used at every stage of the journey of the merchandise. In handling general cargo it is desirable to use different plant for the most efficient handling of different kinds of cargo—fast light lifts, slow heavy lifts, and grabs for loose materials—and it is a great advantage to have the shore based plant mobile.

It is a useful exercise to analyse the handling operation into its component parts as, for example, in loading a ship:

A. Horizontal movement in the port area which may consist of:

(1) Cargo called forward by rail direct to the ship's side.
(2) Cargo called forward by road direct to the ship's side.
(3) Cargo accepted into transit sheds to await shipping.
(4) Cargo taken from transit sheds to ship's side.

Of these, all except (4) are transport problems and outside the present scope. The fourth merits careful study of average distance run, terminal waiting time, and empty journeys.

B. Vertical movement at the ship's side which may be:

(1) From road or rail truck into hold.
(2) From dock trucks into hold.
(3) From lighter into hold.

C. Stacking and unstacking in transit sheds and re-handling areas.

D. Stowing in the hold.

For the horizontal movement we may choose between plant which picks up its own loads, such as mobile cranes, squeeze trucks, fork lift trucks, stillage trucks, and straddle trucks, and those which must have the load put on them and taken off again, such as the load carrier and the tractor/trailer system. The choice will be governed by the length of the run. If the transit shed or rehandling area is within 100 yards of the berth it will probably pay to let the lifting machine also transport. If the average distance is greater, the more expensive machine would be spending too much time transporting, and it is more economical to have a lifting machine at each end of the run and to use cheaper trucks for the transport.

The choice between loadcarriers and tractor/trailer system is governed by the bulk and weight characteristics of the cargoes and the ratio of terminal waiting time to travelling time. If the cargo is so bulky that the platform of a loadcarrier about 8-ft. x 3-ft.—cannot accommodate enough to utilize its full tractive effort, it is economical to use a tractor to pull 2 or 3 trailers. If loadcarriers with their drivers are kept waiting whilst sets are being landed from the ship, it pays to let the unattended trailers wait and the tractor draw them away when loaded. Thus the expensive plant and the driver are always doing profitable work.

The choice of mobile lifting-and-carrying plant depends largely upon how the cargo is packed. The fork lift truck, for example, can only handle loads that are palletised. The ownership of pallets presents a great problem at the present time, and the failure to agree any international standard of size bids fair to neutralize the advantages of this excellent pack. The pallets must go all the way from consignor to consignee and there is little advantage in palletising for one stage of the journey only or merely to facilitate storage. The straddle truck is excellent for sawn timber and steel bar stock. The stillage truck is good for small heavy units, such as castings, which cannot easily be made up into larger unit loads without a container. The bale clamp or squeeze truck is the fastest and best means of handling bales which are not damaged by side pressure.

The mobile crane is the most generally useful machine. It is the only one able to handle both heavy and bulky loads. Equipped with automatic tongs, it can pick up and put down cases, drums, bales, sacks, coils, etc., without the help of a slinger. By means of a magnet it can pick up and release all ferrous goods, and with a grab it can handle most loose materials.

For vertical movement at the ship's side we have the electric quay cranes—portal, semi-portal, and tower, the new mobile cargo cranes, ship's gear, and strut or cantilever jib cranes for loading and discharge of small coasting vessels, barges and lighters.

Until there are deep water berths for every ship in every harbour of the world, cargoes must sometimes be loaded or discharged overside when berthed at buoys. Only the ship's gear, or a floating crane for the heaviest lifts, is then available to handle general cargoes from or into lighters. For certain ports, therefore, the ship's derrick and winch is an essential. When ships are trading between ports without deep water berths, a more efficient ship's gear for loading or discharge overside will so speed up the turn-round that the extra cost of modern gear may quickly be recovered. Some shipowners and builders are therefore replacing derricks and samson posts with modern diesel/electric cranes having luffing jibs and 360° slewing, located fore and aft of the hatchway. These can plumb any part of the hatch square, reach over to lighters on port or starboard, and operate independently of ship's main or auxiliary engines, whilst using fewer men than the conventional type of gear.

The shore based crane is, however, always preferable when the quay width and structure permit its use; its operators are more skilled in its use; they have a better view of their work; the cranes are independent of the movement of the ship; and they are usually kept in better order than ship's gear exposed to seas and weather.

For transferring from lighter to quay, or vice versa, pneumatic-tyred mobile cranes are being increasingly used. Those with cantilever jibs are ideal for loads up to 10 tons, and larger cranes are available with strut jibs for heavier lifts up to 20 tons. Full circle slewing is regarded as an essential to obviate the need to manoeuvre into position on the road wheels, and diesel/electric cranes give the best results due to the absence of clutches and gears.

Stacking and unstacking in transit sheds and rehandling areas is one of the costliest items of cargo handling if not fully mechanized. The principal objectives are to stack to maximum height to obtain full revenue from the shed, to avoid damage to cargo, to reduce handling costs, and to provide easy access for customs check and selective unstacking.

All plant working inside the transit shed should certainly be electrically operated. In addition to the obvious advantages of low fuel costs and low maintenance costs, long life, and ease of driving, the cleanliness, silence, absence of fire risk and absence of contaminating fumes are of vital importance in transit sheds where all kinds of cargo are stored.

What is perhaps the last phase of cargo handling to receive the attention of the mechanical handling expert is the stowing and unstowing of cargo. Much can be done to reduce manhandling in holds by using power shovels, small mobile cranes, lift trucks, rotary slingers, and portable elevators in the hold itself. To make the best use of these aids, the structure of coamings and holds should be designed to hinder their movements as little as possible. Small mobile cranes, fork trucks, angle dozers, front-end loaders and portable conveyors can trim the wings of the hold and 'tween decks; this eliminates much manual work and avoids the "dragging" which so often causes damage to cargo.

General cargo has been well described as "heterogeneous assortment of miscellaneous commodities inadequately packed in an endless variety of containers". In many commodities the individual pieces can be made up into a unit load suitable for mechanized handling of, say, 1 or 2 tons. The shape of this may be suitable for entry of forks and slings without being either palletised or cased. Preferential freight rates should be given to those shippers who consign their merchandise so packed, which would penalize the few who stand in the way of progress by clinging to outdated methods.

## SOME PROPERTIES AND APPLICATIONS OF INDIUM

*Machinery*, v. 84,n. 2160, April 9, 1954, pp. 751-752.

Although indium was first discovered in 1863, it has only been made available on a commercial scale for a period of less than 15 years. One of the principal sources of supply of the metal is in British Columbia, where the Consolidated Mining & Smelting Company of Canada, Ltd., are extracting it from the by-products of lead and zinc smelting operations. By electrothermic and electrolytic processes, indium, having a purity exceeding 99.95 per cent, is obtained in commercial quantities.

Indium is a silvery-white metal similar in appearance to platinum, and is one of the softest of the solid metals that are stable in air. It can be readily scraped with the fingernail, and can be made to adhere to the surfaces of other metals merely by rubbing.

Tests performed on the metal after annealing for one week at 110 to 130 deg. C., reveal that it has a Brinell hardness of 0.9, a tensile strength of 380 lb. per sq. in., an elongation of 22 per cent on 1 in., a reduction in area of 87 per cent, and a modulus of elasticity of 1.57 x $10^{-6}$ lb. per sq. in. The true compressive strength (at 10 per cent true strain) is 310 lb. per sq. in. The relatively low elongation, and the high reduction of area, are due to the fact that almost all the deformation in the tensile tests is localized, since indium does not work-harden. The values quoted were obtained in tests on sheet-material, and tests using conventional round-section specimens yield much higher results, a reduction of area of 99 per cent having been then recorded. This value indicates more truly the capacity of indium for undergoing local deformation during tensile tests.

Among the physical properties of the metal may be noted a density of 7.31 gm. per c.c. and a co-efficient of expansion of 33 x $10^{-6}$ per deg. C., both values being obtained at a test-temperature of 20 deg. C. The thermal conductivity of indium is 0.057 calories/sq. cm./cm./deg. C./sec., and its melting point is 156.4 deg. C. Indium dissolves slowly in dilute, cold mineral acids, more readily in hot, dilute acids, and rapidly in concentrated acids. It is not attacked by strong alkalis or by acetic acid, but is susceptible to attack by oxalic acid. Although indium has no toxic effects on operators handling or working it, and does not act as an irritant on the human skin, it is unsuitable for use with food products since it readily dissolves in food acids.

The principal application of indium has been in aircraft sleeve bearings. In one type of bearing, indium is plated and diffused into a steel backing-shell which has been previously coated with silver and lead. After diffusion, the concentration of indium, at the surface of the bearing, is about 16 per cent, this value corresponding to the proportion of indium in a solid-solution with lead. It has been found that the hardness and strength of the bearing are improved, and that, generally, indium increases the resistance of the metal surface to corrosion by the acids in lubricating oils. When indium is diffused into a steel-backed, cadmium-alloy bearing, the corrosion resistance is improved without adverse effect upon the fatigue resistance of the alloy.

Indium-coated bearings are employed, in the B.R.M. racing car, for the crankshaft, which runs at 12,000 r.p.m. The bearings, supplied by Vandervel Products, Ltd., Western Avenue, London, W.3, consist of mild-steel shells with a copper-lead alloy coating. This coating has a very high fatigue resistance and withstands the high working stresses imposed. An indium coating is applied to the copper-lead shell to provide a low coefficient of friction, a good resistance to corrosion, and a marked resistance to seizure.

Various low-melting point alloys have been prepared with indium content, and the addition of this element to Woods'-metal alloy lowers the melting points of these materials by 1.45 deg. C. for every 1 per cent added.

The alloy of this type having the lowest melting point (47 deg. C.) contains 19.1 per cent of indium. An alloy comprising 24 per cent indium and 76 per cent gallium, melts at 16 deg. C., and is liquid at room temperature.

An alloy containing equal amounts of indium and tin is capable of "wetting" glass and can be employed for making glass-to-glass or glass-to-metal seals. The alloy is applied to the pre-heated glass component by swabbing, and the joint is then made in the conventional manner. Vacuum-tight joints can be obtained with a high degree of consistency, and tin-indium alloys are particularly useful for making joints in glass components where the application of high temperatures is not permissible.

Investigations are proceeding to determine the value of indium as an additive to lubricants in the form of a fine suspension, or as a soluble chemical compound. It is also reported that, when the element is added to chromium-plating baths, the brittleness of the plated coating is reduced, and further experimental work is being carried out in this connection.

## NONE SO BLIND

Editorial, *Aeronautics*, v. 30, n. 5, June 1954, p. 25.

It is inconceivable that, in this year of 1954, anyone who has learnt the elements of metrology could be in any doubt about the status of British Imperial weights and measures, or about the status of the metric system of weights and measures. British Imperial weights and measures and the bastardized versions of them used in the United States of America and elsewhere are derived from untrustworthy and unstable prototypes, they are not decimalized; they are not coherent; they are not international; they are not systematic. They are confused, muddled and misleading measures. The metric system of weights and measures, however, is decimalized, coherent, systematic and international. It is simple to use. The prototype units are stable and trustworthy. These facts are known to most educated people. British Imperial measures are an antiquarian curiosity at best; a hindrance to engineering and commercial progress, a source of error, a cause of waste and a headache to the logically minded at worst.

## VIEWS ON WATERSHED CONTROL

*Journal American Waterworks Association,* v. 46, n. 5, May, 1954, pp. 403-405.

The ideal source for a public water supply is an isolated, forested watershed without habitation and with all recreational use prohibited. It is obvious that, with automobile transportation available to everyone, this situation is impossible to attain. It should be recognized that there are several types of watersheds, although the particular water utility is interested only in the one under its control. Up to the present, no concerted effort has been made to develop the watershed picture in its entirety.

Small cities and towns rely mainly on well supplies. Of all American cities with more than 100,000 population, approximately 20 per cent also depend upon these sources, while the remaining 80 per cent are about equally divided between those cities utilizing impounding reservoirs and those taking water from the Great Lakes or from large rivers.

Cities located on large rivers that serve as their source of supply do not have direct control over their watersheds and must rely on the various state health departments to abate nuisances and eliminate industrial wastes. These conditions apply to such typical rivers as the Potomac, Susquehanna, Ohio, Missouri, and Mississippi.

The Great Lakes cities are in a different category. There is a large volume of water in the lakes, and pollution from domestic sewers and industrial wastes enters at the shoreline. To overcome these hazards, intakes or cribs have been extended several miles offshore. Control over the wastes discharged at the shoreline is vested in the health departments of the states bordering on the lakes. In these instances, the water utilities and health departments maintain close co-operation in pollution control.

Impounded small rivers flowing through sparsely inhabited woodland or farming country with small villages are found in many sections of the United States. The responsibility for the sanitation of such watersheds, although vested in the various state health departments, is usually delegated to local health agencies, with which the water departments must co-operate.

It is apparent that watershed sanitation will differ for various types of supply sources. It has been pointed out that the Great Lakes cities and those on large rivers cannot directly control pollution on their watersheds. Water from large rivers is grossly contaminated, but, with modern purification processes and constant vigilance, these cities produce drinking water that conforms to modern standards of safety and palatability and they have extremely low waterborne-disease death rates. It must not be inferred, however, that stream pollution control should be neglected: on the contrary, it should be enforced as well as local conditions permit.

The primary use of a river is for water supply, and the object of stream pollution control is to minimize the density of pathogenic organisms and industrial wastes in the stream, so that the purification facilities will not be overburdened. Stream pollution control is of vital importance as it is the only watershed sanitation measure available for large rivers.

No hard and fast rule determine what is and what is not pollution. In many instances, the criteria have the protection of aquatic life and the provision of a water supply as free from contamination as possible. It is now known that "much of stream life, (degradation) formerly attributed to pollutants, is really occurring because our streams and lakes are growing old, and are changing in nature and aquatic population with changes in their environment."

Many years ago the Pennsylvania Sanitary Water Board proposed that stream pollution control should be governed by the classification of the stream according to its use. It is now recognized that this fundamental concept is correct, and that fixed standards, as determined by chemical and biological constants, cannot be established or enforced for an entire river. Usage in relation to pollution factors of separate sections or zones must be the basis for pollution control, and procedures that best fit local needs should be instituted. In the last analysis, the object of stream pollution control is to protect the existing clean waters and to improve the unclean and contaminated waters, so that they may be utilized by the most people for the greatest number of purposes. It is believed, however, that water of a purity eoual to that of an impounding reservoir should be the goal where potable supplies are involved.

With modern purification, it becomes evident that for an impounded river supply, a virgin woodland watershed is archaic. Unless storage and chlorination are the only purification processes used, this type of watershed may be considered a relic of the past. Raw water with as little pollution as practicable should, however, be obtained. The courts have usually recognized the need for a utility to protect its watershed even though a limitation of private property rights results. On this type of watershed, protective practices are limited to the control of the area surrounding the reservoir and to periodic inspection of properties upstream. Authority to enter private property in order to abate a nuisance and enforce regulations is usually vested in the water supply agency.

There should be some economic balance between expenditures for purification and those for watershed sanitation, when both are practiced. If a modern treatment plant is part of the system, less money should be spent on watershed sanitation than if reliance is placed upon reservoir storage and subsequent chlorination of the effluent. It must not be forgotten, however, that the most efficient watershed control measures cannot replace purification.

## TEAPOT TEMPESTS COME OF AGE

Homer J. Wood, *SAE Journal*, v. 62, n. 6, June 1954, pp. 21-23.

Small gas turbines (50 to 500 hp.) still can't push piston engines out of many of their jobs, but they've got what it takes to cop some of them. Turbines have, for example, won many posts as aircraft auxiliary powerplants. And they're a serious contender for any other powerplant "positions" where weight reduction is important.

Put another way, if it takes more than a 4-cylinder engine to do the job, the turbine may be competitive; if four cylinders or less are good enough, the turbine can't compete. What's more, it won't be able to for a long time.

The past seven or eight years have seen a great deal of activity in the field of small gas turbines (below 500 hp.). And, from time to time, the proponents thereof have proclaimed the forthcoming obsolescence of piston engines in this size class.

Yet some difference of opinion must be involved, since major automotive companies continue to invest many millions of dollars in tooling for new engines which they say will be in use for 10 years.

This would indicate that the men who control these companies are not convinced that the "teapot tempest" has come of age in the automotive field. In fact, there are people in the gas turbine business who argue that souud and practical applications of small gas turbines are still several years away and, indeed, may never come to pass.

Those who would condemn small gas turbines have some valid arguments.

In the first place, the best fuel consumptions achieved by small turbines today are about 50% higher than would be considered high for reciprocating engines. And this is only part of the story. Most piston engines are capable of maintaining reasonably good fuel economy down to and below 25% load. A gas turbine, on the other hand, tends to consume three to four times as much fuel as a reciprocating engine at similar loads.

Furthermore, gas-turbine engines tend to lose their much-vaunted simplicity or to operate at unfavorable stresses or temperatures when they seek to better their fuel economy. Thus, unless some revolution occurs, the temperature and stress limitations of known materials will leave the small gas turbine in an unfavorable fuel-consumption position for quite some time to come.

Perhaps the answers to a few other questions about small gas turbines as they exist today would be revealing:

*Question:* Are the turbines cheaper in initial cost than present-day piston engines of equal power?

*Answer*—No!

*Question:* Have gas turbines been proved to be more reliable under field conditions than piston engines?

*Answer*—No!

*Question:* Have gas-turbine maintenance costs been proved to be lower under field conditions?

*Answer*—No!

*Question:* Is there any category of gas-turbine superiority that has been demonstrated by practical application?

*Answer:* Yes, low specific weight. This favors transportability.

*Question:* Are there any operating conditions which clearly favor gas turbines?

*Answer:* Yes, low temperature operation, particularly with respect to starting without preliminary heating.

*Question:* Do gas turbines have installation advantages?

*Answer:* Yes, in so far as space required per horsepower is concerned. This is particularly true when postin-engine cooling requirements are included in the comparison.

In view of the number of unfavorable characteristics admitted above, it would seem that the writer exercises considerable temerity in stating that small gas turbines have proved themselves to be useful members of the prime mover society.

This position is taken because of the overwhelming importance of low weight for certain applications. To be more specific, the small gas turbine has come of age as an aircraft auxiliary powerplant where the auxiliary service is primarily for (1) making the airplane self-contained by providing power on the ground when the main engines are inoperative, or (2) for relatively short portions of the flight plan which render fuel consumption of secondary importance.

In such applications, no other form of prime mover can reasonably be substituted—even though life and reliability of small turbines needs to be improved.

The same bold statement is not necessarily as secure with respect to air-transportable ground equipment. For such applications as external-store streamlined pods, there can be no doubt that piston engines are quite undesirable.

However, for equipment that is designed to be transported in cargo aircraft, it can be argued that the weight penalties of piston engines may be accepted.

It is the writer's firm opinion that this is a transitory matter. Why? Because of rapid developments that are coming as a result of field experience. These will soon put gas turbines into a class of life and reliability that will make them unquestionably superior to piston engines for ground equipment that must be air transported.

Laboratory endurance tests have demonstrated, for example, that overhaul life between 500 and 1000 hr. is well within grasp, provided the machines are not subject to misuse or abuse.

It may be argued that a 500 to 1,000-hr. period is not enough (to which we reply that this is not an upper limit). But, somewhere between 1,000 and 2,000 hr. of overhaul life, we would have to start thinking in terms of increasing specific weight substantially.

Actually, when it comes right down to it, there are relatively few lightweight piston engines whose overhaul life exceeds 1,000 hr.

What's more, it is felt that within three years, small gas turbines will have the same service life and reliability as piston engines weighing two to three times as much.

The matter of cost must, of course, enter the picture.

Here again, we believe that in three years the turbine will be able to compete costwise with piston engine in equal production quantities. However, turbines will be unable to compete in first cost with piston engines that represent conversions from fields of large production where, for various reasons, the gas turbine is not suitable.

In discussing this question of cost, it should be noted that the number of cylinders in the competing piston engine plays a major role.

In the aircraft propulsion field, piston engines equivalent to gas turbines must have upwards of 24 cylinders, and the resulting engine are complex and costly. On the other hand, in the 500 h.p. and below market we find anywhere from 1 to 12 cylinders.

And while small gas turbines tend to be simpler than their large relatives (jet engines), the degree of simplification is nowhere near as great as it is between large and small piston engines.

Thus, this generalization seems reasonable. Wherever four cylinders or fewer are good enough to do the job, it will be a long time before a gas turbine can compete. From four cylinders up, increasing piston-engine complication gives the gas turbine a chance to offer competition in the not-too distant future.

Noise level frequently has been cited as a disadvantage of the of the gas turbine. Actually, however, a completely unmuffled piston engine of the same rating as a gas turbine would have approximately the same total noise level, though in different frequency ranges.

The problem with a gas turbine is to provide muffling without excessive intake and exhaust pressure losses. The feasibility of providing such muffling has been demonstrated, but the sacrifices in weight and bulk are noticeable. Even so, a substantial weight advantage exists in favor of the turbine.

Now, what about the future?

It is felt that the first three questions raised earlier in this article aren't always going to be answered in the negative. With time, these answers are going to pass through a "maybe" stage . . . and finally into affirmative answers through normal operation of the "learning curve."

As for the evolutionary trend of small gas turbines, it is toward simplicity, reliability, and adaptability—with fuel consumption and frontal area being of secondary importance. It is not felt that the possible improvements in fuel consumption that could be achieved with more complexity would offset the increased cost and reduced reliability necessarily implied.

This does not mean that fuel consumption reduction is being ignored. The distinction is that we do not believe that the complications necessary in large gas turbines to achieve this end can be justified in small machines.

In summary, the writer believes the small gas turbine is here to stay as a prime mover. It has already demonstrated its basic suitability for aircraft auxiliary power. And it will shortly prove a serious contender in all fields where weight reduction of the prime mover is important (the extent of such fields is not yet fully explored). However, it is likely to be many years before the small gas turbine seriously invades those markets where low weight is not an important consideration.

To venture a prediction, propulsion of small helicopters looks like the next field where the "teapot tempest" will come of age.

## LATEST IDEAS ON RUBBER BELT USE IN PULP MILLS

Donald R. Scheu, *Paper Trade Journal*, v. 138, n. 24, June 11, 1954, pp. 24-28.

Many new, improved types of belting, designed specifically for use in the pulp industry are proving the economy of the belt method of mass materials transportation. Outstanding example in the industry, however, is the economy and efficiency demonstrated by rubber belting in the log-handling operations.

Where a new cord conveyor belt has gone to work in log-handling service, replacement and maintenance problems traditionally associated with conventional systems have been virtually eliminated.

A study of pulp mill conveyor belt operations recently conducted reveals the versatility of belts designed for handling pulp wood logs. Such belts may be used as yard belts for general outdoor transportation of the logs, as recovery belts for bringing the logs in from the storage piles, as debarking drum feeder belts, as sorting belts after the debarking process and as chipper feed belts.

The study showed that for most economical service each application must be individually engineered to meet specific service conditions. In every case, however, the major problem is that of providing a loading method which will induce least injury to the belt. For this reason, the study indicates, the successful use of conveyor belts depends directly on the coordination of thinking between conveyor designers and belt designers.

Yard belts generally receive logs from trucks, railroad cars and barges. Loading is generally from along the sides of the belt. It is nearly impossible to establish impact-absorbing equipment under the entire belt. The belt itself must incorporate the impact resisting features through the use of heavy top covers, cushioned cord tensile members, and synthetic filled fabrics. Rubber covered idlers are of some assistance in protecting the yard belts as it is virtually impossible to prevent the logs from being thrown on the belt directly over the idlers.

Recovery belts are used to bring the logs into the processing plant from the storage piles. Recovery from storage may be accomplished by the use of an orange peel grapple, by hand or by the use of a bulldozer or similar pusher. When a grapple is used, the logs are dropped into a movable hopper which travels along the belt conveyor. Feed from the hopper to the recovery belt is indirect. The hopper construction which is considered best is one having a feeder belt bottom.

The belt for this application is generally short and massive especially designed to withstand the impact and gouging of the logs dropping from the grapple. This service is extremely severe. The use of a short bottom provides an easily replaceable item and prevents undue damage to the longer main conveyor belt. Combination cord and fabric belts have been found to withstand the impact of the logs better than the conventional fabric constructions. A measure of relief for the hopper bottom belt can be developed by supporting the belt on pneumatic impact idlers or solid rubber impact idlers.

The main conveyor belt is loaded by direct discharge over the head pulley of the hopper bottom feeder belt. The direct fall is represented only by the height of the hopper bottom head pulley above the main conveyor belt. A chute on the hopper frame can be of considerable value if it is designed to direct the logs properly onto the main conveyor belt.

Belt speed generally considered suitable for yard belts and recovery belts are from 250 to 350 f.p.m. For debarking drum feeder belts, speeds are reduced to 125 f.p.m. or less.

Perhaps the belts which receive the most severe service are those which receive the logs from debarking drums and are used for sorting of debarking logs. For a newly designed installation it is recommended that an impact plate be built in front of the debarking drum so that the logs tumbling from the drums will land on the plate and thence bounce to the conveyor belt. Unfortunately, in a good many of the older installations there is insufficient room in front of the drums for such a plate.

Where no means can be provided for absorbing the impact, the belt must be designed to withstand the entire forces created by the falling logs. There are several designs of loading points for sorting belts. One of the most popular consists of loading on an open belt span. This consists of removing the idlers under the impact area and replacing idlers at each end of the impact area with rubber covered pulleys 12" or larger in diameter. When the logs hit the open span of belting the belt itself acts as a hammock and through its longitudinal and transverse resiliency absorbs the forces of impact.

Another design involves the use of a pad belt which is merely a short heavy belt running under the sorting belt over its own pulleys. The principle of loading will be the same as that described above as open span loading, or impact idlers can be used to support the pad belt.

A third design consists of supporting the belt on pneumatic tires. The pneumatic tire idlers consist of smaller tires toward the center of the belt and larger tires toward the edges all on the same shaft. The inflation in the tires provides a resilient cushion against which the belt is forced by the impact of the logs. It is necessary that the tires be supported on very heavy shafts.

The use of spring supported impact beds or belt take-ups using dashpots ot springs is not recommended. All of these have the disadvantage of high inertia due to the weight. With the spring loaded mechanisms the periodicity of the springs may easily cause higher impact on the belt than normally would be encountered.

Chipper feed belts present a few problems of their own depending upon the manner in which the chipper is fed. If the belt is started and stopped frequently to supply the logs to the chipper, sufficient strength must be incorporated in the belt to offset the starting stresses. If the chipper is fed by means of a gate and the belt is permitted to run and slide under the logs, there is a problem of providing adequate cover thickness and abrasion resistance.

Although each belt must be specifically designed for its application there are certain general features which can be covered. Balanced cord construction belt, using a relatively heavy top cover with bias laid transcord breakers, has been successful. This construction would incorporate two or more fabric plies having nylon filling to provide transverse strength. Two bias laid transcord breakers will provide superior gouging resistance in the cover and greater adhesion between cover and carcass.

The cord construction is more resistant to the loading shocks by virtue of the fact that the cords are floated in rubber and are displaceable without rupture. The cord construction can readily be designed to give the required operating longitudinal strength. Placement of cords above and below the fabric protect the fabric from shock impact transmitted downward from logs and upward from idlers.

Another important general application of belts in a pulp mill is for handling chips. Choice of belt for handling is dependent on the type of wood chips handled. Hard wood chips do not present unusual problems. The southern soft-wood or pine chips can be very detrimental to improperly chosen belts. Heat created in the chips tends to vaporize turpentines and resins in the wood and then causes these vapors to affect the rubber in the belts.

In order to obtain increased volumetric capacity on chip belts, concentrating idlers are frequently set at 45° This increased angle is not detrimental to a properly designed belt. With the advent of rayon fabrics, thin belts can be built with sufficient strength for handling the load.

As a word of caution, the usual maximum incline angle of 27° for chip-handling belts is applicable only when there is no possibility of frost forming on the belt. Occasions have occurred where the warm, damp chips have been taken from storage silos and loaded on a belt run through an unheated gallery. There seems to be no successful way to prevent cascading of the chips when the moisture forms frost on the belt surface. An angle of perhaps 15° should be the maximum considered where low gallery temperatures are likely to exist.

Handling pulp does not present any major problems unless there is contained in the pulp acids or alkalies of high concentration which could affect the belt. If pulp is at a high temperature, consideration should be given to selection of belting to resist that temperature. Take-ups on pulp belts should allow adequate movement for accommodation of the shrinking or stretching of the belt as caused by the action of the moisture and temperature on the belts.

Ordinary strip bark can be handled on low priced belting without difficulty. If the bark is shredded, consideration should be given as to whether or not deleterious resins or oils may be liberated. If so, an oil resistant type belt should be used.

## ULTRASONICS FOR EMULSIFYING, HOMOGENIZING AND BLENDING

F. Rose, *Canadian Chemical Processing*, v. 38, n. 6, June, 1954, pp. 36-38.

The past few years have seen great strides in the ultrasonics field and the long period of careful research has finally paid off with the perfection of a method to produce effective ultrasonic waves by purely mechanical means. This method has proved the most economical one so far developed to generate low frequency ultrasonics for emulsification, homogenization and blending, and the simplest one perfected for general industrial use. The economics of the ultra-vibration technique of producing emulsions or dispersions lie in the speed and the efficiency of this method, which has been shown to surpass anything achieved previously.

This ultrasonic method can produce particle sizes as small as one micron (one twenty-five thousandths inch), and emulsions made by this process will, therefore, be more stable than those produced by conventional means. It follows that stable emulsions or suspensions can be produced with less and, in some cases, without any emulsifying or stabilizing agents whatever, which is particularly useful where these agents are undesirable in the finished product.

In the latest type of mechanical frequency generator, the sound waves are produced purely mechanically by a blade which vibrates at its own frequency in the liquid stream of the medium passing over it after emerging out of a high velocity jet nozzle. The frequency in liquid is approximately 22 kilocycles per second. At these ultrasonic frequencies particles of the liquid medium are subjected to alternating compression causing pressure spots, a phenomenon known as cavitation. Collapsing of the cavities causes minor local explosions and violent molecular acceleration in the medium as it rushes over the blade maintaining it in continuous ultrasonic vibration.

Resultant pressures of high intensity up to 30,000 lbs. per square inch are released locally and complete the process of breaking down the particle size.

The production unit comprises a low hp. electric motor (as small as 2 hp. for up to 420 gallons per hour), a gear pump driven by the motor, suction and delivery pipes and, at the end of the delivery pipe, the cylindrical shaped ultrasonic head which contains the vibrating element.

The longer inlet pipe takes the liquid under suction up to the pump, which, in turn, forces it at high velocity and pressure through the outlet pipe into the ultrasonic head where the vibrations are generated.

The vibrating element, i.e. the ground edge blade and the jet nozzle are enclosed in a cylindrical housing, or resonant bell, especially shaped to concentrate and disperse the vibrations equally through the medium, and to ensure that the velocity of the jet across the blade is maintained regardless of whether the vibrating element is submerged, or above the level of the liquid in the vessel. The blade position is adjustable in relation to the jet, i.e. fine variations in the vibration frequency can be made according to the desired end product. A filter is used to prevent solid particles from entering the vibrating element and to ensure maximum efficiency of both jet and blade.

The ultrasonic equipment is suitable for use either in open vessels, or closed circuit systems under pressure. A typical example of the latter is the continuous emulsification of margarine. In this application the oil, water and stabilizing agents are mixed in the churns from where they are passed to the gear pump of the ultrasonic unit and then delivered at high pressure and velocity through two or more ultrasonic heads in parallel; depending on the output required. No recirculation is necessary, and in passing through the ultrasonic heads the mixture is emulsified and ready for straight continued passage into the cooling drums or votator. This set-up includes a trough in which the emulsion is kept at a constant level.

One of the first and most successful applications was the processing of salad dressing and mayonnaises. This led to other food products involving butterfat or dried milks dispersion such as cream soups, sauces, ice-cream mix, sugar syrups, soft drink essences, flavors and processed dairy products. Whole milk has not yet been perfectly homogenized by ultrasonics, but research continued and good progress is being made in the right direction.

Among many other successful applications are wax emulsions, spray insecticides, dyes, photographic emulsions, resin preparations, paper coatings, detergents and adhesives, showing the extreme versatility of the ultrasonic method of producing fine dispersions with the minimum of effort.

# From Month To Month

**Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers**

## To the Students from the President

It is my privilege, on behalf of the Council and membership of the Engineering Institute of Canada, to extend greetings to the undergraduates of the engineering faculties and colleges in Canada as they commence another term of studies and as they thus mark another year in their advance toward entrance into a great profession and a great fellowship.

No country in the world today is at quite such a dynamic and exciting stage in national building as is ours; and at no time in our history have we had so many interesting and constructive jobs for engineers to do. Older practising engineers will find themselves just a little envious when they consider the conditions under which you are likely to take on your first full-time engineering jobs.

Without exception the standards of instruction in the universities and degree granting colleges of Canada are exceedingly high and every engineering undergraduate will have the great good fortune of getting to know at least some of the outstanding engineers who comprise the teaching staff.

I know you would not expect an older person to miss such an opportunity as this to offer some advice and I shall not disappoint you on this score. But just two things: First, do not be too prone to treat some of the broader general subjects as unsuited to the needs of an engineer. Remember that more and more engineers are being drafted into managerial posts and the universities, being cognizant of this, have arranged their curricula accordingly. My second bit of advice would be that you do not delay too long in identifying yourself with The Engineering Institute of Canada. The closest possible affiliation with our fellow engineers from one end of this great country to the other will help us all immeasurably and the sooner we become a part of this association the greater the benefit not only to ourselves and our profession but to our country also. One final word, and though some of us may have peculiar ways of showing it, we recognize that the undergraduates in engineering are by much the most important group of young men in the country today.

Good luck to you, in all your endeavours.

D. M. Stephens, *President.*

## Something Different for November

The entire technical section of *The Engineering Journal* for November will be devoted to a series of papers—11 in all—dealing with the gigantic Kitimat, Kemano Nechako project of the Aluminum Company of Canada in British Columbia.

This has been made possible by the co-operation of the company. The selection of subjects and authors has been determined solely by the officers of the company, and the papers will be checked, approved and co-ordinated by the company. Thus it is that the November issue will contain in effect the full and official story of the project

It is only when specially significant projects, of importance to the economy of Canada and to engineers, are available, that an issue of the *Journal* is devoted exclusively to them. The Publications Committee believe that these developments which are really important segments of the story of Canada's growth, deserve such special attention from the profession. Not only is it important that the whole story be told at one time, but it is equally important that such documents be available to record for future technical reference and for posterity, the achievements of industry and the profession today.

Following is a list of the subjects which will be dealt with, and the authors. This shows how complete is the coverage and how wide the interest will be for all engineers, regardless of the branch in which they may have specialized. The papers will require from 90 to 100 pages.

Already it is apparent that some

## Cover Picture

The cover picture is a closeup of the "crossbar" telephone switching equipment being installed in the Toronto long distance centre of The Bell Telephone Company of Canada. These "crossbar" switches, vastly different from the "step-by-step" dial switches currently in use throughout most of Canada, are scheduled to go into service in Toronto in 1955.

They will bring one step closer the day when operators and eventually telephone callers themselves will be able to dial numbers in cities throughout North America on their own telephone dials. This dramatic photograph shows the vertical and horizontal bars which give the equipment its "crossbar" name.

The technical paper on page 1231 of this issue is a review of "Telecommunications in Canada".

members will want extra copies. A greatly increased number will be printed but to be sure that every member has a chance to get extra copies it is important that Headquarters be advised as soon as possible. Please keep this in mind and write immediately if you need more.

**General Description and History**
by McNeely DuBose,
Vice-President,
Aluminum Company of Canada Limited.

**Hydraulics of Kemano Development**
by W. W. Wolcott,
Senior Engineer,
International Engineering Company, Inc.

**The Kenney Dam**
by H. Jomini,
Resident Engineer,
Aluminum Company of Canada Limited.

**Tunnel and Powerhouse Construction**
by F. T. Matthias,
Assistant Manager of the B.C. Project,
Aluminum Company of Canada Limited.

**Kemano Penstocks**
by W. G. Huber,
General Manager, British Columbia Engineering Company Limited.

**Mechanical and Electrical Design and Construction of Kemano-Kitimat Transmission Line**
by Bruce Cooper and D. G. Dunbar,
Design Engineers,
British Columbia International Engineering Limited.

**The Aluminum Towers on the Kemano-Kitimat Transmission Line**
by Dr. K. Sutter,
Head of and Consultant of, Aluminium Laboratories Limited, Geneva,
F. L. Lawton,
Chief Engineer, Power, Aluminium Laboratories Limited,
and
A. Soosaar,
Engineer,
Aluminium Laboratories Limited.

**Investigations of the Effect of the Kemano Power Development on Fisheries**
by R. W. Kraft,
Technical Superintendent, Kitimat Works,
Aluminum Company of Canada Limited.

**Kitimat Harbour**
by W. L. Pugh,
Chief Engineer,
Aluminum Company of Canada Limited.

**Foundations Investigations for Kitimat Smelter**
by R. M. Hardy, M.E.I.C.,
Dean of Engineering,
University of Alberta, Edmonton;
and
C. F. Ripley,
Consulting Engineer,
Ripley and Associates,
Vancouver.

**Design and Construction of Kitimat Smelter**
by Staff members,
General Engineering Department,
Aluminum Company of Canada Limited.

# Addition to Staff

Group Captain E. C. Luke, O.B.E., C.D., M.E.I.C., joined the staff of the Institute on September 1 in the post of assistant general secretary. This position was advertised in *The Engineering Journal* of January

**Group Captain E. C. Luke, O.B.E., C.D., M.E.I.C.**

this year, and he was one of the applicants.

Group Captain Luke was brought up in Montreal, and attended Westmount High School. He graduated from Royal Military College in 1924. From 1925 to 1928 he was a pilot in the R.C.A.F., but left the service to go into civilian engineering, first with the Northern Construction Company at Vancouver, and then over a period of nine years with B.C. Electric, P. G. E. Railway and Western Bridge Company. During this period he became a member of the Association of Professional Engineers of B.C.

In 1938 he returned to the Air Force as chief works officer in Vancouver. A year later he was moved to Headquarters at Ottawa as deputy director of works and buildings. In 1941 he was transferred again to the Western Air Command on a variety of duties including operations, personnel, organization, construction and administration.

1945 saw him at Central Air Command, Trenton, Ontario, with duties somewhat similar to those he performed at Western Air Command. In 1949 he was back again at R.C.A.F. Headquarters in Ottawa as chief logistics planner with a portion of his work being related to NATO. Later he became a member of the R.C.A.F. working party on the planning of the NATO air forces, which took him to both Washington and Paris.

From the latter part of 1951 to September 1954 he was director of construction, Allied Air Forces Central Europe with Headquarters at Fontainebleau, France. This work included military responsibility for the control and supervision of a program embracing 105 NATO airfields, costing about 700 million dollars. He retired from the Air Force and joined the staff of the Institute in September.

Mr. Luke is well known across Canada, and has had a variety of experience that should fit him excellently for his new post. Incidentally, he is bilingual, which also should be helpful to him in his new work.

With Mr. Luke becoming assistant general secretary, Colonel H. G. Thompson's title has become executive assistant general secretary.

# Digby Does It Again

Over the years, the bi-annual professional meeting held in the Maritimes by the Institute branches and the provincial associations has built up a fine reputation for itself. This time it was Nova Scotia's turn and of course the locale was the Digby Pines Hotel. As has been almost a standard custom for these meetings at Digby, everything went off without a hitch, to everyone's satisfaction, with even the weather on its best behavior. From the middle of a long period of bad weather, the committee plucked out three days that could not be beaten.

Two things are vital to the success of such a gathering, first the weather, and that has been dealt with, and then the attendance. The most important single element affecting the success of any meeting is the people who attend. They must be the right people and there must be enough of them. Both these requirements were met fully, to put it mildly. The hotel and cottages could not contain the 285 persons who registered. Fortunately not all registrants attended for all three days. Thus it was that over the period more people were accommodated in the hotel than would seem possible, although some had to register at other hostels in the town. The youngest registrant

**The head table at the Maritime Professional Meeting luncheon on September 9. Left to right: Antony Vickers, Mrs. Keith Leighton, O. Nelson Mann, Mrs. Tweeddale, D. M. Stephens, C. A. Knight, His Worship G. E. Morehouse, Mrs. Vickers, W. L. Sagar, Mrs. O. N. Mann, M. F. Keith Leighton.**

beyond a doubt was Master Michael Bromley, 3 month old son of Mr. and Mrs. George Bromley of Wolfville. He was accompanied by his parents.

It is always a source of surprise to persons attending a maritime meeting for the first time to discover that it is not just a local meeting. This year again there were engineers in goodly numbers from Manitoba, Ontario, Quebec and the United States. To the newcomer it is surprising also to discover how many of the visitors from distant places are regular attendants. However once he has experienced a meeting himself he understands the great pulling power developed by this event. It was a very pleasant experience this year to greet again the many people who have become great friends through the medium of this meeting.

#### Edna Arrives Late

The much touted gale known technically as Edna hit the area, but not until Saturday. By then the festivities were over and most people were on their way home. Those who came across the Bay of Fundy in the afternoon, arrived at Saint John in much better condition than they had expected. Edna did not really get under way until Saturday night, but by Sunday morning she had made quite a showing. Delegates from "Upper Canada" were more than slightly inconvenienced by Edna on their way home. The Montreal train carrying several of them sat out the storm for six hours, and those who motored had a variety of experiences, but everyone reached their destinations eventually and in good order. Even Edna could not down the lustre of the occasion for anyone, but it is just as well she arrived late.

#### Council Meets

Wednesday afternoon was the occasion for a regional meeting of the Council of the Institute, with the president in the chair. While there is no official record to prove it, the attendance appeared to be a record with 41 present, representing 14 branches. Special guests were the president and director of the Ontario Association, Professor W. L. Sagar and T. M. Medland from Toronto.

#### New Publication

A feature not presented previously was *The Eager Beaver*, a newspaper which appeared under everyone's door early Thursday morning, printed on a grade of coated paper that made *The Engineering Journal* stock look like newsprint. Its masthead bore the motto "The facts if necessary but not necessarily the facts"—a basis of operation much envied by other editors.

The paper contained a lot of well written articles, all spoofing the profession in one way or another. One in particular was presented as an account of the council meeting. One subject reported to have been considered was a salary scale for wives, but this "was thrown out after heated debate."

The real feature of *The Eager Beaver* was "Where to Find Them," a list of persons attending the conference, with their local addresses. This took up two of the four sheets. At the top of the list there was this helpful note *The Eager Beaver* will be happy to rectify any errors or omissions in this list, and the editors should be advised at once so that suitable corrections can be made in our next issue—about September 1958."

Congratulations to *The Beaver*. It certainly fills a long felt want—too bad its publishing dates are so far apart.

#### Technical Program

The technical program was excellent, and if critical comment is permitted, this writer would like to say it was the best overall program ever presented for these meetings. Naturally under such circumstances, the attendance also was a new record. Every session had people standing at the side and at the back of the room.

On Thursday morning there were two papers—(1) Some Industrial Applications of Fluid Drive, by Antony Vickers, executive director of Fluid Drive Engineering Company Limited of Middlesex, England, and (2) Gas Turbine Power Plants by C. J. Burke of the Westinghouse Electric Corporation, Philadelphia. These authors knew their subjects well, and in addition knew how to present them. In both instances the subject was presented in such a way that everyone, regardless of his branch of engineering, could understand and enjoy them. This, it must be admitted, is not too easy to do.

On Friday morning the sessions were (1) St. Lawrence Waterways by L. E. Mitchell, special projects engineer, Canadian National Railways, Montreal, and (2) Atomic Power by Dr. John Convey, director Mines Branch, Department of Mines and Technical Surveys, Ottawa. It was Mr. Mitchell who had the difficult assignment. Anyone, even faintly familiar with the St. Lawrence situation will realize how many things there are about the project which have not been settled and of some that have been settled but in such a way as to puzzle even the casual observer. With all these pitfalls around, Mr. Mitchell did a job that landed him in no trouble at all.

Some persons stated that Dr. Convey's paper was the best of all, in that it made the subject seem reasonably simple, and gave information that satisfied, at least partially, the desire to know something about when such power will be available.

#### Lunches and Dinners

Thursday's luncheon was presided over by C. A. Knight, vice-president of the Newfoundland Association. There were three speakers —the Mayor of Digby who very nicely extended the proverbial freedom of the city, W. L. Sagar, president of the Ontario Association and of Dominion Council, followed by D. M. Stephens, president of the Engineering Institute. Frightening and all as a program of three speeches might be, it all worked out extremely well, and possibly proved that short speeches not only take less time, but contain in concentrated form as much good material as the standard length (if there is a standard length).

Thursday's dinner saw John E. Clarke, president of the Nova Scotia Association, in the chair, with Allan J. MacEachren, M.P. for Richmond-Inverness, as speaker. His subject was "The Pattern of Maritime Development."

After dinner terpsichore took over in the lounge, much to everyone's delight. The program suggested that the dance would discontinue at 11.30 p.m., but who cares about time at a maritime meeting! Certainly not the group assembled at Digby.

Friday's "eating-talking" events included a luncheon and a dinner (this time called a banquet). Luncheon was under the direction of J. K. Godfrey, manager, Truro Electric Commission, and the speaker was Leslie Roberts, the Canadian author. Mr. Roberts gave no title to his talk, but it might well have been called "the anecdotage."

The banquet was chaired by R. N. Fournier, general chairman of the committee responsible for the whole meeting. The speaker was O. L. Vardy, Director of Tourist Development in the province of Newfoundland.

#### Swing Your Partner

Again the evening was devoted to dancing, but this time the program said "square dance." Added colour in noticeable variety and strength suddenly burst on the scene as couple after couple returned from their rooms bedizened in allegedly western or rural garb. The wild nature of the colours and styles doubtless had its influence on the character of the party. There is no doubt but that a good time was had by all, even the spectators.

Here again the passing of time and the fading out of the orchestra had no effect on the party. Volunteers—and with considerable skill—laid the music on the line for what was really hours but seemed like minutes. The square dance was forgotten and in its place they substituted oval, elliptical, hexagonal, triangular and straight line patterns. It was a good party.

#### To the Committee

It is hardly necessary to say that the numerous committees were worthy of the thanks and con-

### Technical Sessions, Authors and Chairmen

**Right: C. J. Burke of Westinghouse Electric Corporation, Philadelphia, and M. F. Keith Leighton, chairman of the Moncton Branch.**

**Left, below: L. E. Mitchell, special projects engineer, Canadian National Railways, Montreal, and F. C. Morrison, chairman of the North Nova Scotia Branch.**

**Centre: Antony Vickers, executive director, Fluid Drive Engineering Co. Ltd., Middlesex, England, and R. E. Tweeddale, chairman of the Fredericton Branch.**

**Right, below: Dr. John Convey, director, Mines Branch, Department of Mines and Technical Surveys, Ottawa, and H. A. Marshall, councillor representing the Cape Breton Branch.**

gratulations which they received. Everything was planned carefully and carried out expertly. The Maritimes have proven again that the greatest natural resource of the area is people who know how to do things and who are not afraid to do them.

## "More Power to You"

When over 2,000 people stand for almost an hour and a half in the pouring rain, without shelter of any kind, to participate in an official opening of any kind, it is indeed a tribute. That is precisely what happened at Niagara Falls on August 30, when the Ontario Hydro's Sir Adam Beck Generating Station No. 2 was officially and formally "put on the line".

Ordinarily a heavy rain lasting all day is regarded by hydro power men as perfect weather, but on August 30, that kind of weather was just what was not wanted. An open air ceremony under such conditions has to be experienced to be appreciated.

However, in spite of the downpour, the ceremony was carried out as planned. Following the speech of chairman Robert H. Saunders, which opened the program, the Duchess of Kent, after delivering an excellent address, pushed the button, and wheels began to turn. True, the wheels were only mounted on the backdrop of the platform setting, but they did revolve. Accompanied by the roar from the P.A. system of a 100,000 horsepower generator getting under way, the whole effect was excellent, and impressive. It was well staged.

**R. L. Hearn, M.E.I.C., is general manager and chief engineer of Ontario Hydro. Sir Adam Beck No. 2 has been his principal interest for several years.**

The Sir Adam Beck No. 2 Station is really something of note. Its usefulness to Ontario will be tremendous. The addition of 1,828,000 horsepower to the province's resources, will have a most stimulating effect on industry. The total horsepower now developed by Ontario Hydro amounts to the staggering figure of 4,800,000.

This particular power development has in it much of special interest to an engineer and in particular a Canadian engineer, for this was an all-Canadian project. The plant was designed by Canadians, built by Canadians (mostly), financed by Canadians, and the power is for Canadians. It is a great tribute to Canadians, and is further proof of the oft expressed thought that Canadians can do practically everything there is to be done in Canada. It should do something to shake the beliefs of those who seem to think that a thing or an idea to be good, must be imported.

Already *The Engineering Journal* has published articles on this notable project* and arrangements have been made for publishing shortly the final and complete story, but it may be of interest to note here and now some of the general facts associated with this gigantic undertaking.

Cost figures are considered as one of several means by which to gauge the importance of a project. Sir Adam No. 2 cost $343,742,000. This

*Canadian Hydro Electric Developments on the Niagara River, Dr. R. L. Hearn, M.E.I.C., *Engineering Journal*, August, 1954.

Transmission Lines from the Canadian Niagara Developments, J. E. Sproule, M.E.I.C., *Engineering Journal*, August, 1954.

## Nominees for office

The report of the Nominating Committee, as accepted by Council at the meeting held on September 8th, 1954, is published herewith for the information of all corporate members as required by Sections 19 and 40 of the by-laws:

| | | |
|---|---|---|
| *President* | | |
| *Vice-Presidents* | | |
| *Zone A (Western Provinces) | R. M. Hardy | Edmonton |
| *Zone B (Province of Ontario) | M. A. Montgomery | Kitchener |
| *Zone C (Province of Quebec) | R. L. Dunsmore | Montreal |
| *Councillors* | | |
| †Newfoundland Branch | G. R. Jack | St. John's |
| †Corner Brook Branch | H. B. Carter | Corner Brook |
| †Prince Edward Island Branch | E. K. MacNutt | Charlottetown |
| †Halifax Branch | G. F. Bennett | Halifax |
| †Amherst Branch | L. E. Burrill | Amherst |
| †Saint John Branch | A. G. Watt | East Saint John |
| †Fredericton Branch | P. C. Levesque | Fredericton |
| †Saguenay Branch | B. L. Davis | Arvida |
| †St. Maurice Valley Branch | E. T. Buchanan | Shawinigan Falls |
| †Lower St. Lawrence Branch | L. P. Dancose | Mont Joli |
| †Eastern Townships Branch | G. J. Cote | Sherbrooke |
| §Montreal Branch | W. H. Gauvin | Montreal |
| | C. G. Kingsmill | Montreal |
| †Ottawa Branch | R. E. Hayes | Ottawa |
| †Brockville Branch | H. B. Brewer | Brockville |
| †Kingston Branch | H. G. Conn | Kingston |
| †Belleville Branch | S. Sillitoe | Belleville |
| †Port Hope Branch | G. T. Hunter, Jr. | Port Hope |
| ‡Toronto Branch | M. McMurray | Toronto |
| †London Branch | D. D. C. McGeachy | London |
| †Border Cities Branch | J. C. Aitkens | Windsor |
| | W. R. Mitchell | Walkerville |
| †Nipissing and Upper Ottawa Branch | G. L. Hood | North Bay |
| †Sudbury Branch | R. H. Moore | Falconbridge |
| †Lakehead Branch | G. S. Halter | Fort William |
| †Winnipeg Branch | C. V. Antenbring | Winnipeg |
| †Saskatchewan Branch | J. J. Schaeffer | Regina |
| †Edmonton Branch | E. K. Cumming | Edmonton |
| †Kootenay Branch | H. P. Hamilton | Trail |
| †Central British Columbia Branch | M. L. Wade | Kamloops |
| †Vancouver Branch | H. T. Libby | Vancouver |
| †Vancouver Island Branch | W. A. Bowman | Victoria |
| †Yukon Branch | M. C. Sutherland-Brown | Whitehorse |

*One vice-president to be elected for two years.
†One councillor to be elected for two years.
‡One councillor to be elected for three years.
§Two councillors to be elected for three years each.

**Gordon Mitchell, M.E.I.C., was project manager on the Sir Adam Beck Generating Station No. 2. Its successful completion left him free to go into the St. Lawrence Power Project as director for Ontario Hydro.**

places it alongside or just ahead of some other great industrial undertakings recently completed in Canada.

Ontario Hydro history shows that this is the fourteenth development to go into service since 1945. During the past eight years the Commission has raised its dependable peak capacity by 84 per cent. All these developments have brought the assets of the Commission up to $1,491,000,000, a really impressive figure.

A special word of appreciation and congratulation must go to Hydro's engineers. According to chairman Saunders the Hydro now has an engineering department of over 900. This would seem to make it the largest in Canada. In addition there are many engineers not in the engineering department, but employed in administrative work, from the general manager down.

To each and everyone of these, *The Engineering Journal* offers its congratulations on this, their greatest achievement. Individually and as a team they are outstanding. The profession is justly proud of them, and with them looks ahead to more and more achievements in the future.

# St. Lawrence Power and Seaway Project

## Inaugural Ceremonies

The official commencement of the long-awaited St. Lawrence River Power and Seaway Project marked the initiation of an undertaking which is likely to have far-reaching effects on the economy of both Canada and the United States for many decades to come.

Appropriately, the occasion took the form of "ground-breaking" ceremonies in the international section on both sides of the river near Cornwall, Ontario, and Massena, New York. On August 10, 1954, Governor Thomas E. Dewey of the State of New York pressed a button shortly after 11.00 a.m. to set off a charge of dynamite at the edge of Barnhart Island. He was assisted by Chairman Robert Moses of the New York State Power Authority and a large delegation from Canada was present along with many others from United States points.

Approximately one and one half hours later, the official party had moved to the Ontario Hydro Transformer Station some three miles west of Cornwall on Highway No. 2 for the Canadian ceremony. This is to be the location of the Ontario Hydro's new power plant and three sods of earth were turned to mark the occasion. Prime Minister Louis St. Laurent, Premier Leslie M. Frost of Ontario and Governor Dewey each participated in turn. Assisting at the ceremony were the Right Honourable C. D. Howe, Hon. M.E.I.C., Minister of Trade and Commerce and Minister of Defence Production; the Honourable Lionel Chevrier, president of the St. Lawrence Seaway Authority; General the Honourable A. G. L. McNaughton, M.E.I.C., chairman of the Canadian Section of the International Joint Commission; Mr. Moses; Lloyd Davis, chairman of the St. Lawrence Committee; Robert H. Saunders, chairman of the Hydro-Electric Power Commission of Ontario; the Honourable George H. Challies and W. Ross Strike, first and second vice-chairman respectively of the H.E.P.C.

During the course of the ceremonies, various speakers spoke at length in emphasizing the persistent efforts and close co-operation on the part of those individuals and governments in both the United States and Canada which had been necessary to bring about the actual commencement of this great international development.

Repeated mention was made of the long years which had passed since the project was first conceived. Some made reference to the forty years gone by since Ontario Hydro first began to study and survey the hydro-electric power potential of the St. Lawrence River between Prescott and Cornwall in 1913. Others spoke in terms of the thirty year period since the first report was submitted by Ontario Hydro to the International Joint Commission. Members of the Engineering Institute will be sorry to know that at no time was any reference made to the preachings and prophecies of that great engineer and philosopher, Thomas Coltrin Keefer, first president of The Engineering Institute of Canada who more than a hundred years ago visualized the St. Lawrence River as the highway which would carry the commerce of the world to the farthest ports of the Great Lakes, a thousand miles and more from the sea.

# The President Visits the Branches

For the first time in over twenty years, it is not planned this year that the president shall visit all the branches. With the number of branches now reaching forty-seven and with seven branch sections as well, the task has become practically impossible. For some time Council has recognized this situation, but it is only this year that the revised program has been agreed upon.

The idea is that the branches not visited one year will be included in the itinerary of the president for the following year. The pattern cannot be fixed too rigidly but it is evident to everyone that a scheme of this kind is necessary if the Institute is to continue to have at its head, leading representatives of industry, education and the profession.

President Stephens will do all his visiting over four short periods, none of them requiring him to be away from Winnipeg for more than two weeks at a time. Already one of the jaunts is over. Accompanied by Mrs. Stephens he attended the Maritime meeting at Digby. On the way there he visited Fredericton and on the way back he stopped at Moncton and Sherbrooke.

His next journey will be to the ASME-EIC conference at Potsdam, N.Y. on October 6, 7 and 8. He visits the Ottawa Branch on the

4th and the Brockville Branch on the 5th. The latter meeting will be a regional function shared in by the Kingston and Cornwall Branches. All these events are ahead as this is being written but they will be over before it is read.

In November he does the western areas. The branches visited will be at Winnipeg, Saskatoon, Edmonton, Lethbridge, Trail and Vancouver.

In February he does the balance of Ontario. The branches included in his itinerary are Belleville (including Port Hope and Peterborough), Toronto (including Huronia), Hamilton (including Niagara Falls and Kitchener). A meeting for members in Sarnia, Windsor, London and surrounding areas will be held in Chatham. This centre has been agreed upon because it is within reasonable distance of each branch.

To make this new plan effective it is necessary to have the support of the members. It is important that members of nearby branches attend the meeting when the president is in their neighbourhood. Only in this way can the new arrangement be satisfactory, both to the president and the Institute.

A feature of the president's visit this year will be a discussion with branch executives on the important subject of confederation. Council has asked the president to talk this over with the branches, and to gather together the opinions and the ideas of the members as he visits with them. Only in this way can Council and the committee be kept informed of the members' wishes.

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# Minutes of The E.I.C. Student Conference

## Chateau Frontenac, Quebec, May 11th, 1954

### Part 1 — General

Chairman: Mr. D. C. MacCallum, the chairman, opened the meeting at 9.30 a.m.

### 1. Roll Call

The following members of the Institute, delegates and observers were present:

Carl R. Johnson, University of British Columbia; James Tod, University of Alberta; Baine A. Holmlund, University of Saskatchewan; M. P. Schioler, University of Manitoba; Grant E. Sims, University of Manitoba; J. N. Rossall, University of Toronto; W. C. Moffatt, Royal Military College; J. D. Fowler, Queen's University; R. L. Wright, McGill University; Pierre DeGuise, Ecole Polytechnique; Claude Pouliot, Laval University; Eric C. MacNearney, Nova Scotia Technical College; C. C. Atkinson, University of New Brunswick; D. C. MacCallum, chairman; Col. T. F. Grant, field secretary; R. F. Shaw, J. B. Stirling, D. M. Stephens and R. L. Dobbin, senior counsellors.

### 2. Welcome from Institute Officers

The delegates were warmly welcomed by the new chairman of the Student Conference, D. C. MacCallum, and the outgoing chairman, R. F. Shaw.

### 3. Appointment of Secretary of Conference

The delegate from the University of B.C., C. R. Johnson, was appointed secretary for the Conference.

### 4. Appointment of Resolutions Committee

Resolutions Committee members appointed were: Claude Pouliot, Grant E. Sims, Eric C. MacNearney, J. N. Rossall.

### 5. Report on 1953 Resolutions

(a) 1953 resolution of one conference delegate acting as liaison officer for one year, for the E.I.C student section and the various engineering undergraduate societies, with regard to student news in the *Journal*—it had failed.

(b) 1953 resolution of desire to have exchange of information between universities (e.g. financial structures, activities, etc). It was done, but not too well supported.

#### Discussion on (a) and (b)

(i) C. Pouliot suggested that all information be sent to the General Secretary for publication in the *Journal*.

(ii) Colonel Grant agreed; and suggested cutting out articles and editing bits for the *Journal*.

(iii) A discussion followed.

(iv) Result: made same resolution.

(v) Delegates E. C. MacNearney and J. N. Rossall arrived.

(vi) Further discussion arose regarding the type of information to be sent out to each university by each of the other universities. Manitoba stressed their need for information on social functions. Jim Tod, Alberta, suggested that each delegate appoint a man in his respective organization to be responsible for sending any information.

Result was to form the same resolution.

(c) 1953 resolution regarding Unemployment Insurance.

(i) R. Wright reported that they could collect if the Unemployment Insurance Commission could not find work of an engineering nature after 5.00 p.m.

Regarding 1953 tax exemption resolution:

(ii) Pierre DeGuise suggested a $1,500 exemption.

(iii) Colonel Grant suggested it be an exemption on fees.

(iv) J. Rossall further suggested that the student be classed as a dependent regardless of age.

(v) Colonel Grant: exemption to include fees, instruments, books for all faculties.

(vi) Various methods of advertising the proposal followed, such as: students writing to their respective Members of Parliament, getting E.I.C. to write respective administrations of universities.

A new resolution was to be sought.

(vii) Arrival of Mr. Demers and Mr. Stirling.

(viii) Discussion with Mr. Demers regarding employment:

1. A decision between doing post-grad work vs. going into business was a personal one he stated.
2. Similarly with regard to consulting vs. research.
3. He stated: experience is best gained when you work a while outside your field.
4. How to become a consultant (personal decision). Few years in—
   (a) Public affairs,
   (b) Research,
   (c) Design.
5. Parting words for the new consultant: work without a final contract but be sure of your job.

(ix) Discussion with Mr. Stirling:

1. Canada — a good place to work.
2. Do all types of jobs in a plant (usually decided by the boss and is a rotation scheme).

**Part 2 — Employment Conditions**

1. Colonel Grant:
   (a) Employment good for grads; high starting salary but not a great increase in salary.
   (b) He emphasized the fault of students not punctually or even ever acknowledging an offer from a company. (It reflects poorly on all students as well as on the university.)
2. J. Rossall quoted similar breach of contracts by the employers. This astonished the senior members. Similar situations were voiced by Queen's and Manitoba.
3. Western universities voiced the poor job possibilities in their provinces (in certain fields).
4. Mr. R. Griffith (Federal Civil Service) gave a talk.
   (a) They cannot find enough engineers.
   (b) They are the biggest employer of engineers.
   (c) He commented on positions in the Patent Office.
   (d) Salaries were $300 a month for grads.
   (e) Conditions with them are to improve.

**Part 3 — The Institute and the University**

1. Note to the Resolutions Committee to publish our minutes.
2. Purpose of the Institute.
   (a) Exchange of engineering knowledge and the advantages of personal contacts.
3. Mr. Shaw spoke on relation between the E.I.C. and the Association.
   (a) E.I.C.: promotion of education, prestige in community.
   (b) Association: professional; it overlaps in the field of welfare with E.I.C.
   (c) The two are not competitive.
4. Colonel Grant:
   (a) E.I.C. is to fill in the gaps in education which are left in college, i.e., the social, philosophic, humanitarian, etc. "Make an engineer a man of parts."
5. Mr. Shaw — on counselling:
   (a) Concentrate on High Schools.
   (b) E.I.C. has had a committee working for two years on this problem.
   (c) Pamphlet "After High School Now What" distributed to American and Canadian Universities.
   (d) National Film Board has a film available — "Careers in Engineering Professions."
6. G. Sims — desired to have a published list of industrial men willing to give counsel.
7. General feeling among the seniors was to use the graduates more with regard to counselling.
8. G. Sims — expressed poor publicity of E.I.C. scholarships.
9. Colonel Grant: "Engineering is a creative profession and is not just Canadian."
10. C. Pouliot: desired French articles in the *Journal* as a worthy gesture. Everyone agreed and sincerely applauded his speech about the French in Quebec being as much Canadian as the people of other provinces.
11. Note to resolutions committee regarding French articles came from Colonel Grant.
12. Mr. MacCallum interrupted to ask that our enthusiasm be retained until fall and that we publish a personal report in our faculty paper.
13. Mr. Buchanan was introduced and he reminded us of the existence of the Harry Bennet Educational Fund.
14. Nominations for student chairman were called for. C. Pouliot and G. Sims were nominated — C. Pouliot won — applause.
15. R. Wright moved that the Resolutions Committee be responsible for further resolutions, seconded by M. Schioler.
16. Resolutions Committee to meet at 9.30 a.m. Wednesday, May 12th, Salon 2.
17. R. Wright moved a vote of thanks to C. Pouliot, all seconded it with applause.
18. A vote of sincere thanks and deep appreciation was made by E. MacNearney to the E.I.C., which was seconded by J. Rossall — the ensuing applause adjourned the meeting.

C. R. Johnson,
Secretary 1954.

**Resolutions made and passed by the Student Delegates to the 1954 Conference in Quebec, Que.**

1. RESOLVED that this Conference request E.I.C. headquarters to appoint a co-ordinator who will contact local branches to make available to the Undergraduate Engineering Students a suitable counsellor through a local liaison.
2. RESOLVED that each delegate of this Conference be responsible for the mailing of any student publications (such as: handbooks, newspapers, financial statements, constitutions, etc.) to each undergraduate society. n.b. a report on social activities.
3. RESOLVED that immediate steps be taken to have university student fees made deductible from taxable income and that the following actions be taken:
   (a) The E.I.C. be requested to approach the proper authorities to endeavour to carry out the foregoing aims.
   (b) The E.I.C. be requested to obtain the support and assistance of the university administrative bodies.
   (c) The delegates of the Conference approach the student government at their respective universities for support.
   (d) The delegates of this Conference initiate a letter writing campaign on their campus to their Members of Parliament.
4. RESOLVED that the E.I.C. be requested to continue distributing one free copy of the *Journal* to all students in one undergraduate year; and in order to stimulate interest in the Institute, the Conference recommends that this issue:
   (a) Contain a summary of the minutes and resolutions of this Student Conference, and any other material of student interest such as the counselling service and loan fund and scholarships.
   (b) Contain a letter from the President of the E.I.C. to the students.
   (c) Be distributed by the first of November so that the membership campaign can be conducted before the pressure of studies becomes too great.
5. RESOLVED that in order to create a better understanding between Canadian cultures, the Conference recommends to the E.I.C. that more French language papers be published in the *Journal.*

# Recognition from the Press

The following quotation is from the lead editorial in the *Globe and Mail* of August 31. Not often have Canadian newspapers so clearly and emphatically patted Canadian engineers on the back. The paper's recognition of the achievements of Canadians is very gratifying, and engineers across the Dominion will be grateful for it.

**Engineering Triumph**

The formal opening by the Duchess of Kent of the giant Sir

Adam Beck Generating Station heralds the approaching completion of one of the greatest engineering works ever constructed in Canada. Superlatives are themselves inadequate to describe the scale of the project. Although the actual amount of electricity to be generated has been matched elsewhere, nothing so large has been built by the Hydro-Electric Power Commission of Ontario. In many respects, as an engineering feat, the project outstrips even the St. Lawrence power development.

The most gratifying aspect of this great achievement is that the planning has been the work of Canadian engineers. Beyond question, from now on Canadian professional competence in this field will be recognized as equal to the best anywhere and henceforth any similar work through the world will pay its tribute through the flattery of imitation. Some astonishingly ingenious inventions and discoveries have been worked out by these engineers in mastering the problems which the project presented. The nation is proud to commend them.

# Correspondence

**Report from Pakistan**

Dear Mr. Editor:

I am sorry that I have not written to the Institute Headquarters before this date to send along my annual subscription.

Since mid-December I have been back to London, England, from a Food and Agricultural Organization assignment in Ceylon; now I have taken on a two year contract with the Department of Trade and Commerce under Colombo Plan to act as field service engineer with the Department of Agriculture of the Government of Sind. My location will be in the Hyderabad, Sind, area where summer temperatures go as high as 120 degrees.

**British Machinery**

While I was in Britain waiting for the Department to produce the contract I managed to spend some time at my own expense visiting factories, agricultural machinery testing stations, and meetings of the Institutions of British Agricultural Engineers. The day's visit to the Ford Co. plant at Dagenham to see the New Fordson Major tractors and Consul and Zephyr cars being built was an eye-opener. I had a quick look through the Oshawa G.M. plant in 1936, so it was not my first visit to an automobile plant. I was very interested in the "runing-in" process for the Diesel, petrol and vaporizing oil engines before they are installed in the frames, as we had had trouble in Ceylon with a large batch of another make of tractor which had developed cylinder head gasket trouble at about 190 hours on about every third machine.

Then there was the visit to the Harry Ferguson organization at Coventry (which is now part of the Massey-Harris-Ferguson Co.); I saw the famous Stoneleigh Abbey Training School for tractor operators and instructors, and the Banner Lane factory of Standard Motor Co., which can turn out up to 350 tractors a day. Though British factory management has been criticized in the past for having less installed horsepower per worker as compared to Canadian and American factories, I think that that discrepancy is being overcome.

I went on up to see the Massey-Harris factory which is being enlarged on a trading estate site outside of Kilmarnock. The tractor production there consists of less direct manufacturing and more assembling of purchased parts.

Another up-and-coming company is the Rotary Hoe organization of Horndon, Essex. They are selling their products very admirably in the American market. Their new and extra factory at Basildon, nearby, will be as modern as any I have seen in Canada. Though there is less mass-production than in Canadian or American factories, it must be realized that for every article or farm machine that can be produced in the 1,000s, there are many very essential machines that are only needed in the 100s or 50s each year. That is where such small companies like Rotary Hoes take over where the mighty Ford organization fears to tread. It is better to market a semicustom-built machine that a few farmers need and will willingly pay for than a multipurpose machine that gets cluttered up with gadgets and extras for every particular job.

**Government Research**

The most intriguing place to visit was the National Institute of Agricultural Engineering, Silsoe, Beds., between Luton and Bedford; it is the government sponsored testing and research station, and it has an excellent library, tractor-testing facilities and laboratories. The hydraulic-propulsion agricultural tractor, was being readied for its field trials when the cold weather abated. This machine, with its simple single control, which controls the travel forward and reverse direction, may be the most significant advance in tractor design since an internal combustion engine was coupled to a standard gear transmission and differential many years ago.

Though mechanization of agriculture started in Britain after it started in America and Canada, it has made great strides since the war, and the future looks good with such an institute as this to lead in fundamental and even practical research. I visited its sister institution in Scotland, the Scottish Machinery Testing Station, at Mid Calder, near Edinburgh. There is nothing to compare with Silsoe in Canada or the U.S.A., for the American visitors who have seen the Beltsville, Md., installations of the U.S.D.A. have made that comment. It is even proposed to branch out to study the machinery and equipment requirements in tropical and arid areas, so that British manufacturers can use the information and expand their sales into colonial and foreign markets. Small manufacturers use the Institute for secret tests if they cannot employ their own staff.

**How Canada is Affected**

As I had to make up tool and equipment purchasing lists on two occasions in Ceylon, and am assisting American advisers to compile a tool and equipment list for a workshop here, I have studied the problem of marketing and selling machinery in this country, and especially how Canada is affected.

First of all, more cotton, jute, hides, and furs (karakul and "persian lamb" types) will have to be purchased by Canadian manufacturers before other companies can export back here. In my line of work there is a large demand for heavy crawler tractors, but only Britain, the U.S.A. and Italy are the manufacturing countries. A really more important item is Diesel engine fuel injection test equipment and electrical automotive testing equipment, but there again Britain and the U.S.A. are the only manufacturers. A great deal of money has been spent on large North American cars but the garages are poorly equipped and managed. Automotive equipment will be the main way of opening up large areas of this country as we all know that railroad costs of construction are very prohibitive. Diesel buses have exhaust fumes like coal burners!

**No Tear Shed on Engineer Shortage**

I have noticed that once again the Institute is making press releases to the extent that Canada is not training enough young engineers. For Canada's future the prospects of a shortage of engineers may be an urgent problem, but I cannot shed a tear for those companies who cannot get enough young men; my problem has been that, even if you have studied at the nation's expense under D.V.A., and have served in the Armed Forces for five years, if you have reached the age of forty you are not wanted. Massey-Harris in 1948 when I was 35 said I was too old, and I.H.C. of Hamilton said the same in 1952. That is why I am overseas trying to get experience which will cause some company to ask me to join them; perhaps that will eliminate the snobbish attitude that I have noticed in most personnel employment offices.

**Specialization a Drawback**

I have often regretted that I took the specialized option of Agricultural Engineering; though the course consists of basic Mechanical and Civil Engineering, many prospective employers seem to swallow hard on the word "agricultural" irrespective of whether I tell them that I attended a College of Engineering or not. Perhaps it would be better to advise all these hordes of young fellows who will flood the engineering colleges that they should take one of the major branches, such as Mechanical, Civil, Electrical or Mining, and forget about such offshoots as Agricultural, Aeronautical, Engineering Physics, or Petroleum Engineering. Then they will be able to change companies in future years without too much trouble. Around the University of Saskatchewan in the 1945-49 period many young fellows direct from country high schools came to Saskatoon and wanted to be chemical engineers, or engineering physicists. They could not keep up the high standard required and eventually ended up as just plain civil or mechanical engineers.

**Needless Export of Experts**

Out here there are about five times as many law college students as engineering students. I met one engineer working for the Sind Public Works Dept. who wanted to travel to Canada to study for his doctorate in engineering. I advised him to travel to Canada, either under government or private sponsorship, and work for a construction company or architect for two or three years, and then return to Pakistan to form his own company, as I know he has money. In that way he could demonstrate new ways of building houses, government buildings or roads and still make a good living. Why should technical experts come to Pakistan to train people, when engineers from here want to settle in Canada!

Hugh A. Templeton, jr.e.i.c.
Karachi, Pakistan

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# Utilization of Engineering Manpower

An interesting report recently appeared about a week-long conference on the development and utilization of the services of three types of professional workers in the United States—engineers, medical personnel and the teaching profession. The conference, convened by the National Manpower Council, was held in October of 1953 on the Harriman Campus of Columbia University.

The sessions, held in three panels, were designed to focus attention upon manpower problems and practices in the fields to be covered, specifically with a view to evolving any helpful suggestions for the future. The meeting proceeded from acceptance of the point of view that to some extent there are present shortages of engineering, medical and teaching personnel in the country; but developing shortages, given a continuance of present trends, threaten an eventual problem of considerable magnitude unless timely measures are taken to obviate such a situation.

The stage was set for the engineering working group discussion by posing five questions basic to a fresh study of the future demand for engineers. These were: (1) has the ratio of workers to engineers stopped declining since 1950; (2) has there been a marked increase in trained technicians; (3) will new defence plants need fewer engineers; (4) will declining Federal research costs release more engineers and scientists and (5) what is the outlook for industry?

The report of the engineering working group cited twelve points on utilization to which the engineers agreed. The full Conference reaffirmed the importance of two themes of this report. One is that better utilization requires a consideration of the whole man or woman, off the job as well as on. The second is the need of cooperation between the engineering profession and the education world to provide that exchange of men and knowledge which is needed by both the universities and industry.

The Proceedings, published by the Columbia University Press, report the three phases of the Conference. The discussions centered around conditions in the United States, but are not without significance when applied to conditions in Canada.

# *Thirty-five Years Ago*

Comment on the *JOURNAL* of October 1919

The fifth general professional meeting of the Institute was held in Saint John, N.B., on September 10, 11 and 12, 1919. The *Journal* for the following October is naturally almost entirely devoted to accounts of what went on at this meeting and to the publication of some of the papers presented there.

Registration was 106, all, with few exceptions, from the Maritime Provinces. This figure included members and guests, of whom three or four came from across the line in Maine and one from as far away as Boston. We notice the name of one member from Windsor, Ont.; he seems to have travelled the farthest. The Institute had not as yet developed a thoroughly national character; its members were still inclined to think in terms of their own immediate environments.

Not much Institute business was transacted at this meeting; it was given over to papers and to limited social functions. The Institute's committee to investigate the action of sea water on concrete reported, regretting that it had not been able to accomplish much on account of the short time since its appointment and that "no replies or expressions of opinion" had been received from queries it had addressed "to various engineers stationed in Nova Scotia." It had therefore drawn up a "report based on the experience and opinions of its members." The general conclusion, qualified in some particulars, was "that the chemical action of sea water on mass concrete . . . is not serious in itself . . . (but) the belief that a reinforced concrete marine structure will require little or no maintenance does not . . . appear to be fully warranted . . ."

The social side was not entirely neglected at this meeting in Saint John. "Muriel" and her "room" had not then appeared, of course, so there was little to tempt members to stay away from the presentation of papers. The ladies were completely ignored; for all one can gather to the contrary, the meeting was a congress of bachelors.

The Saint John Board of Trade lent its rooms for the meeting and entertained those present at luncheon one day. Another luncheon was tendered visiting members by the Saint John Branch. A visit was paid to the Courtenay Bay harbour works, then under construction. The contractors, the Bedford Construction Co., Ltd., provided lunch: "In a dining hall especially constructed for the occasion, surrounded by evergreens and having at one end a beautifully arranged design in sweet peas bearing the letters 'E.I.C.', about one hundred men sat down to a well appointed banquet which would have done credit to the chef of a modern hotel."

#### Council Supports Legislation

At its meeting of September 23, 1919, Council resolved "that the Council will further in every way the desire of the members regarding legislation, and inasmuch as the actual application of such legislation is in the hands of the engineers in each province, it is desirable that the branches and provincial divisions in co-operation with other engineering organizations in each province, take the initiative . . . in which they are assured of the moral support of the Institute." The Saint John Branch did not wait for this go-ahead signal. It had sponsored a meeting on September 12 of all engineers in New Brunswick to form an association of professional engineers, to present the model act with slight modification to the provincial legislature and to ask for its enactment, and to locate the headquarters of the organization in Saint John. The Halifax Branch was also becoming active in much the same way. These were the first concrete results of the long period of study and discussion of legislation for engineers initiated and carried out by the Institute.

It was reported that the Civil Service bill, which would improve the working conditions of engineers in the federal government, had been so thoroughly criticised that its classifications were being "fifty per cent" rewritten. Council's advice to some impatient members was "to refrain from expressing any personal dissatisfaction . . . in order that the bill may be passed and that their individual cases can be considered by the machinery provided."

Halifax was the only branch reporting in this issue and most of its report was given over to the remarks of its chairman on the occasion of the then recent visit of H.R.H. the Prince of Wales to the Studley Quoit Club. Who says that engineers are without civic consciousness or social graces?

Seeing that the matter of legislation had been disposed of for the time being by the resolution already quoted, and that progress was being made with the Civil Service reclassification, Council found little of much importance on the agenda of its two meetings in September, 1919. It was noted "with pleasure" that the Canadian National Railways had adopted the Institute's standard specifications for portland cement. It voted to present a gold Institute badge, "engraved for presentation" to each honorary member. It appointed Brig.-Gen. Sir Alexander Bertram as treasurer of the Institute; the October *Journal* carried his portrait and an announcement of his appointment. A rumour that "road work" in British Columbia was to be undertaken by a "prominent politician" without engineering help was also noted, but nothing was done because "no direct word had yet been received from either of the branches in British Columbia" regarding the matter.

#### Technical Papers

The nine papers which appeared in this *Journal* were all presented at the Saint John meeting just past. They dealt with a variety of subjects; the day of the planned program limited to various aspects of one or two topics had not yet arrived. The stabilization of beaches and dunes by planting grass, forestry in New Brunswick, the water powers of the same province, a tidal power development scheme on the Petitcodiac and Memramcook rivers, the new Bear River bridge of the Dominion Atlantic Ry., high-frequency apparatus, telephone cables and the problems of Canadian military engineers in France all came in for attention.

Most of these papers are of little interest today. "Usefulness of Vegetation in Maritime Engineering" was an exception. Though E. T. P. Shewen, its author, was brief, what he said is still useful. "The Water Powers of New Brunswick" was really an informal report of what had been accomplished by the province's power commission in the first year of its life. The author, C. O. Foss, M.E.I.C., was chairman of the commission. R. F. Armstrong's paper on the work of our military engineers in France was most readable, made so by homely touches: "The Germans had large dumps of . . . bridging timbers and with these . . . many bridges were constructed, the Canadian sapper being very much in his element with a cross-cut saw, squared timber and spikes, a welcome change from . . . pick and shovel work."

Looking through the news items and the personals, we note that the Nova Scotia Water Power Commission had just been organized, with K. H. Smith, A.M.E.I.C., as chief engineer and acting secretary, that the Canadian Engineering Standards Association "is beginning to exercise the influence . . . (that it was) hoped it would", by appointing new committees. Mr. C. LeMaistre, secretary of the British Engineering Standards Association, was then on a visit to Canada and asked for the C.E.S.A.'s co-operation in "obtaining some degree of Anglo-American agreement as to screw thread standards." He got the co-operation, but it took another world war to get any agreement on standards.

The war had raised hob with the Institute's membership rolls, so the *Journal* published two pages of names of "lost" members. All of us would recognize among them the names of some who have since become prominent in one way or another; the writer found twenty-odd without half trying.

We also find that Dr. F. D. Adams was acting as principal of McGill University until Sir Eric Geddes could take over the post. Actually, he never did, as he was appointed British Ambassador to Washington and never returned to

Canada. Portraits of R. S. L. Wilson, later dean of the engineering faculty at the University of Alberta, and of S. J. Hungerford, later president of the Canadian National Railways, appeared.

The few employment notices followed the usual line. Quite inadequate salaries by any standard were being offered, e.g., $3,000 for an electrical engineer with long executive experience and $1,040 for a junior mechanical draughtsman.

"And so to bed."

## Elections and Transfers

At the meeting of Council held at The Pines, Digby, N.S., on Wednesday, September 8, 1954, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

*Members*

G. J. W. Baker, *Vancouver*
P. A. Benn, *Montreal*
C. G. Campbell, *Calgary*
J. A. Chalmers, *Ottawa*
G. E. Crippen, *Vancouver*
E. H. Dithridge, *Port Hope*
E. F. Foord, *Montreal*
D. Fulton, *Montreal*
W. G. Huber, *Vancouver*
H. R. Jorgensen, *Winnipeg*
P. Kubilius, *Montreal*
R. R. Lloyd, *Montreal*
A. M. H. Norris, *Windsor, N.S.*
J. H. Redding, *Norfolk, Eng.*
A. B. Whelan, *Montreal*
C. A. Wright, *Montreal*

*Juniors*

J. H. Allen, *Montreal*
V. G. Barnden, *Montreal*
L. C. Cossette, *Montreal*
F. W. Orlando, *Montreal*
S. F. Smith, *Valleyfield*
H. S. Watson, *Montreal*
J. A. Waugh, *Amherst, N.S.*

*Transferred from the class of Junior to that of Member*

K. Barlow, *Vancouver*
A. Blauer, *Montreal*
D. F. Coates, *Montreal*
D. G. Dunbar, *Vancouver*
R. W. McKnight, *Winnipeg*
G. F. McLean, *Montreal*
W. E. Mulholland, *Windsor*

*Transferred from the class of Student to that of Junior*

M. Lacroix, *Quebec*

*The following Students were admitted*

W. W. Brown, *Hamilton, B.Sc., Queen's 1954*
R. M. Francis, *Montreal, Student C.P.E.Q.*
J. D. Koppernoes, *Halifax, N.S.T.C.*
J. L. Lemay, *Three Rivers, B.Eng., N.S.T.C., 1954*
H. O'Beirne, *Toronto, B.A. Cambridge 1953*
B. S. Sheehan, *Halifax, St. Mary's University*
F. B. Stankiewicz, *Sarnia, Student Ontario Assn.*
W. S. Zawadzinski, *Toronto, B.Sc., Eng., Polish Univ. Coll. 1954*

**Applications through Associations:**

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

ALBERTA

*Juniors*

B. M. Dafoe
H. M. MacKay
J. M. Willsher

*Junior to Member*

J. C. D. Mallet-Paret

*Student to Junior*

D. A. Carlson

## News of Other Societies

**University of Toronto Engineering Alumni** are meeting on October 29-31, in Toronto for the 1954 triennial reunion.

"Highways for Tomorrow" will be the theme of the 1954 convention of the **Canadian Good Roads Association** (270 Maclaren Street, Ottawa) at the Royal York Hotel, Toronto, November 8-10.

The program will include again the "Roads Round-up", at which federal, provincial and municipal highway ministers and engineers report on the progress of road building and maintenance; and a general session on "Factors in Long-Range Planning".

The annual meeting of the **American Institute of Chemical Engineers** (120 East 41st Street, New York City 17, N.Y.) will be in New York City, at the Statler Hotel, December 12-15, 1954.

The 21st national exposition of power and mechanical engineering will take place at the Commercial Museum in Philadelphia, December 2-7, under the auspices of the **American Society of Mechanical Engineers.**

For this technical and professional show admission is by invitation and registration. The International Exposition Company (480 Lexington Ave., New York, 17, N.Y.) is managing the Power Show.

The 62nd annual meeting of the **Society of Naval Architects and Marine Engineers** (74 Trinity Place, New York 6, N.Y.) will be held at the Waldorf-Astoria Hotel, New York City, on November 12 and 13, 1954.

**The Society of the Plastics Industry Inc.** (67 West 44th Street, New York 36, N.Y.) will hold the thirteenth SPI Canadian conference on February 22-23, at the Hotel London, London, Ontario.

Norman L. Mochel, manager, metallurgical engineering, Westinghouse Electric Corporation, Philadelphia, is the president of the **American Society for Testing Materials** for the year 1954-55.

Duncan M. Jones, Eastern Canada representative of Curtis Lighting of Canada Limited, Montreal, recently was elected president of the **Illuminating Engineering Society.**

At the recent annual meeting of the **Canadian Management Council,** A. M. Mackenzie, M.E.-I.C., vice-president of the Bell Telephone Company, was elected president. The vice-president is C. T. MacKenzie, of the Treasury Department of T. Eaton Company; J. A. Coote, M.E.I.C., chairman of the Institute of Administration is secretary and P. W. Wright, of Shawinigan Chemicals Limited, is treasurer.

Assisting these officers in the work of the Council there will be C. A. Peachey, M.E.I.C., past-president, and the following directors: J. G. Campbell, S. M. Gossage, Bruce A. C. Hills, M.E.I.C., E. B. Jubien, M.E.I.C., F. R. Manuel, M.E.I.C., and John Walters.

**The 69th Annual Meeting**

*of*

THE ENGINEERING INSTITUTE OF CANADA, TORONTO, ONT.

ROYAL YORK HOTEL, MAY 11, 12, 13, 1955

# NEWS OF THE ASSOCIATIONS & CORPORATION

Information received through co-operation with the provincial organizations

## Quebec

### Results of Salary Surveys for Graduating Engineers

The annual Salary Survey of the 1954 graduating classes in engineering at McGill and Ecole Polytechnique revealed that initial salaries in the spring of this year were still on the upgrade.

The median salary for 1954 graduates was $310. per month at both universities, and the average salary was $314. per month at McGill and $316. per month at Polytechnique.

The highest average salaries were paid to metallurgical and mining graduates, with chemical, civil, mechanical and electrical following in that order.

The comparable figures from the 1953 survey, which were published in the November 1953 issue of the Bulletin, were $300. per month for the median salary and $301. per month and $307. per month for the average salary.

Of considerable interest is the fact that placement salaries for new engineering graduates released by the National Employment Service, technical division, gave an average of $314. per month.

### Quebec Now Has Five Universities

The Corporation of Professional Engineers of Quebec is very happy to hail the birth of a fifth university in the Province of Quebec. It is particularly pleased to do so since the new institution, Sherbrooke University in the Eastern Townships, has, at its very beginning, established an engineering school within its Faculty of Science.

One hundred and twenty-four students have already registered in engineering for the 1954-1955 session. The three first years of the courses will be offered initially with the more advanced courses being organized later on as laboratories and apparatuses are installed.

The four existing universities of Quebec are: Laval in Quebec City, McGill and Montreal (whose school of engineering is called Ecole Polytechnique) in Montreal and Bishop's in Lennoxville. The first three named offer excellent five year courses in all major branches of engineering.

The provincial government has created this new university in the knowledge that by so doing it will provide the population of the Eastern Townships with a more convenient means of attaining to a higher education.

### Evening Courses for Montreal Engineers

For the past several years McGill University has offered a valuable educational service to graduate engineering students through their post graduate evening extension courses. They have also offered a number of undergraduate courses in engineering subjects, and in many cases these courses could be applied towards the qualifying examinations for membership in the Corporation of Professional Engineers of Quebec.

Through the co-operative efforts of the Corporation and McGill University, there has been a movement towards making the extension courses more directly applicable to the requirements of the C.P.E.Q. examinations. This year some of the elementary mathematics and engineering courses have been especially designed to assist persons who are working towards qualifying themselves as professional engineers through written examinations.

The Corporation has also conferred and co-operated with Ecole Polytechnique who are offering evening courses in engineering subjects for the first time this year. Similar courses have been in operation at Laval University in Quebec for two years.

The Corporation is particularly happy that qualified engineers are thus afforded the opportunity to improve and enlarge their technical knowledge under the guidance of recognized leaders in the various branches of engineering technology. All professional engineers are urged to avail themselves of these opportunities to increase their knowledge and advance the standards of the engineering profession.

The assistance given to members qualifying for the C.P.E.Q. examinations is also commendable. While we believe that there is no substitute for a regular engineering undergraduate education, there are those who find such a course impossible, and for those persons the advantage of skilled guidance through the university extension courses is strongly recommended.

### List of Members

The Corporation has just issued its annual list of members. The names of all professional engineers authorized to practise their profession in the Province of Quebec are recorded therein with an indication of their function, employer, university graduation and addresses. Copies may be had from the Corporation's headquarters, 1290 St. Denis Street, Montreal.

## Ontario

### Sales Manager, Ontario District

G. B. Hunnisett, of Packard Electric Co. Ltd., of St. Catharines, has been recently appointed Ontario district sales manager of the company.

He joined the company upon graduation in electrical engineering from the University of Toronto in 1939 and prior to his recent promotion was Toronto area manager.

### Staff Changes at C.G.E.

Three members are affected by a realignment of responsibilities within the electronic equipment department of the Canadian General Electric Co. Ltd., Toronto. Henry S. Dawson, is named manager—engineering; David H. Johnston, manager — manufacturing; and James R. Warren, manager—marketing.

Prior to joining the company in 1948 H. S. Dawson had a wide experience in research, as chief engineer of CRFB Toronto, assistant chief engineer of Research Enterprises and as general manager of the Canadian Association of Broadcasters. Latterly he has been manager of product planning and defence co-ordination in the electronic equipment department of C.G.E.

Mr. Johnston joined the company in 1947 and for five years was in sales and product planning work on mobile communication, broadcast and television. His recent position was manager of the manufacturing subsection of the electronic equipment department.

Mr. Warren likewise joined the company in 1947 and the following year was made manager of the transmitter division, Royce Works. For the past two years he has been manager of manufacturing and engineering in the electronic equipment department.

### Dr. D. R. Derry

Dr. D. R. Derry, of Toronto, who was formerly the chief geologist of Ventures Ltd., and is a Member of Council of the Association, has been made executive vice-president of Rio Canadian

Exploration Ltd., Toronto. This company succeeds Ownamin Ltd., of London, England, and Segemines Ltd., the Canadian company which is associated with the Belgian group of Societe Generale de Belgique. Dr. E. B. Gillanders, who was manager of Ownamin Ltd., is vice-president of Rio Canadian Exploration Ltd.

### Art Show

An innovation at the Canadian National Exhibition at Toronto this year was an exhibit of paintings by members of the various professions. This "Amateur Art Show" formed a part of the Fine Arts Display and included pictures by professional engineers, architects, lawyers, educators, ministers, doctors and pharmacists. In all over one hundred entries of the foregoing professions were on display. The Associations entries were the result of the fine job done by the Committee comprising R. C. Poulter, P. J. Croft, and J. R. Cavanagh.

The comments of the various art critics of the Toronto press indicate the warm reception accorded this new venture of the Art Committee of C.N.E., whose chairman is Col. Mackenzie Waters, F.R.A.I.C., and the probability of similar exhibits in succeeding years.

In practically all pictures entered adherence to conventionalism was the "school" and people and places the subjects. Those of the Association of Professional Engineers whose work was shown included Gordon Alison; G. E. Booth; W. R. Carruthers; J. R. Cavanagh; P. J. Croft; Dr. D. R. Derry; Dr. O. W. Ellis; P. W. Geldard W. J. Gibson; A. V. Grundmanis; H. H. Leeming; E. C. Little; Prof. J. W. Melson; F. Aimeer; A. L. Ross A. Russell; Dr. K. R. Rybka; H. Teekman; M. B. Watson; Dr. C. R. Young.

### To Indo-China

Lieut. Col. A. L. Maclean has been appointed to the International Supervisory Commission and has left for Indo-China. It is expected that he will be away from Canada for about a year, during which time he will be working as part of the Canadian Military Truce Team. His promotion to the rank of Lieutenant-Colonel coincided with the above appointment.

A graduate in metallurgy of the University of Toronto, he served with R.C.E.M.E. in England and on the Continent during World War 2.

Latterly he was a staff officer with R.C.E.M.E. at Canadian Army Headquarters at Ottawa.

### U. of T. Engineering Alumni Reunion

Final details are rapidly being completed for the October 29, 30, and 31 University of Toronto Engineering Alumni Triennial Reunion and already advance registration indicates a record attendance.

On Friday morning, October 29, delegates to the Reunion will have an opportunity of going behind the scenes at Toronto's Union Station. Included will be a general tour of the Station facilities, visits to the switching control tower, and the steam plant. It is also expected that a new diesel engine will be available for inspection.

All main events of the 15th Triennial Reunion will be held at the Royal York Hotel. Further information can be obtained from the Reunion Office, Suite 301, 73 King Street West, Toronto. The chairman in charge of all events for this 15th Triennial Reunion is J. D. Breithaupt, of Page-Hersey Tubes Ltd., Toronto.

## Manitoba

### Golf Tournament

The final round of the Association of Professional Engineers of Manitoba, annual golf tournament, was held on Thursday afternoon, September 2, at Elmhurst Country Club. The turnout, according to J. Sill, golf chairman, was the largest in many years.

At the dinner afterwards several prizes were distributed and the winner of the coveted Sullivan cup, donated by the late J. G. Sullivan, was R. D. Cahoon, prairie regional engineer for the Canadian Broadcasting Corporation, who turned in the low net score. The cup was presented to Mr. Cahoon by D. M. Stephens, president of the Engineering Institute of Canada. Other prize winners were: low gross—E. H. Chippendale; high hidden hole—R. N. Sharpe; low hidden hole—R. M. Gordon.

The Association is grateful to the following firms for donations of prizes and active participation in the tournament: Armco Drainage and Metal Products of Canada Ltd., Westeel Products Ltd., Harris Construction Co. Ltd., Building Products and Coal Co. Ltd., McCurdy Supply Co. Ltd., Bird Construction Co. Ltd., and Commonwealth Construction Co. Ltd.

## British Columbia

### B.C. Municipal Engineers' Convention

More than 200 delegates attended the B.C. Municipal Engineers' Convention in Kelowna, September 16 to 18, including representatives of cities and municipalities throughout British Columbia.

Highlighting the all round participation of professional engineers in community development was the paper on "The City Engineer's position in Civil Administration" presented by W. C. Miller, city engineer of St. Thomas, Ontario, and first president of the City Engineers' Association.

Technical subjects included papers on "Sewage Treatment" by N. J. Goode, of the B.C. Department of Health and Welfare; "Streets and Sidewalks" by R. M. Martin, Vancouver's assistant city engineer; "Town Plan of Penticton" by J. A. Walker, and "External Corrosion" by H. T. Libby, of the B.C. Electric Co.

The Hon. P. A. Gaglardi, Minister of Public Works for B.C., was guest speaker at the annual banquet in the Royal Anne Hotel. Mayor J. J. Ladd extended to the delegates the official welcome of the City of Kelowna.

The social program specially for the ladies included a morning "Koffee Klatch", an afternoon tea, and a smorgasbord dinner.

### Engineers in the News

The appointment of **J. H. Salter** to the newly created position of general superintendent, Chemicals and Fertilizers Division, was announced recently by R. D. Perry, general manager of The Consolidated Mining and Smelting Company of Canada Limited. In his new position Mr. Salter is directly responsible to the manager of the division, E. A. G. Colls. The appointment became effective September 1.

**G. F. Winterburn,** has just returned from a four months vacation motoring through ten of the European countries. He is now employed by the Canadian Comstock Company as estimator.

**L. W. Wight,** assistant manager, Nanaimo-Duncan Power District, B.C. Power Commission is now a member of the Nanaimo School Board.

**B. Finerty** who has been with B.C. International Engineering at Kemano has accepted a position with B. D. Bohna, J. L. Miller & Company.

**G. Sanders,** has received an appointment with the B.C. Department of Public Works as district engineer at Golden, B.C. He was formerly assistant municipal engineer at Kitimat, B.C.

The Editor

cordially invites discussion

on papers appearing in the

*Journal*

# THE ENGINEERING INSTITUTE OF CANADA

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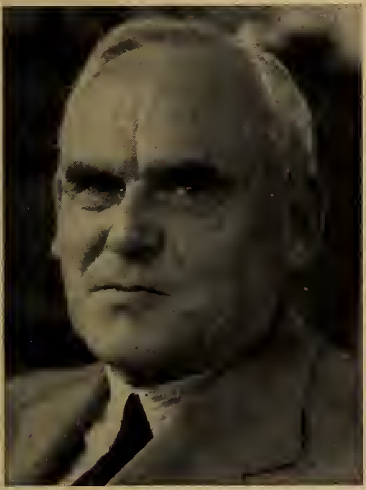
# *Personals*

## News of the Personal Activities of Members of the Institute

**Rt. Hon. C. D. Howe,** HON. M.E.I.C., minister of trade and commerce and minister of defence production, was awarded the Daniel Guggenheim Medal on October 8 at the session of the National Aeronautic meeting of the Society of Automotive Engineers which sponsors the award jointly with the American Society of Mechanical Engineers and the Institute of the Aeronautical Sciences.



**The Right Hon. C. D. Howe, Hon.M.E.I.C.**

Mr. Howe has been so honoured for "initiating and organizing commercial air routes and services, promoting aeronautical research, development and production of aircraft and engines, and advancing the art of aeronautics."

A native of Waltham, Mass., and a 1907 civil engineering graduate of the Massachusetts Institute of Technology, Mr. Howe has served as a cabinet minister since 1935 and has been responsible for most of the Canadian developments in aviation. To him goes the credit for organizing the ground and operating services for Canada's first trans-continental air route and for founding the government-owned Trans-Canada Air Lines.

As minister of munitions and supply during World War II, he supervised the growth of Canada's aircraft industry from 200 planes per year to 4,000 planes per year. As postwar minister of reconstruction, he saw to it that government-owned companies were turned over to private industry on terms insuring a continuing aircraft industry.

His position as minister of trade and commerce makes him chairman of the Privy Council on Scientific and Industrial Research, which has responsibility for a number of government aeronautical laboratories.

He has received the Herbert Hoover Medal awarded jointly by four leading American engineering societies, and the Order of Merit of the United States. As a recipient of the Guggenheim Medal, he joins the company of such earlier medalists as Orville Wright, Donald Douglas, James H. Doolittle, **Sir Frank Whittle,** HON. M.E.I.C., Igor Sikorsky, and Charles Lindbergh.

**A. C. Crepeau,** M.E.I.C., who was recently awarded an honorary doctor's degree from Laval University, has been appointed dean of the faculty of science of the new University of Sherbrooke.

Dean Crepeau has had for many years his private practice as consulting engineer in Sherbrooke.

**Gordon Mitchell,** M.C., M.E.I.C., project manager of Ontario Hydro's 1,828,000-horse-power Sir Adam Beck-Niagara Generating Station No. 2, has been recently appointed director of the St. Lawrence Power Project.

Graduating from the University of Toronto in 1915 in civil engineering, he had a distinguished record in the first World War, and was awarded the Military Cross. Upon his return he became assistant superintendent on powerhouse construction at the Sir Adam Beck-Niagara Generating Station No. 1. After a varied and colourful career in power plant construction for Ontario Hydro and other organizations, he was named in 1937 Hydro's construction engineer, generation, culminating in his appointment to the Niagara project in 1951.

**Wm. L. Fraser, M.E.I.C.**

**William L. Fraser,** M.E.I.C., has been appointed project manager of Sir Adam Beck-Niagara Generating Station No. 2 Project to succeed Gordon Mitchell, M.E.I.C., who was recently named project manager of the St. Lawrence Power Project.

A graduate of Dalhousie and McGill Universities, Mr. Fraser first joined Ontario Hydro in 1947 as project manager for the Chenaux development on the Ottawa River, and continued in that position until his appointment to Niagara in January, 1951 as field project engineer.

**William M. Hogg,** M.E.I.C., project field engineer of Ontario Hydro's Sir Adam Beck-Niagara Generating Station No. 2, has been recently appointed to a similar post on the St. Lawrence Power Project.

**Wm. M. Hogg, M.E.I.C.**

Mr. Hogg began his hydro training as a water boy on the original Niagara development, the Sir Adam Beck-Niagara Generating Station No. 1. Later, following graduation in 1939 from the University of Toronto, he held many important engineering posts with the Commission, including those of designing engineer in the generation department and senior resident engineer at the Des Joachims development on the Ottawa River.

J. F. Mills, M.E.I.C.

**J. F. Mills,** M.E.I.C., president of Siemens Brothers (Canada) Limited, has been appointed commissioner and general manager of the Manitoba Telephone System.

Mr. Mills was associated with the Siemens Company from 1926 until 1936 In 1930 he undertook a special telecommunication engineering course in the main factory in London, England.

He joined the Manitoba Telephone System in 1936 and was appointed chief engineer in 1945, and in addition, assistant general manager in 1948.

Mr. Mills became vice-president of Siemens Brothers (Canada) Limited in 1952, and president of the company in January, 1954.

He assumed his new position with the Manitoba Telephone System following the recent retirement of Peter Millar, commissioner and general manager since 1945.

**C. W. West,** M.E.I.C., formerly senior deputy minister of transport, has been appointed a member of the St. Lawrence Seaway Authority.

An honour graduate in engineering of the University of Toronto, Mr. West was employed prior to World War I with Smith, Kerry and Chase, consulting engineers, on hydro-electric power development as a senior assistant engineer on Trent Canal construction, and as assistant engineer on hydraulic reports and investigations with the Ontario Hydro-Electric Power Commission.

During World War I he served with the Canadian Infantry and the Canadian Engineers, and after demobilization, was appointed senior assistant and division engineer in charge of the construction of sections 3, 4 and 4b of the Welland Ship Canal.

In 1933 he organized the operating staff of the Welland Ship Canal and became the first superintending engineer, which position he held until 1947, when he was transferred to Ottawa as director of Canal Services. He was appointed senior deputy minister of the Department of Transport in October, 1953.

**Col. R. D. Harkness,** M.E.I.C., president of Northern Electric Co. Ltd., and **T. W. Eadie,** M.E.I.C., president of the Bell Telephone Company of Canada, were recently promoted to commander brothers of the Most Venerable Order of the Hospital of St. John of Jerusalem.

**R. R. Noyes,** M.E.I.C. general sales manager of Canadian Sirocco Company, Ltd. in Windsor, Ont., has been elected a member of the board.

A mechanical engineering graduate of the University of Toronto, class of 1936, he joined Canadian Sirocco the same year as a sales engineer, working out of the Montreal office. In 1947 he was appointed eastern district manager in Montreal, and in 1952 he was moved to Windsor to occupy his present position.

R. R. Noyes, M.E.I.C.

Mr. Noyes is a member of the Association of Professional Engineers of Ontario, the American Society of Heating and Ventilating Engineers, and a past-president of the Society's Montreal chapter, the American Society of Mechanical Engineers, and the Canadian Pulp and Paper Association.

**Air Vice Marshal C. R. Dunlap,** R.C.A.F, M.E.I.C., has been transferred from the National Defence College in Kingston where he served as commandant, to Air Force headquarters in Ottawa, where he will be vice chief of the Air Staff.

**F. G. East,** M.E.I.C., former development engineer of Hamilton Gear and Machine Co. Ltd. of Toronto, has been appointed general manager. Mr. East joined the company in 1924, and during the past 20 years has been responsible for the development of all new products including new lines of gear reduction units and couplings.

He has been active in the Ontario section of the American Society of Mechanical Engineers, and has served as chairman. He has also been active in the American Gear Manufacturers Association and the Canadian Standards Association.

**Ben Russell,** M.E.I.C., has retired from the services of the Alberta government and has accepted the position of chief engineer with Square M. Construction Ltd. of Edmonton. At the same time he will serve as consulting engineer.

For the past ten years he has been director of water resources for the Alberta government, and prior to that he was chief engineer with the irrigation branch of the Department of the Interior where he pioneered in irrigation and water power development in western Canada.

Mr. Russell, a civil engineering graduate of McGill University, is a Dominion Land Surveyor, and a member of the Prairie Provinces Water Board, secretary of the Irrigation and Drainage Council for Alberta, and a Life Member of the Engineering Institute.

E. R. McMullen, M.E.I.C.

**Elmer Russell McMullen,** M.E.I.C., general superintendent of the Laurentide division of Consolidated Paper Corporation Limited in Grand'mere, Que., has been elected chairman of the St. Maurice Valley Branch of the Engineering Institute.

Mr. McMullen is a native of Middleboro, N.S. He received his B.Sc. degree in pure science from Mount Allison University in 1924, and his B.Sc. degree in mechanical engineering from the Nova Scotia Technical College in 1930. During the intervening years he served as head master of a private school in Calgary.

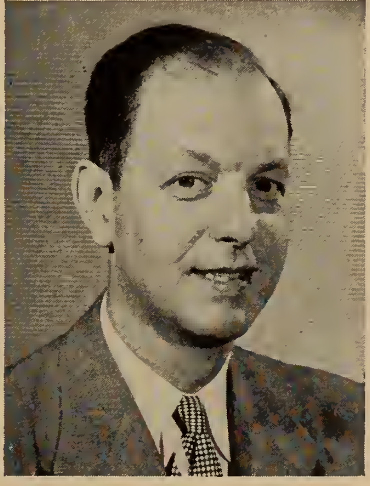
Mr. McMullen joined the Consolidated Paper Corporation in 1930 as assistant superintendent of the control department. In 1933 he was appointed divisional accountant and he was named to his present position in 1946.

Mr. McMullen is a member of the Corporation of Professional Engineers of the Province of Quebec.

**G. E. M. Proctor,** M.E.I.C., has become a partner in Proctor, Redfern & Laughlin, Toronto consulting civil engineers, according to a recent announcement made by **E. M. Proctor,** M.E.I.C., senior partner.

Mr. Proctor, manager of the Scarborough branch of the company, is a civil engineering graduate of McGill University, class of 1946.

**O. Nelson Mann,** M.E.I.C., of the Nova Scotia Department of Trade and Industry,



O. Nelson Mann, M.E.I.C.

has been elected chairman of the Halifax Branch of the Engineering Institute.

He was born in Sydney, N.S., where he received his general schooling. He then obtained his engineering certificate from Acadia University in 1933, and his B.E. degree in mechanical engineering from the Nova Scotia Technical College in 1935.

His early engineering training was in the shops of the steel plant in Sydney and at the Imperial Oil Refinery in Halifax. In 1937 he moved to the Montreal area and during the war was superintendent of process engineering on small arms manufacture with Defence Industries Ltd. After the war he was associated in the consulting engineering field with J. D. Woods & Gordon, Ltd. and Stevenson & Kellogg, Ltd. in Toronto.

At the beginning of 1950 Mr. Mann returned to his native province with the Nova Scotia Research Foundation, later moving to the Department of Trade and Industry.

**J. B. Carswell,** O.B.E., M.E.I.C., consulting engineer and chairman of the board of Kitimat Constructors Ltd. in Vancouver, has announced the opening of his private consulting engineering office in Toronto.

**Eric R. Jacobsen,** M.E.I.C., president of Brazaco S.A., which represents the United States Steel Export Company in Sao Paulo, Brazil, recently paid a visit to Engineering Institute headquarters in Montreal.

Mr. Jacobsen graduated in civil engineering from McGill University in 1929 and received his M.Eng. degree from the same university in 1932. After graduation he was first associated with Dominion Bridge Company Limited. During the war he was on loan to the Australian War Supplies Procurement in Washington, D.C., and in 1945, joined the United States Steel Corporation in New York.

**Wing Commander R. M. Aldwinkle,** R.C.A.F., M.E.I.C., is now R.C.A.F. resident engineering officer at Canadair Limited in Montreal. He was previously stationed at the R.C.A.F. Staff College in Armour Heights in Toronto.

Within the past year he has been elected an associate fellow of the Royal Aeronautical Society and a member of the Society of Automotive Engineers.

**Douglas T. Bayer,** M.E.I.C., has been appointed general superintendent of Eastern Light & Power Co. Ltd. in Sydney, N.S.

A graduate in electrical engineering of the Nova Scotia Technical College, class of 1932, he previously held the position of assistant general superintendent.

**James L. Patterson,** M.E.I.C., who has been factory manager of La France Fire Engine and Fomite Ltd. since 1947, now heads Eade Wood Products at Kleinburg.

A mechanical engineering graduate, Mr. Patterson, has been associated in the past with Aluminum Company of America, Canada Cycle and Motor Co. Ltd. and A. P. Green Fire Brick Co. Ltd.

**Ross Stanley,** AFFIL.E.I.C., is operating his own office as architect in Edmonton. He was formerly a partner in the firm Dewar, Stevenson & Stanley in Edmonton.

Mr. Stanley received his B.Sc. degree in architecture from the University of Alberta in 1938.

**Commander (L) W. E. Smith,** R.C.N., M.E.I.C., has been transferred from H. M. C. Electrical School in Halifax to Sorel, Que. where he will serve as principal naval overseer with Marine Industries Ltd.

Commander Smith received his B.Sc. degree in electrical engineering from the University of New Brunswick in 1935.

**W. A. Williamson,** M.E.I.C., former general sales manager of Reliance Electric & Engineering (Canada) Ltd. in Welland, Ont., is vice-president and managing director of Electric Panel Mfg. Ltd. in Vancouver.

Mr. Williamson is a 1934 graduate in electrical engineering of the University of Toronto.

**O. Margison,** M.E.I.C., will continue as president of A. D. Margison and Associates Limited, the consulting professionnal engineering firm in Toronto whose name was recently changed from Margison Babcock and Associates Limited.

**H. A. Babcock,** M.E.I.C., has withdrawn his directorship in the firm.

**A. D. Margison,** M.E.I.C., will continue to serve as vice-president and general manager, and **V. D. Hunter,** M.E.I.C., as secretary-treasurer and assistant general manager.

Associates in the firm include **J. E. Margison,** M.E.I.C., chief engineer of the process department, **D. L. B. Hamlin,** M.E.I.C., chief engineer of the structural department, **W. A. Stewart,** JR.E.I.C., chief engineer of the municipal department, and **R. A. Cunningham,** M.E.I.C., of the field supervision section.

**George W. Hand,** AFFIL.E.I.C., has been named manager of the real estate department of the Montreal Trust Company in Montreal.

**John L. Darimont**, M.E.I.C., is resident engineer with R. M. Hardy & Associates Ltd. in Whitehorse, Yukon Territories. He was formerly resident engineer with Engineering and Construction Services Ltd. in Whitehorse.

Mr. Darimont received his B.Sc. degree in mining and metallurgy from the University of Alberta in 1934.

**Kenneth R. Shipley**, M.E.I.C., has been transferred by Imperial Oil Limited from Winnipeg to Toronto where he is serving as assistant chief engineer of the pipeline division.

Mr. Shipley is a 1935 B.A.Sc. graduate of the University of Toronto.

**F. Petricek**, M.E.I.C., formerly field engineer with the Gulf Power Company in Clark City, has joined H. G. Acres Co. Ltd. in Niagara Falls.

Mr. Petricek graduated in civil engineering from the Technical University in Prague in 1938.

**E. D. Wilson**, M.E.I.C., has been transferred from Regina to Calgary as management assistant in the producing department for the western division of Imperial Oil Limited.

Mr. Wilson is a 1939 mining engineering graduate of the University of Alberta.

**R. H. Nicolson**, M.E.I.C., a 1939 civil engineering graduate of the University of Alberta, is superintendent of the waterworks distribution system in Edmonton.

Mr. Nicolson has been associated with the engineering staff of the City of Edmonton since his return from overseas service with the Royal Canadian Engineers in 1946.

**C. R. Phillips**, M.E.I.C., formerly associated with Kelvinator Company of Canada Ltd. in London, Ont., has joined Ex-Cell-O Corporation of Canada Ltd. in London.

He is a graduate in mechanical engineering of the University of Toronto, class of 1939.

**E. Kostitch**, M.E.I.C., who graduated in civil engineering from Ecole Speciale des Travaux Publics in 1939, is structural designing engineer with Lord & Company in Montreal. He was formerly with the bridge division of the Department of Public Works for the Province of Quebec in Quebec City.

**Bruce Wm. Hamer**, M.E.I.C., is now district engineer for the Department of Fisheries in Prince Rupert, B.C. Previous to accepting this position, he was resident engineer in the engineering department of the City of Ottawa.

Mr. Hamer graduated in mining engineering from the Nova Scotia Technical College in 1939.

**E. A. Sprenger**, M.E.I.C., former production manager with Sorel Industries Ltd., is now assistant chief inspecting engineer with Dominion Engineering Works in Lachine.

Mr. Sprenger received his B.Eng. degree in mechanical engineering from McGill University in 1940.

**J. C. Finlayson**, M.E.I.C., has been transferred from the air services branch of the Department of Transport, to the aircraft branch of the Department of Defence Production as senior production officer.

Mr. Finlayson received his B.A.Sc. degree in mechanical engineering from the University of Toronto in 1940.

**M. Konforti**, M.E.I.C., has recently entered into partnership in the Tesla Technical Company in Toronto. He was formerly a partner in Dunsan Lazarevic in Toronto.

Mr. Konforti received his mechanical engineering degree in 1937 and his electrical engineering degree in 1941 from the University of Belgrade.

**Major M. O. Rollefson**, R.C.E., M.E.I.C., is commanding officer of the 3rd Field Squadron, R.C.E. in Korea, and has been promoted from the rank of captain.

Previous to this appointment he was stationed at Vedder Crossing, B.C.

Major Rollefson is a 1941 civil engineering graduate of the University of Alberta.

**Major K. F. Collins**, R.C.E.M.E., M.E.I.C., has just returned from a tour of duty in Germany as commanding officer, No. 1 Canadian Base Repair Section, R.C.E.M.E. in the Ruhr. His new appointment is to the staff of the R.C.E.M.E. School at Barriefield, Ont.

Major Collins graduated in 1941 in chemical engineering from Queen's University.

**Paul M. Smith**, M.E.I.C., is now superintendent with William R. Souter & Associates, Hamilton architects, and is employed on the plant extension of the Chrysler Corporation of Canada in Windsor.

A 1942 graduate in civil engineering of Ecole Polytechnique, Mr. Smith was formerly associated with Surveyer, Nenniger & Chennevert in Montreal.

**H. B. White**, M.E.I.C., formerly design engineer with B.C. International Engineering Co. Ltd. in Vancouver, has joined Aluminum Company of Canada Limited in Montreal as development engineer.

Mr. White is a graduate in civil engineering of the University of Toronto, class of 1944.

**J. Blair Scott,** M.E.I.C., has been appointed an associate engineer with Pandia Incorporated of New York City, manufacturers and designers of continuous pulping equipment and other pulp and paper machinery.

Previous to this appointment he was pulp superintendent with the Richmond Pulp & Paper Company in Bromptonville, Que.

Mr. Scott graduated from Queen's University in mechanical engineering in 1945.

**Andrew T. Wilson,** M.E.I.C., formerly supervisor with Foundation Co. of Canada Ltd. in Montreal, is resident engineer with Racey, MacCallum & Associates Ltd. in Sherbrooke.

He received his B.Sc. degree in civil engineering from the University of Belfast in 1946.

**James Ross Dalrymple,** M.E.I.C., formerly with the market research and product planning department of the Canadian General Electric Company in Montreal, has joined Standard Tube and T.I. Ltd. in Woodstock, Ont.

He graduated in 1944 from the University of Toronto in mechanical engineering.

**Thos. P. Hutchinson,** M.E.I.C., has joined H. K. Ferguson Company of Canada, Ltd. of Montreal. Previous to joining the company, Mr. Hutchinson was senior engineer with Aluminum Company of Canada, Ltd. at Chute du Diable, Que. He was also associated with James MacLaren Co. Ltd. in Buckingham, Que., and with Canadian National Railways as resident engineer.

Thos. P. Hutchinson, M.E.I.C.

A graduate civil engineer of McGill University, class of 1944, Mr. Hutchinson served as a lieutenant in the Royal Canadian Engineers during World War II. He is a member of the Association of Professional Engineers of Ontario and the Corporation of Professional Engineers of the Province of Quebec.

**J. S. Sugiyama,** M.E.I.C., formerly associated with Rule, Wynn and Rule in Calgary, has become a partner in the firm named Izumi, Arnott and Sugiyama of

## Correction

In the September *Journal*, page 1132, **C. W. Currie,** M.E.I.C., was said in error to have been appointed district engineer with the Department of Public Works of Canada in Charlottetown, P.E.I.

Mr. Currie's new appointment is that of district engineer. Previous to this he served as assistant district engineer, having joined the Department in Charlottetown in 1934 after working for six years on design with the Nova Scotia Power Commission.

He is an electrical engineering graduate of the Nova Scotia Technical College, class of 1928.

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Regina which will specialize in architecture, city and rural planning and engineering.

Mr. Sugiyama is a 1947 civil engineering graduate of the University of Manitoba.

**S. G. Jackson,** M.E.I.C., is associated with Charles Warnock & Co. Ltd. in Montreal. Before joining this company, he was highway engineer with Fraser Brace Terminal Constructors in Saint John, N.B.

Mr. Jackson received his engineering degree from Norwich City College of London in 1947.

**J. R. Lewis,** M.E.I.C., is associated with General Steel Wares Limited in Toronto, and is employed as production superintendent of the kitchen equipment department.

A 1948 graduate in mechanical sciences of the University of Cambridge, Mr. Lewis was previously with the Canadian International Paper Company in Temiskaming, Ont.

**W. H. Griffin,** M.E.I.C., is regional engineer with The British American Oil Company Ltd. in Regina.

He is a graduate in civil engineering of Queen's University class of 1948.

**Norman S. Trouth,** M.E.I.C., formerly division superintendent with West Kootenay Power & Light Co. Ltd. in Penticton, B.C., is now manager of Kelwood Corporation Limited, a land development company in Calgary. Previous to joining this company, Mr. Trouth was briefly associated with Messrs Haddin, Davis & Brown, as resident project engineer in Edmonton.

Mr. Trouth graduated in electrical engineering from the University of Alberta in 1949.

**G. MacGregor,** M.E.I.C., former electrical draughtsman with Canadian Vickers Ltd. in Montreal, has joined the Manitoba Power Commission.

He is a 1949 electrical engineering graduate of the University of Edinburgh.

**L. A. W. Davis,** M.E.I.C., formerly electrical testing engineer with Canadian Vickers Ltd. in Montreal, is now defence research technical officer with C.A.R.D.E. in Quebec City.

Mr. Davis, an associate member of the Institute of Electrical Engineers, is a 1950 graduate of Melbourne Technical College in Australia.

**F. T. Peters,** M.E.I.C., former structural design engineer with Anfo Steel Corporation in Toronto, is manager of Ontario Bridge Co. Ltd. in that city.

Mr. Peters received his B.Eng. degree from the Nova Scotia Technical College in 1950.

**S. J. Medwasowski,** M.E.I.C., formerly project engineer on the staff of the

Foundation of Canada Engineering Corporation in Montreal, is now on the staff of the civil engineering department of the University of California where he is also pursuing a course of graduate study leading to the degree of Ph.D. in structural mechanics.

Mr. Medwasowski is a graduate of the Polish University College, London, class of 1950.

**D. E. Doxsee,** M.E.I.C., is field construction engineer with Canadian Kellogg Co. Ltd. in Edmonton. Before joining this company, he was on the staff of Brown & Root Ltd.

He is a mechanical engineering graduate of the University of British Columbia, class of 1951.

**R. L. Donaldson,** M.E.I.C., is plant laboratory supervisor for Sherritt Gordon Mines Ltd. in Fort Saskatchewan, Alta. He was previously associated as sales engineer with Northwest Industries Ltd. in Edmonton.

Mr. Donaldson is a 1951 graduate in chemical engineering of the University of British Columbia.

**W. H. George,** M.E.I.C., former resident engineer with the Department of Northern Affairs and National Resources in Jasper, has joined Hipperson Construction Co. Ltd. in Regina.

He is a 1951 civil engineering graduate of the University of Saskatchewan.

**Lieut. Comm. (L) L. R. Wagener,** R.C.N., JR.E.I.C., is stationed at the Royal Canadian Naval Station at Dartmouth, N.S. He was previously stationed at Naval headquarters in Ottawa.

Lieut. Comm. Wagener received his B.Sc. degree in electrical engineering from Queen's University in 1946.

**H. M. Sullivan,** JR.E.I.C., a 1946 chemical engineering graduate of Queen's University, has joined the staff of McLean Budden Ltd. in Montreal.

**Major R. W. Potts,** D.S.O., R.C.E., JR.E.I.C., has been appointed officer commanding of No. 1 Field Squadron, R.C.E. at Vedder Crossing, B.C., following his return from overseas where he was officer commanding No. 58 Independent Field Squadron, R.C.E.

He is a 1947 civil engineering graduate of the University of Saskatchewan.

**R. N. Flaherty,** JR.E.I.C., is on the staff of the engineering department of the Township of Scarborough in Toronto.

A 1947 graduate in civil engineering of McGill University, Mr. Flaherty was previously design engineer with the Anfo Steel Corporation in Toronto.

**W. H. Potts,** JR.E.I.C., formerly associated with Electric Reduction Co. of Canada Ltd. in Buckingham, Que., is now with Shepherd & Powell, consulting engineers in Toronto.

Mr. Potts graduated in civil engineering from Queen's University in 1948.

**A. F. Inderwick,** JR.E.I.C., has been transferred by Defence Construction (1951) Ltd. from the R.C.A.F. Station in Edgar, Ont. to Chatham, N.B.

He received his B.Sc. degree in civil engineering from London University in 1948.

**K. W. Stairs,** JR.E.I.C., is a consultant engineer with the inspection services of the Department of National Defence in Ottawa. He was formerly with the Directorate of Installations, U.S.A.F., at Pepperrell Air Force Base in St. John's, Nfld.

Mr. Stairs is a civil engineering graduate of the University of New Brunswick, class of 1948.

**Squadron Leader C. E. F. Underwood,** R.C.A.F., Jr.E.I.C., is stationed at Air Force headquarters in Ottawa. Formerly, associate professor in the civil engineering department of the Royal Military College in Kingston, Squadron Leader Underwood is a graduate in civil engineering of the University of British Columbia, class of 1948.

**D. M. Stewart,** Jr.E.I.C., is now employed with the Alberta Government Telephones as an engineer in training in the transmission department. Before accepting this position he was on the staff of the Schlumberger Well Surveying Corporation in Calgary.

Mr. Stewart is a 1949 electrical engineering graduate of the University of Saskatchewan.

**R. L. Wood,** Jr.E.I.C., is associated with Brown Boveri (Canada) Ltd. in St. Johns, Que. He was previously with the Canadian Westinghouse Company in Hamilton.

Mr. Wood is a 1949 graduate in electrical engineering of the University of New Brunswick.

**Gerald Flanagan,** Jr.E.I.C., who has been an engineer in training with the Canadian Johns Manville Company in Toronto, has been transferred to Montreal as sales engineer in the contract sales department.

Before joining the company, Mr. Flanagan was associated with the Reymer Atlas Construction Company in Niagara Falls.

He is a 1949 graduate in civil engineering of McGill University.

**R. M. MacKenzie,** Jr.E.I.C., is sales engineer with the Butler Manufacturing Company, manufacturers of steel products in Minneapolis, Minn.

A graduate in engineering and business of the University of Toronto, class of 1950, Mr. MacKenzie was formerly associated with Federal Mogul Service in Dallas, Texas, Calgary and Toronto.

**Wm. O. Codrington,** Jr.E.I.C., has been transferred by Aluminum Company of Canada Ltd. from Arvida to Kemano.

Mr. Codrington is an electrical engineering graduate of the University of British Columbia, class of 1950.

**Richard I. de St. Croix,** Jr.E.I.C., who received his master's degree in business administration from the University of Michigan this year, has joined the staff of The McKinnon Industries, Limited in St. Catharines.

R. de St. Croix, Jr.E.I.C.

A mechanical engineering graduate of McGill University, class of 1950, Mr. de St. Croix was previously employed by the Ford Motor Company in Windsor.

**Thos. D. Leaver,** Jr.E.I.C., is on the staff of Northern Electric Co. Ltd. in Montreal. He was formerly in the employ of Canadian Vickers Ltd. in Montreal.

Mr. Leaver received the higher national certificate in electrical engineering in 1950. He is a graduate member of the Institution of Electrical Engineers.

**John C. Heath,** Jr.E.I.C., a 1950 graduate in mechanical engineering of the University of Manitoba, is now on the staff of Canadian Aviation Electronics in Winnipeg.

Mr. Heath was previously diesel supervisor with the Algoma Central and Hudson Bay Railway in Sault Ste. Marie.

**W. L. Garvin,** Jr.E.I.C., a 1950 mechanical engineering graduate of the University of Manitoba, is on the staff of Defence Construction (1951) Ltd. in Winnipeg.

**Dale A. Douglas,** Jr.E.I.C., is communication design engineer with Canadian General Electric Co. Ltd. in Toronto. He previously occupied the position of chief engineer with Essex Electronics in Trenton Ont.

Mr. Douglas is a 1950 electrical engineering graduate of the University of British Columbia.

C. E. Petite, Jr.E.I.C.

**Chesley E. Petite,** Jr.E.I.C., formerly associated with the Fisheries Research Board of Canada at the Atlantic biological station in St. Andrews, N.B., has joined Canadian Oil Companies in Montreal.

Mr. Petite received his mechanical engineering degree from the Nova Scotia Technical College in 1950.

**Herman Erkku,** Jr.E.I.C., who has been temporarily employed during the summer with Aluminum Company of Canada, Limited in Arvida, has returned to the Massachusetts Institute of Technology where he is pursuing post-graduate study in chemical engineering.

Mr. Erkku graduated in chemical and metallurgical engineering from Ecole Polytechnique in 1950.

**James H. Legere,** Jr.E.I.C., is now on the staff of the Corporation of Professional Engineers of Quebec.

A graduate in engineering physics of McGill University in 1950, Mr. Legere undertook post graduate study from the same university in business administration and management. Upon graduation

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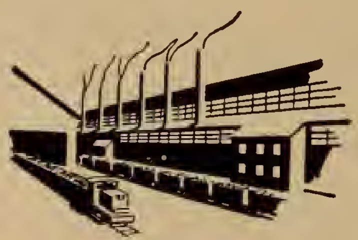

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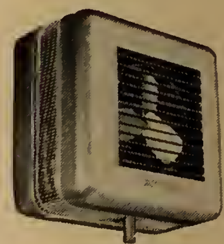
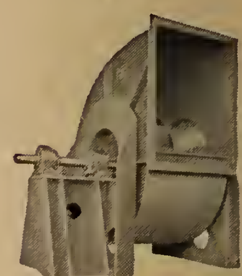


**Unit Heaters**



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*In the United States:* AMERICAN BLOWER CORPORATION • DETROIT 32, MICHIGAN he served as engineering assistant with the Bell Telephone Company of Canada in Montreal.

In November, 1952 he entered Canadian Aviation Electronics Ltd. as assistant to the chief engineer, and in December, 1952 was appointed executive assistant to the vice-president in charge of manufacturing and engineering.

**J. E. Savage,** Jr.E.I.C., formerly inspecting engineer for Manitoba with the Trans-Canada Highway division of the Department of Public Works in Winnipeg, has been appointed supervising engineer for Saskatchewan.

Mr. Savage received his B.Eng. degree in electrical engineering from McGill University in 1950.

**K. R. Simmons,** Jr.E.I.C., has been appointed town engineer for the three towns of Acton, Georgetown and Milton of Ontario. He was previously on the staff of Imperial Tobacco Co. of Canada Ltd. in Montreal.

Mr. Simmons is a 1950 engineering and business graduate of the University of Toronto.

**W. G. Thompson,** Jr.E.I.C., has recently accepted the position of plant manager with Pioneer Electric Alberta Ltd., located in Red Deer, Alta. He was formerly associated with Reliance Electric and Engineering (Canada) Ltd. in Welland, Ont.

Mr. Thompson graduated in electrical engineering from the University of Manitoba in 1950.

**W. E. Trann,** Jr.E.I.C., a 1950 mechanical engineering graduate of the University of Manitoba, is plant engineer with the Anthes Imperial Co. Ltd. in Winnipeg.

**Roy S. Thibodeau,** Jr.E.I.C., formerly associated with Molson's Brewery Ltd., is now industrial sales engineer with Crane Limited in Montreal.

Mr. Thibodeau graduated in 1950 in mechanical engineering from the Nova Scotia Technical College.

**Hugh A. Templeton,** Jr.E.I.C., who has completed a Food and Agricultural Organization assignment in Ceylon, is now under a two-year contract with the Department of Trade and Commerce under the Colombo Plan to act as field service engineer with the Department of Agriculture for the Government of Sind. He is located in the Hyderabad area.

Mr. Templeton, a 1950 agricultural engineering graduate of the University of Saskatchewan, was formerly associated with the engineering department of Cockshutt Farm Equipment Limited at Brantford, Ont., and with W. C. Wood and Company in Guelph, Ont.

**C. J. Deines,** Jr.E.I.C., a 1951 electrical engineering graduate of the University of Alberta, has joined the Texaco Exploration Company in Stettler, Alta. He was formerly associated with Western Geophysical Co. Ltd. in Calgary.

**J. J. Lazurko,** Jr.E.I.C., is electrical-mechanical inspector of mines with the Ontario Department of Mines, covering the Kenora and Thunder Bay districts.

Previous to joining the Department in March, 1954, Mr. Lazurko was associated with Steep Rock Iron Mines Ltd. in Steep Rock Lake.

He is a 1951 electrical engineering graduate of the University of Saskatchewan.

**J. E. Jansen,** Jr.E.I.C., a mechanical engineering graduate of the University of Toronto in 1951, is associated with the Bendix Aviation Corporation in Baltimore, Maryland.

**William J. Howell,** Jr.E.I.C., formerly with the Ford Motor Company in Windsor is now on the staff of Babcock Wilcox and Goldie McCulloch Ltd. in Galt, Ont.

Mr. Howell graduated in mechanical engineering from the University of Toronto in 1951.

**A. T. Nikiforuk,** Jr.E.I.C., is on the staff of Defence Construction (1951) Ltd. in Edmonton. He was previously electrical inspector for the Government of Alberta in Edmonton.

Mr. Nikiforuk is a 1951 electrical engineering graduate of the University of Alberta.

**T. J. Sluymer,** Jr.E.I.C., formerly design engineer with consulting engineer Henry Jasen in Montreal, is now structural engineer with Precompressed Concrete Engineering Co. Ltd. in Montreal.

Mr. Sluymer graduated in 1951 from the University of Delft in civil engineering.

**Constructor Lieutenant H. A. Shenker,** D.F.C., R.C.N., Jr.E.I.C., has completed a three-year course in naval architecture and marine engineering at the Massachusetts Institute of Technology, and has received the advanced degree of naval engineer.

A civil engineering graduate of the University of Toronto, class of 1951, Lieut. Shenker's next appointment will be on the staff of the Naval Constructor-in-chief at National Defence headquarters in Ottawa.

**R. T. Worden,** Jr.E.I.C., a 1951 mechanical engineering graduate of McGill University, is industrial heating sales engineer in the apparatus division of Canadian General Electric Co. Ltd. in Montreal.

**C. R. Wilkins,** Jr.E.I.C., of the Montreal Engineering Co. Ltd. in Montreal, has been transferred to Seebe, Alta. where he is employed as construction engineer on the Pocaterra-Interlakes hydro-electric development.

Mr. Wilkins is a 1951 civil engineering graduate of the University of Saskatchewan.

**Donald T. Vanstone,** Jr.E.I.C., has been transferred by Canadian Industries Ltd. in Maitland, Ont. to Dupont Company of Canada, Ltd. as design engineer in Montreal.

Mr. Vanstone graduated in chemical engineering from Queen's University in 1951.

**John H. Dinsore,** Jr.E.I.C., has been transferred from Peterborough to Toronto by Canadian General Electric Co. Ltd. He is an electrical engineering graduate of McGill University, class of 1952.

**Paul Hamel,** Jr.E.I.C., is on the staff of C. D. Howe Limited in Montreal. He was formerly technical advisor and designer with Peltier Handling Equipment Co. Ltd. in Montreal.

Mr. Hamel received his B.A.Sc. degree in mechanical and electrical engineering from Ecole Polytechnique in 1952.

**R. T. Giovannetti,** Jr.E.I.C., is on the staff of the layout engineering department of the Ford Motor Company in Windsor. He was formerly in the employ of Canadian Industries Ltd. in Windsor.

Mr. Giovannetti is a 1952 mechanical engineering graduate of the Nova Scotia Technical College.

**R. J. D. Gardner,** Jr.E.I.C., formerly on the staff of Lethbridge Iron Works Co. Ltd. in Lethbridge, has joined the staff of the Hudson's Bay Company as research engineer.

Mr. Gardner is a mechanical engineering graduate of the University of British Columbia, class of 1952.

**Urban P. Burke,** Jr.E.I.C., is associated with Giffels & Valet of Canada Ltd. in Windsor, Ont. He was formerly on the staff of the Dominion Coal Company in Glace Bay, N.S.

Mr. Burke is a graduate in mechanical engineering of the Nova Scotia Technical College, class of 1952.

**E. S. Eichmann,** Jr.E.I.C., a 1952 B.Sc. graduate of the University of Alberta, is a research assistant on the staff of the University of Illinois.

**H. P. Gillespie,** Jr.E.I.C., who graduated in 1952 in civil engineering from the Nova Scotia Technical College, is construction engineer with Canadian Petrofina Ltd. in Montreal.

**K. J. Ellis,** Jr.E.I.C., is attached to the U.S. Army Corps of Engineers at Goose Bay, Labrador. He was previously associated with Messrs R. P. Allsop & Associates in Toronto.

Mr. Ellis graduated in civil engineering from the University of Birmingham in 1952.

**David R. Hughson,** Jr.E.I.C., is now on the staff of Turnbull Elevator Co. Ltd in Toronto.

**David R. Hughson, Jr.E.I.C.**

After graduation from the University of Toronto in engineering and business in 1951, he joined Canadian General Electric Co. Ltd. on the Company test course. In 1952 he enrolled in the Harvard Graduate School of Business Administration and completed the two-year course this year, graduating with an M.B.A. degree.

**Eric W. Spurrell,** Jr.E.I.C., is employed by the Department of Transport in Ottawa He was formerly attached to the United States Corps of Engineers at Goose Bay, Labrador.

Mr. Spurrell graduated in electrical engineering from the Nova Scotia Technical College in 1952.

**Rene Bedard,** Jr.E.I.C., is now on the staff of Canadian Industries Ltd. in Montreal. He was previously a patent examiner in the Patent Office in Ottawa.

Mr. Bedard is a 1952 chemical engineering graduate of Laval University.

**A. P. Kilroy,** Jr.E.I.C., is now attached to the Corps of Engineers, U.S. Army, at

Goose Bay, Labrador. He was previously junior works engineer in the City of Toronto Department of Works.

Mr. Kilroy graduated with a B.A.I. degree from Trinity College, Dublin, in 1952.

**L. Gasner,** JR.E.I.C., a 1952 mechanical engineering graduate of the University of Toronto, has set up his own business in Ranee, Ont., under the firm name of Auto Parts Exchange Ltd.

**Alcide J. LeBlanc,** S.E.I.C., is project engineer with Dominion Wabana Ore Ltd. in Wabana, Nfld.

A 1953 civil engineering graduate of McGill University, Mr. LeBlanc was previously assistant to the resident engineer of the Quebec North Shore & Labrador Railway Company.

**Wallace L. Angus,** S.E.I.C., a 1953 graduate of the University of Toronto, is mining exploration engineer with Ventures Limited at Ore Knob Mine in Jefferson, N.C.

He was previously an engineer in training with Wright Hargreaves in Kirkland Lake, Ont.

**Tom McGreer,** S.E.I.C., is associated with the Department of Highways of the Province of Alberta in Two Hills.

Mr. McGreer received his B.Sc. degree in civil engineering from Queen's University in 1953.

**R. W. J. Moore,** S.E.I.C., has accepted the position of assistant city engineer with the City of Woodstock, Ont.

Mr. Moore graduated in civil engineering from the University of Toronto this year.

Johannes Defeyter, S.E.I.C.

**Johannes Defeyter,** S.E.I.C., who has been an engineer in training with the Canadian Westinghouse Company in Hamilton, has joined Canadian Industries Limited.

A native of the Netherlands, Mr. Defeyter received his M.Sc. degree in engineering from the Institute of Technology in Delft in 1953.

He is a member of the Royal Society of Engineers in Holland.

**Robert Brunette,** S.E.I.C., has been transferred from Beauharnois, Que. to the Northwestern Quebec System of the Quebec Hydro-Electric Power Commission in Noranda.

Mr. Brunette is a 1953 electrical engineering graduate of Ecole Polytechnique.

**Ronald T. Haine,** S.E.I.C., is maintenance engineer with Canadian Tube & Steel Products Ltd. in Montreal.

A 1953 graduate in mechanical engineering of Queen's University, Mr. Haine was previously associated with the Consolidated Pulp & Paper Company in Grand'mere, Que.

**Derald A. Harris,** S.E.I.C., formerly with Quebec Metallurgical Industries Ltd. in Whitehorse, Y.T., is now design engineer with the architectural branch of the Province of Alberta.

He is a 1953 graduate in civil engineering of the University of Alberta.

**C. Irwin Cameron,** S.E.I.C., has left the employ of the City of Saint John, N.B., where he served as structural engineer and is now on the staff of the bridge department of the Province of Nova Scotia.

Mr. Cameron is a graduate of the University of New Brunswick in civil engineering, class of 1953.

**W. A. Pangborn,** S.E.I.C., is associated with the John F. Wickenden Construction Company in Three Rivers, Que.

Mr. Pangborn graduated in civil engineering from McGill University in 1953.

**Maurice Steele,** S.E.I.C., a 1953 geology graduate of the University of Manitoba, is on the staff of the Hydro-Electric Power Commission of Ontario.

**D. I. Tilden,** S.E.I.C., a 1953 graduate in civil engineering of the University of Saskatchewan, is in the employ of the Pate Engineering Company of Tulsa, Okla.

**J. Alberto Dada,** S.E.I.C., a graduate this year in electrical engineering of McGill University, is associated with the firm Dada-Dada & Co. in San Salvador, El Salvador.

**Danny T. Nishimura,** S.E.I.C., who graduated this year from the University of Alberta in chemical engineering, is associated with Atomic Energy of Canada Limited in Deep River, Ont.

**Anthony King,** S.E.I.C., is with Canadian Pratt & Whitney Aircraft Co. Ltd. in Longueuil, Que.

Mr. King graduated in mechanical engineering from the University of Manitoba this year.

**Morris Jakowec,** S.E.I.C., is associated with the Dibblee Construction Company in Hawkesbury, Ont.

Mr. Jakowec graduated this year in civil engineering from Queen's University.

**A. E. Houghton,** S.E.I.C., after graduating in mechanical engineering from the Nova Scotia Technical College this year, has accepted employment with Cia Colombiana de Electricidad in Barranquilla, Colombia.

**Andre C. Hebert,** S.E.I.C., a graduate this year in electrical engineering of Laval University, is associated with the Hydro-Electric Commission of Quebec in Montreal.

**D. L. Gingerick,** S.E.I.C., is petroleum engineer with the Tide Water Associated Oil Company in Regina.

He graduated this year in mechanical engineering from the University of Saskatchewan.

**John M. MacLeod,** S.E.I.C., who graduated this year in metallurgical engineering from the Nova Scotia Technical College, is on the staff of the production department of the Shell Oil Company in Calgary.

**Charles E. Brabant,** S.E.I.C., formerly with the Calgary division of the Shell Oil Company, is now with Metropolitan Vickers Electrical Company Limited in Trafford Park, Manchester, England, on an Athlone Fellowship.

Mr. Brabant graduated this year in electrical engineering from McGill University.

**Gilles E. Dorion,** S.E.I.C., who graduated in civil engineering from McGill University this year, has joined the firm of Geo. Demers, consulting engineer in Quebec City. He was previously associated with Canadian National Railways as junior assistant engineer in Quebec City.

**Donald A. Buchanan,** S.E.I.C., is on the staff of the patent section of the research development department of the Hooker Electrochemical Company in Queenston, Ont.

Mr. Buchanan graduated this year in chemical engineering from the University of Toronto.

**Richard P. Stewart,** S.E.I.C., a graduate this year in mechanical engineering of McGill University, is on the staff of Canada Iron Foundries Limited in Three Rivers.

**Henry Strozyk,** S.E.I.C., is associated with Canadian Petrofina Limited in Montreal.

**G. Sernas,** JR.E.I.C., who graduated in civil engineering from the University of Toronto this year, is on the staff of consulting engineer Gordon Urwin of Oakville, Ont.

**Eugene M. Yaremy,** S.E.I.C., a graduate this year in mechanical engineering of Queen's University, is on the staff of the application engineering department of Taylor Instrument Companies of Canada in Toronto.

**Jean Tetreault,** S.E.I.C., has been employed on the Bersimis Quebec transmission line as engineer for technical projects for the Quebec Hydro-Electric Commission since graduation this year in civil engineering from McGill University.

**A. N. Tufts.** S.E.I.C., a graduate of this year of the University of Saskatchewan in mechanical engineering, is on an 11-month training program with the British American Oil Company in Toronto.

**M. Tomlinson,** S.E.I.C., has been employed as field engineer with Shawinigan Engineering Co. Ltd. in Montreal since his graduation in civil engineering from the Nova Scotia Technical College this year.

**Frank W. Taylor,** S.E.I.C., who graduated this year in civil engineering from the Nova Scotia Technical College, is maintenance engineer in the explosives division of Canadian Industries Ltd. in Nobel, Ont.

**Ivar Thomassen,** S.E.I.C., has been employed by the Hydro-Electric Power Commission of Ontario in Toronto since his graduation in civil engineering from the University of Manitoba this year.

**E. C. Barrett,** S.E.I.C., is development engineer in the Welland plant of North American Cyanamid Ltd. in Niagara Falls.

Mr. Barret graduated this year in chemical engineering from the Nova Scotia Technical College.

**S. A. Endersby,** S.E.I.C., is on the staff of the Aluminum Company of Canada Ltd. in Isle Maligne, Que.

**Jose Weiss,** S.E.I.C., a 1953 mechanical engineering graduate of McGill University, is treasurer and technical advisor with Industrias Lanacero, S.A. in Havana, Cuba.

# Obituaries

*The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.*

**Laurence Bradley Kingston,** M.C., M.E.I.C., formerly of the Gulf Pulp and Paper Company of Quebec City, was killed together with his wife at a level crossing near Kingston, Ontario, on October 1, 1953. This information only recently reached the Institute.

Mr. Kingston was born in Ottawa on August 6, 1883. He received his general education at the Ottawa Collegiate Institute, and in 1908 obtained his B.Sc. degree in civil engineering from McGill University.

Previous to graduation he was employed as a draughtsman, topographer and transitman with the National Transcontinental Railway. Upon graduation he became transitman with Smith, Kerry and Chace Ltd. on the Matabitchouan Power Company plant. During the succeeding five years he was resident engineer for the same firm on the Auburn Power Company plant, the Healey Falls Power Company plant and the Sidney Power Company plant. In 1913 he became engineer with Morrow and Beatty Ltd. on the Abitibi Power and Paper Company's hydraulic development and paper mill at Iroquois Falls.

He joined the Canadian Field Artillery in 1915 and served overseas until 1919, first as a lieutenant and then as a captain. He was awarded the Military Cross for outstanding service.

Upon his return to Morrow and Beatty Ltd. he was appointed manager of the Bathurst Lumber Company's hydro-electric development. Mr. Kingston was associated during 1922-1923 with Walter J. Francis and Company on the Paugan Falls investigation and report. He was employed by Dominion Safety Locknut Co. Ltd. as works manager in 1925-1926, and the following year served as resident engineer with consulting engineer George F. Hardy on the Ste. Anne Paper Co. Ltd. mill.

In 1927 he joined the Anglo Canadian Pulp and Paper Mills Ltd. as construction engineer, and two years afterwards became chief engineer of the Quebec Logging Corporation, a subsidiary of that company and the Ontario Paper Company. In 1932 he was appointed resident engineer with George F. Hardy and the Anglo Canadian Pulp and Paper Mills on the extension of the mill of its affiliated company, the Anglo Newfoundland Development Company.

He became chief engineer in 1934 of the Gulf Pulp and Paper Company which operates a groundwood mill at Clarke City, Que. Nine years later he re'oined the Anglo-Canadian Pulp and Paper Mills Ltd. at Quebec City as works engineer in the shipbuilding division, and in 1944 he was engaged in developing a new town water supply and storage system for the Municipality of Chandler, Que.

He was plant engineer for Gaspesia Sulphite Co. Ltd. at Chandler in 1948 and 1949, and also acted as consulting engineer for the Municipality of Chandler during the year 1951, after his official retirement from the company in 1949.

Mr. Kingston joined The Engineering Institute of Canada as a Student in 1905, transferring to Associate Member in 1912, and to Member in 1934.

**Roderick Bearce Young,** M.E.I.C., associate director of research of the Hydro-Electric Power Commission of Ontario, and one of the world's top authorities on concrete, passed away in the Wellesley Hospital in Toronto on August 24, 1954.

Mr. Young was born in Minneapolis, Minnesota on April 24, 1891. He was educated at schools in both the United States and Canada and matriculated from the Brandon Collegiate Institute. He received his B.Sc. degree in civil engineering in 1913 and his C.E. degree in 1919 from the University of Toronto.

Previous to graduation he was employed during the summers as axeman, tapeman, rodman and instrumentman with the Canadian Pacific Railway, and as an apprentice engineer in the shop, sales and test departments of Canadian Westinghouse Co. Ltd.

After graduation he joined the Hydro-Electric Power Commission of Ontario as assistant engineer in the structural materials department of the laboratories responsible for carrying out all chemical and physical testing and research investigations of engineering materials as well as field and shop inspection work. He was then promoted successively to the positions of engineer in charge of the structural research department and assistant chief testing engineer. In the latter position he was responsible for the shop inspection of all generating equipment, penstocks, castings, tower steel, and similar items used by the Commission. Mr. Young became assistant director of research when the research and testing department obtained division status in the general reorganization of the Commission in 1948. He was appointed associate director of research in 1951 and from that date until the time of his death he served in a consulting and advisory capacity.

Mr. Young was well known for his work in the field of concrete research, particularly through his activities with the American Concrete Institute which he joined in 1917, served as its president in 1940-1941, and which elected him to honorary membership in 1953. He was, either as author or co-author, one of the most frequent contributors of papers in the Institute. In 1937 his paper, "Concrete — Its Maintenance and Repair" was awarded the Wason Medal of the American Concrete Institute for "the most meritorious paper of the year". Earlier, his paper, "Producing Concrete of Uniform Quality" earned him in 1928 the Thomas Fitch Rowland Prize of the American Society of Civil Engineers. This was one of the few instances when the award was made outside the Society.

Mr. Young was a member of the Committee for the Long Time Study of Cement Performance in Concrete, organized by the Portland Cement Association. He was also active in other fields both in this organization and in the American Society of Testing Materials.

He joined The Engineering Institute of Canada as a Student in 1911, transferring to Junior in 1916, to Associate Member in 1918, and to Member in 1923. He was a past chairman of the Toronto Branch and served as a councillor representing that branch. In January of this year he was named a Life Member of the Institute.

**Stuart Southmayd Scovil,** M.E.I.C., Ottawa consulting engineer and authority on river flow, storage and related branches of hydraulic engineering, passed away in hospital on July 17, 1954.

Mr. Scovil was born at Kenora, Ontario, on May 17, 1886. He received his B.Sc. degree in electrical and civil engineering with honours from Queen's University in 1912. While attending university he was employed during the summers of 1908 and 1910 as chainman on Alberta government road surveys and on the assembly department staff of Canadian Westinghouse Co. Ltd. in Hamilton.

In 1912 Mr. Scovil was appointed assistant engineer by the Department of the Interior in Winnipeg, and was engaged on power and hydrometric surveys of Manitoba. The following year he was transferred to Ottawa as assistant chief engineer.

In 1914 he was named chief engineer of the Lake of the Woods Technical Board of the Water Power Branch of the Department of External Affairs. This board was organized at that time to co-ordinate various Canadian interests in making representations to the International Joint Commission. He was later engaged on other investigations in connection with Rainy Lake and other boundary waters. He resigned from the Department (now known as Dominion Water Power and Resources) as assistant director in 1925, but continued to serve the Department in a consulting capacity until 1934. For a year, 1926-1927, he was a partner in the firm of H. G. Acres and Company at Niagara Falls, maintaining an office in Ottawa.

In 1927 he began a consulting practice as a hydraulic engineer in Ottawa. In this capacity he was retained by the Gatineau Power Company, the Hydro-Electric Power Commission of Ontario, the Dominion Government, the Winnipeg Electric Company and the International Paper Company as well as many construction companies. He was long associated as consulting engineer to Montreal Power and later to Quebec Hydro, and for the last several years, was superintending and consulting engineer for the Chaudiere Water Power owners and lessees. One assignment during this period was in connection with the extensive hydraulic investigation related to the Beauharnois hydro-electric development on the St. Lawrence River.

From 1935 until 1940 he was Canadian arbitrator on an international arbitration case on the Saint John River which he won.

In 1951 Mr. Scovil designed the cut at the Seven Sisters power plant in Manitoba.

Mr. Scovil enlisted for overseas duty in 1915, but was recalled by Sir Robert Borden to continue work on the Western Waterways. He was then sent to Washington where he assisted in drafting the Western Waterways treaties. When these were completed he re-enlisted and served overseas from 1917 until 1918.

He was a member of the Association of Professional Engineers of Ontario. He joined The Engineering Institute of Canada as a Member in 1921.

**Harold Stewart Dunn,** M.E.I.C., founder and president of Dunn Construction Company Limited in Truro, Nova Scotia, passed away on June 2, 1954.

He was born in Moncton, New Brunswick, on December 14, 1891, and received his general schooling at the Aberdeen High School there. He graduated in 1926 from the International Correspondence Schools in mining and railroad engineering.

Mr. Dunn began his engineering career as chainman on the Intercolonial Railway, and as rodman and transitman on the National Transcontinental Railway. In 1911 he joined the Grand Trunk Pacific Railway as transitman in Saskatchewan and Alberta, and later in the same year, the Canadian National Railways in Ontario where he remained until 1913. During the next two years he served as transitman for the same railway company in Truro and New Glasgow.

He joined the Canadian Expeditionary Force in 1916 and served as a lieutenant with the Canadian Engineers until May, 1919. Upon his return to civilian life he resumed his position with the Canadian National Railways in New Glasgow.

In 1920 Mr. Dunn joined the Bras d'Or Coal Company in North Sydney, Nova Scotia. He continued there as mining engineer until 1926 when he was appointed chief engineer with the Alton, Quincy and Northern Railway in Quincy, Illinois. Returning to Canada in 1929, he became resident engineer on construction work with Canadian National Railways. In 1932 he was named superintendent of construction for the William Cooke Company in North Sydney.

Mr. Dunn joined the Royal Canadian Engineers during the period of 1940 to 1946 and served as officer commanding of No. 6 Company in Halifax, and as district works officer. He retired from the Army in 1946 with the rank of major, and subsequently founded his own construction company in Truro.

Mr. Dunn was a charter member of the Association of Professional Engineers of Nova Scotia, and a member of the Nova Scotia Roadbuilders Association. He joined The Engineering Institute of Canada as an Associate Member in 1931, transferring to Member in 1940.

**Robert Percy Donkin,** M.E.I.C., professor emeritus of Nova Scotia Technical College, and one of Nova Scotia's best known authorities on technical research, passed away suddenly in Halifax on April 5, 1954.

Professor Donkin was born at Port Mulgrave, Nova Scotia, on July 4, 1888. He attended Horton Collegiate Academy, and Acadia University where he received his engineering certificate in 1912, and the Nova Scotia Technical College from which he graduated with a B.Sc. degree in engineering in 1914.

Professor Donkin began his engineering career in 1915 as a draughtsman with Blair Manufacturing Co. Ltd. in Dartmouth. The following year he became associated with Nova Scotia Tramways and Power Co. Ltd. as chief draughtsman on gas works construction, and was promoted to the position of assistant to the general superintendent in 1917. During the following two years he was associated with the Department of Soldiers' Civil Reestablishment as instructor in machine tool operation, mathematics, gas engines and draughting.

In 1920 he became an instructor in mechanical engineering on the staff of the Nova Scotia Technical College, and subsequently became associate professor of mechanical engineering, a position he held for many years. As such he was well known throughout the province and eastern Canada for his work in connection with fuel research.

Professor Donkin was a director of fuel research for the Nova Scotia Research Foundation, and a member of the Association of Professional Engineers of Nova Scotia. He was also a member of the board of directors of the Halifax Infirmary and the Blue Cross Medical Association.

He joined The Engineering Institute of Canada as a Member in 1940.

**Robert Lee Schleihauf,** JR.E.I.C., sales engineer with Dow Corning Silicones Limited in Toronto, was drowned on July 22, 1954, while swimming in Lake Huron at Sarnia, Ontario.

Mr. Schleihauf was born at West Lorne, Ontario, on January 8, 1929. He received his early education there and at Dutton. In 1946 he entered Queen's University, and in 1950, graduated with a B.Sc. degree in chemical engineering.

During the summer of 1948 he was employed by the Department of Lands and Forests of Ontario, and did survey work on crown lands in eastern Ontario. The following summer he was employed as a pipe cleaning machine operator by Dokken Pipe Line Construction Co. Ltd. in Edmonton, Alberta.

He joined Aluminum Company of Canada Ltd. after graduation and was appointed ore plant supervisor at the Arvida plant. Two years later he left Arvida, and after a brief period of employment with Alsco Products in Toronto, he joined Dow Corning Silicones Limited.

Mr. Schleihauf joined The Engineering Institute of Canada as a Junior Member in 1951.

# Employment Service

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

## SITUATIONS VACANT

### CHEMICAL

GRADUATE CHEMIST, required to be trained as assistant to chief chemist. Plant located at Cardinal in Ontario in one of Canada's oldest food industries. Forward all details of experience, education, with pictures, and anticipated salary to File No. 4837-V.

CHEMICAL ENGINEER required to work in control department of paper mill located in Province of Quebec. Graduate from a Canadian or British University. Pulp and paper experience desirable but other chemical engineering experience would be acceptable. File No. 4915-V.

CHEMICAL ENGINEER or chemist, preferably with experience in paint, printing inks, rubber or plastic industries. To sell chemicals in Toronto district. Apply fully in writing to File No. 4960-V.

SALES ENGINEER required by progressive Vancouver company specializing in process equipment in Western Canada. Canadian graduate preferred with experience in chemical or petroleum industries. Excellent opportunity for man with initiative and personality. File No. 4961-V.

CHEMICAL SALES OPPORTUNITIES for engineering graduates. Young graduates to develop three-on-the-job training within sales organization and graduates with sales experience in chemical or allied field. File No. 4964-V.

CHEMICAL ENGINEERS required for refinery located in South America. Must be experienced in process engineering including design, economic studies, and/or scheduling of operating programs. Write giving age, education, marital status and complete details of experience. File No. 4970-V.

CHEMIST OR CHEMICAL ENGINEER for control department of a newsprint and specialty mill in P.Q. Preferably some experience in pulp and paper. Duties to include development and mill investigations. Give details of experience and references in initial letter. File No. 4982-V.

### CIVIL

THE TOWN OF BRIDGEWATER, Nova Scotia requires the services of an experienced civil engineer for regular municipal services. Reply stating age, municipal experience, and when available to File No. 4921-V.

SALES ENGINEER for promotion and sales in professional field. Background in structures and/or construction. Preferred age early thirties. Location Ontario. File No. 4922-V.

GRADUATE CIVIL ENGINEER with about 2 years experience required by major oil company. Duties include job inspection; service stations, bulk storage depots and marine terminals. Preferably bilingual but not necessary. Territory Quebec and Eastern Ontario. File No. 4932-V.

CIVIL GRADUATES. Recent graduates in Civil Engineering required by structural steel firm, in Montreal. Men to be employed in Engineering Department. Experience in structural steel design of advantage but not necessary. Chances of advancement excellent. File No. 4938-V.

CIVIL ENGINEER required by established construction firm operating in the west suburbs of Toronto. Duties entail sewer, water and road layouts planning and general construction problems. Opportunity for a young man wanting to advance. Please reply stating age, education and experience. File No. 4939-V.

CIVIL ENGINEER required in a city in Western Canada to assist in the planning and designing and supervising of construction in extensions of sewers and also sewage treatment plant. File No. 4940-V.

OFFICE ENGINEER AND ESTIMATOR REQUIRED BY LARGE CONSTRUCTION organization opening new office in Montreal. Services of bilingual graduate engineer experienced in heavy construction. Duties involve quantity takeoffs, estimating and design. Good opportunity with permanent position for right party. File No. 4945-V.

CIVIL ENGINEER or architect engineer to act as assistant to chief engineer with large organization in the flour, feed and associated industries. Ten years in civil engineering required. 5 years of design, foundations, superstructures, steel and reinforced concrete, 3 years in construction, 2 years in project co-ordination and administration. $12,000., starting with annual improvements, benefits include health insurance, retirement plan, etc. File No. 4946-V.

GRADUATE CIVIL ENGINEERS required for specialized work in soil mechanics and foundation engineering. Post graduate study essential. Locations Montreal and Toronto with some travelling. File No. 4968-V.

APPLICATIONS WILL BE received by The Federal District Commission for the position of Junior Engineer on highway work in the Ottawa area. Duties would be to assist in design and supervision of highway location and construction. A recent graduate would be suitable preferably with experience on highway work. Salary will depend on qualifications and experience. Position may lead to permanent employment. File No. 4969-V.

AN OUTSTANDING OPPORTUNITY for a qualified graduate engineer. Applicants must have had extensive supervisory experience in the construction of highways, dams, tunnels, bridges and like projects, together with a thorough knowledge of estimating and the preparation of tenders. This is a permanent position with an established firm. Write giving full particulars. File No. 4975-V.

WORLD RENOWNED INSTITUTE requires immediately a research engineer to work full time in the materials field for a highway research project. Work includes as well as practical testing, emphasis at the present time on bituminous pavement problems. Young civil engineer with at least a bachelor's degree. He should be interested in research and be able to work on his own. Experience in the materials field will be helpful. The opportunity is given to take one course per term. The salary is in the range of about $350 to $450 per month depending upon education and experience. File No. 4984-V.

CIVIL ENGINEER required by a municipal corporation in Western Canada. Recent graduate having some experience in railroad maintenance preferred. Other duties will cover the design and construction of water and sewage works. This job offers a good variety of experience in the municipal engineering field. File No. 4991-V.

### ELECTRICAL

ELECTRICAL UTILITY has opening for two junior electrical engineers or engineering graduates in Halifax, N.S. The work will provide opportunities for advancement along both technical and administrative line. Applicants should have a university degree and have not over three years post graduate experience. File No. 4904-V.

HEATING VENTILATION AND air conditioning specialists. Salaries up to $7,200 per annum. Department of Public Works, Transport and National Defence at Ottawa. Details and application forms at your nearest Civil Service Commission Office and National Employment Office. No. 54-1209. File No. 4905-V.

ELECTRICAL ENGINEERS (electronics and radar) salaries up to $6,840 per annum. Department of National Defence and Post Office Department, Ottawa. Details and application forms at your nearest Civil Service Commission Office, and National Employment Office. No. 54-1150. File No. 4906-V.

ELECTRICAL SALES ENGINEER required by manufacturer of switchboards high and low tension, panelboards, busways and switches to cover territory East of Province of Quebec and Maritimes. Bilingual preferred. Opportunity for the right man to become district sales manager. File No. 4918-V.

ELECTRICAL ENGINEER required to take charge of draughting and inspection of switchboards, panelboards, busways, switches, etc. Location Province of Quebec. Bilingual preferred. Opportunity for right man to become plant superintendent. Previous practical experience preferred. Permanent position, salary depending upon qualifications. File No. 4918-V.

PROJECT ENGINEER to join a rapidly expanding company which is a leader in the electronics field and offers scope for advancement. Applicant should be graduate in Electrical Engineering with a minimum of 2 years experience in Television designing, and the development of television and radio receivers, a knowledge of production manufacturing and production processing desirable. Excellent working conditions and a complete program of employee benefits. Salary is open for discussion. File No. 4927-V.

LARGE ALBERTA ELECTRICAL wholesale firm will, due to retirement, require an executive, qualified as an electrical engineer about 45 years of age. Must be a first rate administrator, now holding a very responsible position and able to manage a large portion of the company. A substantial investment in this company, will be made available to a top man with proper qualifications, personally and technically. File No. 4930-V.

PROCESS ENGINEER with about ten years manufacturing experience preferably in the electrical industry. He would report to the Works manager and would be responsible for methods and cost reduction studies, plant layout work and the supervision of time study, tool room and maintenance departments. A knowledge of sheet metal work, plastic moulding, metal finishing, assembly operations, material handling, etc., is desirable. The salary would depend upon the applicant's qualifications. File No. 4931-V.

A LARGE MANITOBA UTILITY requires a graduate electrical engineer to fill the position of assistant to the distribution engineer. Applicant should have at least three years experience in distribution practices, including layouts of large distribution areas; estimating of costs of distribution changes and extensions: improvement of voltage conditions and expansion of existing systems, basic economic studies and design of transformer and other special distribution system structure. Ability to write clear and concise reports to supervise one or more junior engineers and a group of draughtsmen and to deal with field staff is essential. A limited amount of travel within the province will be required. Location is in Winnipeg. Applicants should submit details of family status, age, educational background and experience. Applications will be treated confidentially. File No. 4948-V.

ELECTRICAL ENGINEER with at least five years experience on electrical maintenance and operating problems of generating stations and substations of public utility companies. Permanent positions with long established consulting organization New York. Some travel in Latin America. Spanish or Portuguese useful. Salary commensurate with experience. Reply stating age, education, experience and personal particulars. File No. 4950-V.

ELECTRICAL ENGINEER required as junior or assistant distribution engineer. Graduate with at least 3 years field experience operating utility company. Permanent position with long established consulting organization New York. Some travel Latin America necessary in future. Knowledge of Spanish or Portuguese useful. Salary commensurate with experience. Reply giving age, education, experience and personal particulars. File No. 4950-V.

TWO COMPETENT EXPERIENCED graduate electrical engineers, with approximately 10 years experience in design, operations and maintenance of distribution facilities in established rapidly growing utility located South America. Reply giving resume education, experience and personal data to File No. 4950-V.

GRADUATE ELECTRICAL ENGINEER interested in a career in Latin America with a Canadian owned electric light and power utility located Maracaibo, Venezuela. Age limit 30 years and should have 4 to 5 years' experience in electrical distribution. Immediate prospects for promotion to assistant distribution superintendent and ultimately to executive position if qualified. File No. 4953-V.

CITY IN WESTERN CANADA requires an electrical engineer. Duties: to prepare reports on problems of electrical distribution and utilization: to consult with large wholesale power customers concerning their electrical supply; to maintain technical records and perform related engineering tasks as required. Salary $335 to $408 per month (graduated scale). Qualifications: graduation in electrical engineering from a recognized university with some experience, preferably in electrical distribtuion system work. File No. 4976-V.

GRADUATE ELECTRICAL ENGINEER required with 1-5 years experience in contracting or consulting work to train as electrical representative in Hamilton office. File No. 4978-V.

SENIOR DESIGN ENGINEER with a degree in electrical engineering is required for our rotating machines. direct current design section. Applicants should be between 30-45 years of age, with at least six years experience on design of rotating electrical direct current machines in all sizes, including motors, generators, convertors and rotating regulators. He must possess ability to organize, plan, schedule, promote cost reduction and product improvement in engineering. In addition, he must have a thorough knowledge of direct current machine application, and the ability to promote teamwork. This is a senior appointment with excellent opportunity for promotion. Reply in confidence, giving full personal resume, experience, salary expected. File No. 4980-V.

SENIOR DESIGN ENGINEER required with a degree in electrical engineering for our rotating machines. Small motor design section. Applicants should be between 30-45 years of age, with at least four years experience on design of all types of fractional horsepower motors. He must possess ability to organize, plan schedule, promote cost reduction and product improvement in engineering. In addition he must have a thorough knowledge of small motor application and the ability to promote teamwork. This is a senior appointment with excellent opportunity for promotion. Reply in confidence, giving full personal resume, experience, salary expected. File No. 4980-V.

### MECHANICAL

TOOL DESIGNER REQUIRED mechanical engineering graduate or equivalent in actual experience. Should have approximately five years experience in design of cutting tools, light, sheet dies, forging dies, fixtures, jigs and gauges. Canadian background required. Location in Montreal. Write giving full details of training experience and state salary desired. File No. 4884-V.

MECHANICAL ENGINEER $4,100.00-$5,820.00 for Post Office Department, Montreal, P.Q. Details and application forms at your nearest Civil Service Commission Office, Post Office or National Employment Office. File No. 4916-V.

WANTED GRADUATE MECHANICAL ENGINEER with several years experience for work on design of steam power plants and industrial steam plants. South Eastern Ontario location. State full details. Your letter will be treated in strictest confidence. Our Staff knows of this ad. File No. 4933-V.

GRADUATE MECHANICAL ENGINEER required by Quebec (Eastern Townships) paper mill to act as assistant to mechanical superintendent. Some experience preferred but not essential. File No. 4944-V.

MECHANICAL ENGINEER with approximately ten years experience in production and administration for small sheet metal plant located in Toronto vicinity. Excellent opportunity for future. File No. 4949-V.



MECHANICAL PLANT ENGINEER required by operating division of service organization. University graduate preferred, having 5 to 10 years experience in operation and betterment of steam plants operated by public utilities. Location New York, some travel. Spanish desirable, but not necessary. Reply by letter giving age, education, experience, personal data, and minimum salary acceptable. File No. 4950-V.

SENIOR TOOL DESIGNER required by high class tool and gauge manufacturer in Southern Ontario. Must be mechanical engineering graduate or equivalent in actual experience. Should have approximately five years experience in design of cutting tools screw thread systems, fixtures, jigs and fixed and indicating types of gauges. Position provides good prospects for the future. Salary will be commensurate with ability. Reply in writing, stating details of age, experience, education and salary desired. Applications will be kept confidential. File No. 4951-V.

YOUNG MECHANICAL ENGINEER required for sales work. Must be energetic. have a good personality and the ability or a real desire to sell. Some knowledge of heating and ventilating equipment and their applications is desirable. Good opportunity for ambitious man, with right future in a growing business. Location Montreal. Write giving full particulars including training, experience, age and marital status. File No. 4954-V.

GRADUATE MECHANICAL DESIGN ENGINEER experienced in heavy industry machine design. He should have three or more years of applicable experience. His general duties would include supervision of work of several draughtsmen, stress analysis of structural steel machine frames and machine parts. Evaluation of new designs and improvements to existing designs. Good salary and opportunity for the right man with a well established medium sized manufacturer of pulp and papermill equipment. Location, northern New York State. Enclose full details as to qualifications, experience, salary expected, and recent photograph. File No. 4955-V.

MECHANICAL ENGINEER required in Regina, Sask., who is a graduate mechanical engineer and has at least five years practical experience in the design of heating, ventilating, air conditioning and refrigeration systems for buildings. Applicants reply giving full details and expected salary in first letter. File No. 4963-V.

PLANT MAINTENANCE ENGINEER, mechanical graduate with three to five years of applicable experience and the ability to supervise personnel for a chemical works engineering department located in the Province of Quebec. Please reply with full particulars to File No. 4967-V.

MECHANICAL ENGINEER required by paper mill located in Province of Quebec with head offices in Montreal. Ap-

## National Research Council Canada

### DIVISION OF BUILDING RESEARCH

## Snow and Ice Research

**With the completion of special laboratory facilities for Snow and Ice Research in the New Building Research Centre, Ottawa, the National Research Council, Division of Building Research invites applications for the following Research Officer positions:—**

**A Civil or Mechanical ENGINEER, preferably with knowledge of Soil Mechanics and some practical experience to work on the engineering aspects of snow and ice research, especially on field studies of ice and snow.**

**A PHYSICIST or Engineering Physicist with M.S.C. or Ph.D. degree to assist with the research programme to be developed in the new laboratory.**

**Salary will depend on training and experience. The opening provides challenging opportunities in a new field of work, vitally important to Canada. Applications with full details of education and experience should be sent to the Employment Officer, National Research Council, Ottawa 2, Ontario.**

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plicant should have some paper mill experience or interest to be trained for such a position. File No. 4972-V.

MECHANICAL ENGINEERS REQUIRED for refinery located in South America. Must be thoroughly qualified and experienced in design of refinery or chemical plant equipment including piping, pressure vessels, heat exchangers, etc. Write giving age, education, marital status and complete details of experience. File No. 4970-V.

YOUNG MECHANICAL ENGINEER required for sales work. Must be energetic with a good personality and the ability or a real desire to sell. Some knowledge of heating and pumping equipment and their applications desirable. Location Toronto. Good opportunity with long established business concern. Write giving full particulars including training, experience, age and marital status. File No. 4981-V.

MECHANICAL ENGINEERS required for sales positions with prominent Canadian manufacturer. Experience in gear and mechanical power transmisison field would be an asset. Will be located in Ontario or Queoec. Write giving full details of training, experience and salary desired. File No. 4988-V.

JUNIOR DESIGN ENGINEER to be a graduate mechanical engineer, required for designing and making layouts of piping and equipment installations in a chemical engineering plant. Two years experience essential. Location Ontario. File No. 4990-V.

### MISCELLANEOUS

PROJECT ENGINEER, process-instrument engineer, and piping layout draughtsmen required by consulting firm located in Niagara Peninsula. Applicants must have considerable experience in refinery and chemical plant design and construction. Please write stating qualifications and full details to File No. 4910-V.

MECHANICAL OR ELECTRICAL ENGINEER with education equivalent to graduation in engineering and at least four and preferably six years of engineering experience. Must be registered professional engineer. Experience in plant maintenance and plant engineering is desirable, as well as experience in job installation supervision and in layout and design. Duties will consist of preparation of equipment layout for supermarkets and supermarket renovation and warehouse; plans for refrigeration, air conditioning, ventilation, plumbing, electrical etc. for supermarkets, supervision of mechanical plans prepared by consultants and correlation of these plans with architectural plans; calling of tenders for mechanical trades; the preparation of maintenance work orders for field forces and minor amount of field supervision. File No. 4914-V.

PATENT OFFICER REQUIRED at Ottawa. The successful applicant will be required to undertake various duties dealing with patent applications in the electronic field. University graduation in engineering physics, electrical engineering or physics, with specialization in electronics is required. Pertinent experience desirable but not essential. Initial salary up to $4620.00 per annum depending on qualifications. Apply by letter giving full details of education and experience. File No. 4917-V.

FIRE PROTECTION ENGINEER required for employment on a national basis in Canada preferably with headquarters at Ottawa, under direction of a group of regional and national forest industry associations to design and carry out fire research on all phases of the fire protection problem in Canada, to coordinate educational activities in fire protection and fire prevention, to generally conduct a public relations program on fire protection for the improvement of the standards of fire protection in all classes of properties and occupancies. Should have qualifications for membership in the Society of Fire Protection engineers. Should have experience in modern fire prevention theory and practice with some knowledge of the principle of fire insurance underwriting and fire loss adjustments; and should have ability to meet and address the public with authority on the above subjects. Salary commensurate with qualifications. Duties to commence as soon as satisfactory arrangements can be made. File No. 4919-V.

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## REFINERY ENGINEERS

### SOUTH AMERICA

**Staff positions are available with a large American Company.**

**MECHANICAL ENGINEERS — must be thoroughly qualified and experienced in design of refinery or chemical plant equipment including piping, pressure vessels, heat exchangers, etc.**

**CHEMICAL ENGINEERS—must be experienced in process engineering including design, economic studies, and/or scheduling of operating programs.**

**Can also consider recent graduate Mechanical and Chemical Engineers for training.**

**Attractive salaries, liberal annuity and savings programs offered.**

**Write giving age, education, marital status and complete details of experience.**

**Box 308-Z**
**Radio City Station**
**New York 19, N.Y.**

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OPERATIONS MANAGER required by long established and progressive pre mixed concrete company in major Canadian city. Man who is capable of taking complete charge of operating its 5 modern concrete plants and 100 plus truck mixer fleet. Applicants must have had previous experience and successful record in a similar capacity. Give age, particulars of experience, references, state when available and salary requirements. All replies will be treated strictly confidential. File No. 4924-V.

THE SASKATCHEWAN RESEARCH COUNCIL requires an industrial engineer preferably with mechanical or chemical experience to assist in making industrial surveys, to prepare reports on process and developments, and to provide liaison between science and industry. Position available immediately. Salary will depend on academic attainments and experience. Apply with all particulars, recent photo and addresses of reference, to File No. 4926-V.

NATIONAL PARKS ADMINISTRATIVE OFFICERS, $4,260.00-$4,860.00. National Parks and Historic Sites, Department of Northern Affairs and National Resources, Ottawa. Details and application forms at your nearest Civil Service Commission Office, Post Office or National Employment Office. Quote No. 54-652. File No. 4934-V.

SPECIALIST ON WEAPON Analysis. Salary up to $7,900.00 depending upon qualications. Department of National Defence, Ottawa. Preferably graduation in mechanical or electrical engineering. Details and application forms at your nearest Civil Service Commission Office and National Employment Office. Quote No. 54-1205. File No. 4935-V.

TECHNICAL ASSISTANT to the Chief Cartographer. Department of Mines and Technical Surveys, Ottawa. Salary $5,760.00 to $6,480.00. Address all enquires to the Civil Service Commission of Canada, Ottawa, and quote competition number 54-1707. File No. 4936-V.

ASSISTANT CHIEF ENGINEER. Salary $10,000.00 per annum. Harbours and Rivers Branch Department of Public Works, Ottawa. Details and application forms at your nearest office of the Civil Service Commission, Post Office and National Employment Office. Competition number 54-1258. File No. 4937-V.

ENGINERING FIRM Toronto requires the services of a graduate engineer with high academic standards and particular interest and qualifications in applied gas dynamics and fluid mechanics with special reference to flow machines. Applicant must also be willing to work on a broad range of investigation, design and development assignments including both mechanical and electro mechanical problems. File No. 4941-V.

DESIGN ENGINEER REQUIRED to undertake, under general supervision, the design and development of a wide range of mechanical products and devices. Preference given to applicants having higher N.C. and with design experience on aero engines or their accessories, alternatively to University graduates with post graduate experience in design of highly stressed light weight mechani-

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## Opportunities

### FOR 4 AGGRESSIVE YOUNG ENGINEERS

**SALES**

**One young graduate to develop thru on-the-job training within sales organization.**

**One graduate with sales experience in chemical or allied field.**

**PROCESS**

**Two chemicals to progress thru process development department to process supervision.**

**For details write**
**W. M. Kirk, Personnel Manager**

## DOW CHEMICAL OF CANADA, LIMITED

### SARNIA, ONTARIO

**(Inquiries Confidential)**

**CONTROL ENGINEERS FOR PAPER MILL AND PULP MILLS**

**Control engineers for paper mill and pulp mills situated in urban area in the province of Quebec. Applicants must be university graduates with a minimum of 3 to 5 years experience. Opportunity for advancement excellent. Salary commensurate with experience. File No. 4992-V.**

cal devices. Small engineering company located in Toronto Suburb. File No. 4941-V.

APPLICATIONS ARE INVITED for positions requiring engineers and technicians with adequate technical qualifications and practical in board and paper industry. Locations in West Pakistan. Free furnished married accommodation will be provided. Appointment on contract for 3 years including six months probation and provision for passage and leave. Successful applicants required at site early October, 1954. Applications stating full qualifications, experience, position held, age and accompanied by copies of references and passport size photographs should be sent in duplicate. For further information apply to File No. 4947-V.

YOUNG GAS ENGINEER wanted in connection with operation of two manufactured gas plants and distribution systems Excellent opportunity for future. Desire mechanical chemical graduate with few years experience manufactured gas. Reply stating age, experience, education and personal particulars. Location Panama, R de P. File No. 4950-V.

METER SUPERINTENDENT required by established rapidly growing utility in Brazil with 10 years experience in meter department of Canadian or large Latin American public utility to supervise meter departments in several operating companies. Single man preferred as considerable travelling involved. Reply giving resume education, experience and personal data. File No. 4950-V.

FIRE PROTECTION ENGINEER required by well known insurance brokers office. After a period of training, duties would consist mainly in inspection work and sprinkler equipments and eventually general work usual to an insurance brokerage business. Position offers excellent prospects to right party. File No. 4952-V.

SALES ENGINEER required by manufacturers of centrifugal pumps offer opportunity to young college graduate age 22-28, in sales engineering career. Edmonton area. Salary and commission. Reply in writing giving full particulars of age, education and background, including photograph. File No. 4955-V.

MECHANICAL OR ELECTRICAL ENGINEER for the position of instrumentation engineer to be responsible under the chief design engineer, for the application, design and selection of instrumentation and control equipment in connection with all operational phases of a self contained pulp and paper mill. File No. 4957-V.

ENGINEER FOR PATENT ATTORNEY'S office. Ambitious recent graduate with flair for writing and willing to learn, wanted as technical assistant in large Toronto patent law firm. This man will qualify to try registered patent agent examinations in three years. Apply by writing giving full details of education and experience. File No. 4959-V.

INDUSTRIAL ENGINEER required to head department of plant manufacturing diversified machinery and structural steel Location Province of Quebec. Prefer bilingual French Canadian. Good opportunity for advancement. Applicant should have good basic training, qualifications and technical references. Applications should be written in French and will be held in strict confidence. File No. 4966-V.

MECHANICAL, ELECTRICAL AND CIVIL ENGINEER required by organization in Ontario undergoing large development program. Each should have some construction experience. File No. 4962-V.

DIRECTOR ENGINEERING and water resources Branch. Salary up to $11,000., depending upon qualifications. Department of Northern Affairs and National Resources, Ottawa. Details and application forms at Office of the Civil Service Commission, Post Office or National Employment Office. Quote No. 54-685. File No. 4965-V.

**Mechanical or Civil Engineer**

**Mechanical or civil engineer required by large mining and milling firm in Eastern Townships for design of plant mechanical installations under supervision of a senior engineer. Will be responsible for layout, specifications, scheduling and engineering supervision of installations. Blue Cross, group life and pension plans available. Personal interview will be arranged at company expense for suitable applicants. Reply giving full particulars, including salary expected, to:**

**Employment Manager,**
**Canadian Johns-Manville Co. Ltd.,**
**Asbestos, Quebec.**

VEHICLE EXPERIMENTAL and Proving Officer. $5,100 to $5,820. Department of National Defence, Orleans, Ontario. Details and application forms at nearest office of the Civil Service Commission, Post Office or National Employment Office. Quote No. 54-1210. File No. 4971-V.

GRADUATE ENGINEER required for Industrial Work. This is an unusual opportunity in a reputable Montreal organization for a man between 25 and 35 years of age with experience in equipment maintenance and plant engineering. Some planning and development experience would also be advantageous. Please state full details of personal and professional background and salary required in first letter. All applications treated in strictest confidence. File No. 4973-V.

COMMUNICATIONS SYSTEMS PLANNING engineer. A leading Canadian electronics manufacturing and sales organization requires a senior engineer in its sales systems group. This man must be well versed in power utility communications, supervisory control, systems, telemetering, etc. Since this position is in a technical sales group, experience on or an adaptability for sales customer contact, cost estimation and contract bidding is essential. Salary will be commensurate with qualifications and demonstrated ability. File No. 4974-V.

GRADUATE ENGINEER in mechanical, civil or electrical engineering with a maximum of two years experience. General shop experience preferred. The duties of this engineer would be to assist the mechanical superintendent in the specification and procurement of material, as well as to study and follow up maintenance problems. The position leads to that of mechanical superintendent. Salary open. File No. 4977-V.

DESIGN ENGINEER for editorial position required on new technical publication covering the whole field of engineering design. Applicant should be a University Graduate in either mechanical or electrical engineering with practical experience in design engineering work. This is a senior position in a major publishing house and calls for a man who had technical writing experience. A most attractive proposition with good salary and hospitalization, life insurance and pension plans. All applications will be treated in strict confidence and should be as comprehensive as possible, detailing age qualifications and experience. File No. 4983-V.

AN ENGINEER NOT OVER 45 with some experience in estimating. We are a young company specializing in sewer and waterworks. We also do some wharfs and breakwater, etc., apply stating age, salary expected for the first year, graduation, experience and references. If satisfactory, the applicant will be sold an interest in the company. File No. 4987-V.

TIME STUDY ENGINEER preferably with a University Degree and 5 or 6 years experience required by electrical manufacturer in Ontario. Lacking a degree a good technical background might suffice provided the applicant had the necessary practical experience in time study. This position is permanent. File No. 4985-V.

ELECTRO CHEMICAL ENGINEER for plant operating electric arc furnaces. College graduate or equivalent with two years plant experience to carry out technical investigations and process studies. Ability to picture ideas by drawings essential. A working knowledge of French, mechanically inclined, have initiative and able to work with other members of our staff are all necessary qualities. File No. 4989-V.

DESIGN DRAUGHTSMAN required for designing and making layouts of piping and equipment installations in a chemical engineering plant. Five years experience essential. Age 24 to 30. File No. 4990-V.

## SITUATIONS WANTED

ELECTRICAL ENGINEER, B.Sc. (E.E.). Manitoba, 1943, P.Eng. (Ont.), M.E.I.C., age 34, married, requires immediate employment. Six years with Industrial

**Senior Gun Inspector**

**Salary — up to $6500 Per Annum Depending Upon Qualifications**

**Inspection Services**

**Dept. of National Defence Ottawa.**

**To supervise inspection and proof of light and heavy ordnance equipment in Canada.**

**Details and application forms at Post Office, National Employment Office or nearest Civil Service Commission Office.**

**Quote Competition 54-1212.**

**CIVIL SERVICE OF CANADA**

Motor Control manufacturer, mainly application engineering including circuit design, plus general supervisory and manufacturing experience and liaison with sales, purchasing, production and inspection departments. Eighteen months with National Research Council, Ottawa. Three years Cdn. Army (R.C. Signals) immediately after graduation. Desires responsible position with consultant or manufacturer. Will locate anywhere. File No. 1408-W.

MECHANICAL ENGINEER age 32, Polytechnique 1945, bilingual. Employed as combustion engineer with large distribution of coal and fuel oil in Montreal. Extensive field experience on all aspects of fuel utilization, sales and service. Seeks employment with oil company or equipment manufacturers related to power engineering as combustion and/or sales engineer. File No. 2554-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng. (Ont.) B.Sc. (Queens) 1941, age 38, 13 years experience in manufacturing methods, process engineering, production engineering of high precision components, plant layout and engineering desires position as plant engineer or mechanical superintendent; available immediately. File No. 3272-W.

CIVIL ENGINEER, Jr.E.I.C., Alberta 1951, veteran, age 38, single. 3½ years experience in hydro-electric field, both in design and field work. Also experience in municipal engineering. Two years experience in airport construction with the Department of Transport. Location preference, Alberta or British Columbia. Desires position in hydro electric field, but will welcome offers from other civil engineering fields. Available on month's notice. File No. 3489-W

ELECTRICAL ENGINEER B.Sc. (E.E.) 1950 Jr. E.I.C., age 33, married. Presently employed managerial capacity in sales and sales promotion, directing small sales staff. Present earnings in excess $5,000.00. Varied experience in sales, sales promotion, office management and with Public Utilities. Desires responsible position in sales, sales representative or in line with experience. Details of education, experience and reference upon request. File No. 3375-W.

GRADUATE ENGINEER 1951 (Mining), age 30, is interested in position offering scope and responsibility where an engineering background is helpful (not necessarily in the mining field). Other training includes military engineering, RCAF service and business management course. Mining experience as miner, surveyor, layout engineer and mine engineer in base metal and industrial mineral operations. More recent duties have included engineering reports and studies and supervision of construction. Married, one child, available on reasonable notice. File No. 4000-W.

GRADUATE MECHANICAL ENGINEER, Jr.E.I.C., age 28, with four years experience in design and research in the hydraulic field is seeking position with a progressive company as designer and/or sales engineer. File No. 4102-W.

CIVIL ENGINEER B.A. (Honours) maths. B.Sc. (Civil Eng.) M.Eng. (McGill University). About two years experience in field and design work (structural and hydraulic work) in Canada. Age 26. Married, one child. Citizen of India. Available from October 1954 for teaching engineering design work in India or Colombo Plan countries, or Indonesia. Keen, hard working good references. File No. 4108-W.

MECHANICAL ENGINEER, Jr.E.I.C., 51 McGill graduate, 29 years of age, single. Completed 2 years graduate student training course with Canadian Electrical manufacturer. Presently engaged as manufacturing engineer. Desires a position with opportunity to demonstrate his ability. Location—anywhere. File No. 4217-W.

CONSTRUCTION ENGINEER, Jr.E.I.C., B.Eng. (Civil) McGill 1951 married. Considerable experience in design and field supervision of industrial and commercial projects, including steel, concrete and timber structures. Thoroughly familiar with office routine, estimating, writing specifications and preparing plans for tendering. Interested in position with progressive, growing firm of consultants or contractors. File No. 4273-W.

CIVIL ENGINEER, M.Sc., M.E.I.C., P.Eng. (Ont.), graduate 1947 is available. First class designer of all types of modern structures, inventive, enterprising and with flair for structures involving complex statical problems. File No. 4173-W.

GRADUATE ENGINEER, B.Sc., 1951, Jr.E.I.C., P.Eng., married, 3 years varied experience in mechanical handling and municipal engineering desires position in plant, mechanical handling or industrial engineering. File No. 4207-W.

CHEMICAL ENGINEER with several year's experience in control, operation and development in the field of metal finishing and protective coatings for appliances, chemical and food industry. Has had varied experience in finishing, design and maintenance of large factory equipment as well as small serial articles in aluminium, magnesium, steel and brass. Multicolor finishing on anodized aluminium. Formulation of cleaning, etching and phosphating solutions etc. Desires permanent position with opportunity for advancement. Will locate anywhere. File No. 4359-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950 graduate, Toronto, veteran, 32, single; some research experience, over three years in chemical industry on project and design work, involving process and services equipment and piping, instrumentation and building construction, including some estimating, purchasing, expediting and inspection. Desires position of greater responsibility in similar work or in maintenance work of a general nature. File No. 4418-W.

CIVIL AND STRUCTURAL ENGINEER, Jr.E.I.C., P.Ont. Cambridge University 1947. 6½ years experience, civil and structural engineering in industry, consulting engineering and research. Expert knowledge in structural analysis, specializing in prestressed concrete. Presently employed in Toronto. Desires change of employment where experience could be best utilized. File No. 4467-W.

ADMINISTRATOR, professional engineer in early forties, extensive manufacturing experience large corporations; well qualified industrial relations including contract negotiations, arbitrations, proven record in safety, supervisory training, policy formation, cost budgeting, maintenance and stores control; sales and warehousing experience; seeks challenging position in small or medium company. File No. 4496-W.

ELECTRICAL ENGINEER, B.A.Sc., Toronto, 1950, P.Eng. (Ont.) Jr.E.I.C., age 30, married, experience in industrial construction, field supervision, electrical generation and distribution, paper mill operation and maintenance. Desires position offering opportunity. Will locate anywhere. File No. 4545-W.

CIVIL ENGINEER, B.E. 1953 U. of S., Jr.E.I.C., seeks position in design and construction. Working at present with prominent Government engineering department. Interested in position with good possibilities for advancement. Willing to work hard. Single with car. Experience in surveys (all types), supervision of survey crews and construction crews, design in water and sewer lines, some concrete design. Was completely in charge of installation of many hydraulic structures, highway-type bridges, large culvert installations and a gravel contract. Has also had experience photoelastic analysis, soils studies and river studies. Has taken night classes in photography, welding and carpentry. Interview can possibly be arranged. File No. 4563-W.

GRADUATE CIVIL ENGINEER, D.R.T.C. (Glasgow), A.R.T.C. (Glasgow) San. Eng. (Glasgow), age 31 years, single, bilingual, willing to travel, desires senior position with responsibility in municipal engineering, contracting, concrete or structural steel installations. Experience: one year research work, 3 years general municipal engineer, 4 years drainage and irrigation experience in Malaya, including supervision of earth moving plant, reinforced concrete design, estimating, surveying, office routines, design of irrigation schemes and structures, chief assistant on a $5,000,000 (Canadian) irrigation scheme. Experienced in jungle clearing and swamp drainage. Available September 1st. File No. 4565-W.

MECHANICAL AND INDUSTRIAL ENGINEER, P.Eng., M.E.I.C., A.M.I.Mech.E., junior executive, 10 years experience of industrial plant specifications, layout, design and erection, also specialized machine design and plant maintenance. Interested in entering consulting field in Southern Ontario. File No. 4568-W.

CIVIL ENGINEER, McGill, 1951, Jr.E.I.C., P.E.Q., married. Presently employed as area field engineer, on large project. Experience— 6 months drafting, 2½ years office engineer (quantities, costs, progress reports etc.) and 1½ years varied field engineering in heavy construction. Seeks responsible and permanent position in Montreal with firm requiring above experience, or in design office. File No. 4579-W.

CHEMICAL ENGINEER, M.E.I.C., 1937 graduate, married, Canadian, would like to locate in the Toronto area. Experienced in pilot plant design, production and management phase of organic chemical plants both in Canada and the U.S. Interested in production and in sales in the field of chemical plant equipment or engineering services. File No. 4580-W.

ENGINEERING AND BUSINESS graduate Jr E.I.C., P.Eng. Ontario, B.A.Sc. Toronto (honours) 1953, age 24 single, C.G.E. test course graduate tool design and sales experience. Desires position with small or medium sized company in Toronto or South Central Ontario area. Prefers manufacturing or industrial engineering position leading to supervision and management. File No. 4581-W.

A YOUNG CIVIL ENGINEER, 27, married, with Master's degree in hydro-electric structures from Columbia University, New York, and with 4½ years' practical experience in design and construction of hydro-electric projects and reinforced and steel structures in U.S.A., India and Canada. Knows Eastern and Indian languages. Desires a suitable job with any concern working overseas in any part of the world, preferably in Eastern or Middle Eastern countries. Presently employed. File No. 4582-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng. (Que.), B.Eng. McGill 1951, single age 26, 1½ years' experience technical assistant sales in rubber industry, assistant construction engineer for new pulp and paper mill in New Zealand, assistant power engineer pulp and paper mill in Australia. Desires position with small manufacturing company in Montreal. File No. 4584-W.

CIVIL ENGINEER, university graduate, P.Eng., age 38, married, one child, with practical experience in road construction, surveying, steel structures and reinforced concrete (industrial structures and heavy foundations for power stations, steel mills, etc.) both with contractors and with consulting engineers, used to work on own initiative and responsibiltiy, attending to correspondence, site meetings and negtiations with clients, some knowledge of accounting and financial matters, at present with consulting firm, desires responsible position with construction company, consulting engineers or investment organization requiring the services of a competent engineer, preferably but not exclusively in Toronto. Apply File No. 4536-W.

MECHANICAL ENGINEER (Polish University College, London, 1951) specializing in aero and thermodynamics. Three years' experience as designer and draftsman in pneumatic and electric equipment. One year in Canada. Interested in position in research or development. Age 35. Will go anywhere. File No. 4587-W.

CIVIL ENGINEER, McGill 1950, with five years excellent construction experience (design, supervision of construction, costing). Two and a half years on construction with Canada's largest textile company. Recent overseas experience in pulp and paper mill construction, oil refinery construction, building design. Desires position with company allied with the construction industry where there is a chance for responsibility and advancement. Willing to work anywhere but preferably in the Toronto-Montreal area. File No. 4588-W.

DIPLOMA ENGINEER—CIVIL, age 41, with 10 years of varied continental and British experience on the design of concrete buttress, gravity and arch dams, weirs, sluices, tanks, fishpasses, large steel welded pipe lines, and structural steelwork, reinforced concrete and prestressed concrete bridges and industrial structures with shell roofs. Seeks responsible position in British Columbia, Ontario or Quebec. File No. 4590-W.

MECHANICAL ENGINEER, London University 1948. Experience includes 6 years, project and plant engineering in chemical industry, U.K. and Argentina. Presently employed in Canada in non-technical capacity. Desire position in line with previous experience. Location immaterial. File No. 4596-W.

CIVIL ENGINEER, B.Sc., Manitoba, M.E.I.C., ten years varied experience as designer and field engineer on plant construction and maintenance. Supervised structural and mechanical installations in Canada's largest pulp and paper, foundry, and automotive industries. Seeks position as assistant to resident or plant engineer with progressive company. Highest references and executive evaluation reports. File No. 4597-W.

PROFESSIONAL ENGINEER with master's degree in business administration, bachelor's degree engineering, 3½ years utility, 6 years manufacturing and sales, test course. Author technical papers. Accustomed to responsibility. Age 30. Seeks position with future. File No. 4599-W.

MUNICIPAL ENGINEER, M.E.I.C., age 46, bilingual, seeks managerial or senior engineering position with an expanding municipality. Also would consider work for a consulting firm specializing in town planning, design of subdivisions and municipal services. The advertiser would require some 2 or 3 months notice from his present position of project engineer for a large urban subdivision. File No. 4600-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., married, 7 years design experience in pulp and paper equipment, heavy industrial and marine equipment, 4 years research and development in combustion engines, mainly diesel. File No. 4601-W.

MECHANICAL ENGINEER, M.E.I.C., P. Eng., grad. U. Riga, Latvia, age 43, family, 8 years preliminary and 14 years responsible practice. Latter includes: heating and plumbing, design and installation; industrial engineering, process, research, production, maintenance, design and supervising of plant expansions; construction engineering; roads — survey, design, construction. Four years of this experience in Canada and five under U.S. army in Germany. Available for an engineering appointment in Montreal area, end of April 1955. Interview—Jan. 1955. File No. 4602-W.

ELECTRICAL ENGINEER, B.Sc.E.E., Man. 1950, Jr.E.I.C., age 26 married, 1 child. Four years with public electric power utility, including supervision of transformer repair dept., supervision of recloser servicing, experience in metering installations and meter testing, and experience in various operational problems of power lines and associated equipment. Seeks position in work related to experience, preferably design, with manufacturer, power utility, or industrial concern where conscientious work and ability result in opportunity for advancement. Available on suitable notice to present employer. File No. 4603-W.

MECHANICAL ENGINEER, age 33, married, no children, university of Toronto 1943, veteran. Ten years industrial experience, four years design, engineering, manufacturing, production and purchasing, six years application, marketing, sales and service. Experience covers power plant equipment, pumps, feed water conditioning apparatus, boiler controls, materials handling equipment, electric, hydraulic and pneumatic control systems, petroleum products, mining machinery and power transmission machinery. Presently employed but desires challenging work for aggressive firm with opportunity for administrative and/or management career in sales, service or manufacturing. Would prefer Ontario, Alberta, or British Columbia. Particulars willingly supplied to interested employers. File No. 4604-W.

MECHANICAL ENGINEER, Australian. Graduated 1943, A.M.I.E. Australia, 32, married. No children. Experience includes field installation of mechanical or electrical plant, army workshop. Supervision large scale refrigeration unit. Design, development and manufacture of welded steel pipe plant. Physical testing, instrument calibration, materials investigation, lecturing in mechanical engineering and laboratory supervision Factory management. Consultant on steel fabrication factory design and layout. Recently arrived Canada. Desires position in or near Montreal. Available immediately. References. File No. 4605-W.

CIVIL ENGINEER, B.Sc., P.Eng., M.E.I.C., age 30, family. Desires to become permanently established in large city, preferably in Western Canada. Three years experience as city engineer in charge of public works and utilities. Experienced in sewer and water main installation, sidewalk and curb construction, drainage, paving. Four years experience as resident engineer on highway construction, four summers on federal government geodetic and irrigation surveys. Further particulars will gladly be forwarded to interested employers. File No. 4606-W.

MECHANICAL ENGINEER, M.E.I.C., P. Eng., age 36, married, wide experience in plant engineering, maintenance, plant layout, design and development in industrial and aeronautical field. Proven executive ability. Presently employed in managerial capacity. Wishes permanent position in progressive organization requiring initiative and ability. Montreal area preferred. Resume on request. File No. 4607-W.

# Attention, Members

Please telephone in advance and make an appointment if you propose using the Institute's Employment Department.

This will result in a better service to everyone concerned.

**TELEPHONE PLATEAU 5078**

**Except in special cases all interviews will be arranged between the hours of 9 and 12.**


**Activities of the Forty-seven Branches of the Institute and abstracts of papers presented at their meetings**

## Hamilton

N. A. Parry, Jr.E.I.C.,
*Secretary-Treasurer*
F. S. Gue, Jr.E.I.C.,
*Branch News Editor*

On Friday, September 17, Hamilton branch members were guests of the Hydro Electric Power Commission of Ontario during a visit to the St. Lawrence Hydraulic Model at Islington, Ont.

All present were impressed with the detailed information which could be obtained from the elaborately constructed concrete model of "Canada's River." From the model an insight into the proposed Seaway was obtained which would be unavailable in any other way.

A model of the projected bascule dam structure and corrective works to be built in conjunction with the Sir Adam Beck G.S. No. 2 was also inspected.

The Branch is indebted to Mr. Don Harkness, Assistant Hydraulic Engineer, Power Generating Division, H.E.P.C., for supervising the tour.

## Toronto

Louis Bresolin, Jr.E.I.C.,
*Secretary-Treasurer*

***Professional Development Program***

Four years ago the Toronto Branch initiated a Professional Development Program consisting of a series of lectures, with discussions, on a general range of subjects. From its outset the program was an outstanding success, and last year a second group was added to permit a larger participation, and to round out the development of those who had already attended the previous series. The enthusiasm of the graduates of this second series was so great that they have decided to continue their association by meeting in a discussion group this autumn which will be called Professional Development Course III. Registration took place in late September, and regular meetings will be held once a week for each group in the Wallberg Memorial Building at the University of Toronto.

The tentative program received by the *Journal* indicates that this year's activities will hold plenty of interest, and could well fulfil the announcement's promise of the best year yet. It is particularly noteworthy that this whole Professional Development Program is being organized and directed by the younger members of the Toronto Branch, the chairman of the three groups being either Juniors or Students.

## Cornwall

Lawrence H. Snelgrove,
*Secretary-Treasurer*
J. H. Summerhill,
*Branch News Editor*

***Plant Tour***

On Sept. 9 some 35 members of the Cornwall Branch of the Engineering Institute of Canada toured TCF of Canada Limited, a plant that is producing transparent packaging material. The members were guided on a two-hour tour by works manager A. E. King and departmental heads. The Company's president R. K. Tinkler was also present.

Manufacture of TCF — transparent cellulose film — is largely automatic, and although the company plans to produce some 200 tons of the material a week it employs less than 300 men and women.

***Viscose Extrusion***

Main operation of the process is extrusion of viscose on two identical machines that carry the product through several solutions, rolling the semi-finished film on spindles ready for the coating department.

The liquid viscose, contained in several large tanks, is filtered through screens and by a vacuum process before being pumped to the production machines. It is passed through a long aperture into a bath of sulphuric acid which changes the viscose to a semi-solid state.

From there, the material passes on rollers through baths of weaker solutions, each contributing to its coagulation. At this stage in the manufacture, the film remains semi-opaque and milky-white.

Passing at speed along the complex equipment, it is washed free of acid, bleached for transparency, washed again, softened with a glycerin solution before passing through a drying chamber.

After the drying process, another chamber adds some seven per cent of moisture to the product before it is rolled on spindles for the coating room.

The finished film is considerably narrower than the original viscose extrusion. Officials told the engineers that some 45 per cent is lost in the process.

Temperature control is strictly enforced in the coating department where potentially explosive nitro-cellulose is used for moisture-proofing. Here, the film is again placed on rollers, run through a lacquer bath, then up 90 feet through the drying tower.

***Recovery Plant***

A fully automatic recovery plant makes it possible to use 95 per cent of lacquer solvent released in the atmosphere of the drying tower.

Final stage of the tour took the visitors to the shipping rooms where the clear, crinkly film is cut to sizes specified by customers, packed and sent to manufacturers as far away as South Africa. Four grades of film are produced.

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### Film Available for Branch Meetings

"Breakthrough" the drama packed motion picture on the driving of Alcan's ten-mile power tunnel at Kemano, B.C., has just been released by Canadian Ingersoll-Rand. Produced in sound and full color the film records in a concise and understandable manner the complete story of modern hardrock tunnelling.

The "breakthrough" of this 10-mile, 25-foot diameter giant tunnel represents a remarkable achievement in organization and team work, and an impressive tribute to the design and construction of the equipment used.

The company has arranged to show the film throughout the country and will give priority to requests received from Branches of the Institute. If your Branch is interested contact the local Ingersoll-Rand branch or write to the Film Department, Canadian Ingersoll-Rand Co. Ltd., 620 Cathcart St., Montreal, Quebec.

# LIBRARY NOTES

## Additions to the Institute Library

**Reviews — Book Notes — Abstracts**

### BOOK REVIEW

**Canada's tomorrow; papers and discussions, Canada's tomorrow conference, Quebec City, November 1953.** G. P. Gilmour, ed. Toronto, Macmillan, 1954. 324 pp., $3.50.

To celebrate its fiftieth anniversary, Canadian Westinghouse sponsored a conference in Quebec City in October 1953, the theme of which was "Canada's tomorrow". Nearly three hundred people attended, to participate in this experiment in national self-examination and prophecy.

The nine papers presented at the Conference, together with a digest of the discussions on them, are reproduced in this book, which is edited by G. P. Gilmour, the President of McMaster University.

The subjects discussed cover many aspects of the Canadian scene; the people, natural resources, the roles of science, industry and government, education, and cultural development. The last two papers deal with Canada's place in world affairs, and an outsider's view of the country.

The papers are both an analysis of past events and developments, and an attempt at objective appraisal of what the next fifty years may bring. The editor says in his introduction: "To many nations, the next fifty years will present problems of survival and of unity, of needed change in institutions or traditions: but to Canada the next half-century presents a happier prospect, of a people greatly blessed with goods and resources . . . with a record of representative government remarkably free from corruption, and with habits of honesty and decency of inestimable value. If it is not given to us to map the future, we can at least get a running start into it by discovering where we are and by what stages we have come thus far, and by gaining a sense of direction and an awareness of possible dangers."

Every Canadian interested in the future of his country should read this serious, stimulating book, written by some of Canada's leading figures. S.C.

### BOOK NOTES*

**Prepared by the Library**

**The Engineering Institute of Canada**

*Book notes marked by an asterisk have been provided through the courtesy of the Engineering Societies Library in New York.

**Achieving your career.** J. S. Kopas and Wiley Garrett. Youngstown, Industrial information institute, 1953. 138 pp., $1.50 (U.S.).

Intended primarily for those attending high school in the United States, the aim of this book is to present a review of the various types of occupation existing in that country, and the educational and other requirements needed for each.

The material is presented in a simple form, and the book should be of interest to Canadian high school students, uncertain for which type of job they are best fitted.

**Bibliography of interlingual scientific and technical dictionaries,** 3rd ed. United nations educational, scientific and cultural organization. Toronto University press, 1953. 178 pp., $1.75.

This third edition of the Bibliography lists over fifteen hundred dictionaries in seventy-five languages, under more than two hundred and thirty subject headings.

The dictionaries are arranged by subject according to the Universal Decimal Classification. A key to this is included and there are language, author and subject indices. As it was intended to make the bibliography as complete as possible, listings include dictionaries which are not up-to-date, as well as those known to be out of print. The compilers have indicated those works known to them to be satisfactory and obtainable.

This bibliography will be an invaluable addition to the reference shelf of any library.

**Cabma register of British products and Canadian distributors, 1954-55** London, Kelly's directories and Iliffe 1954. 780 pp., $7.50.

The various sections of this register are: the Buyers' guide, an alphabetical list of products with their British suppliers and names of their Canadian representatives, followed by the French-English glossary giving the French equivalents of these products; an alphabetical directory of British manufacturers and distributors with details of the 4,500 firms concerned; Canadian distributors' announcements; proprietary names and trade marks. This new edition will thus quickly show the nearest, quickest and most convenient source of supply of any British product sold in Canada.

**Climatological atlas of Canada.** Canada, National research council. Ottawa, N.R.C., 1953. 253 pp., spiral binding, maps. $2.00.

Prepared jointly by the Meteorological division of the Department of transport, and the Division of building research of the National research council, this atlas was originally intended to be part of the 1953 revision of the National building code. However, it became evident that the amount of information available warranted the preparation of a separate work.

The eighty-four maps included in the Atlas show temperatures, both average and extreme, humidity, wind, snowfall, rainfall and total hours of sunshine.

A section of the book is devoted to Hythergraphs. These show in diagrammatic form the average annual climate of many Canadian locations, and of severa cities outside Canada for purposes of comparison.

This Atlas provides information on the Canadian climate in a form which will be of use to all those whose work is influenced by the weather: builders, architects, engineers and others, and will be of interest to those who are merely curious about our weather.

**Coastal engineering. Proceedings of the fourth conference on coastal engineering, October 1953. J. W.** Johnson, ed. Berkeley, Council on wave research, 1954. 398 pp., illus., $5.00 (U.S.).

This collection of papers covers a wide variety of problems connected with coastal engineering. The four main sections are titled Basic information for shoreline investigation; Shoreline sediment problems; Shoreline protection problems; .Design of shoreline structures. The

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#### Bibliography and Reference Service

Short subject bibliographies are compiled on request. When placing these requests, please give as much detail and background information as possible.

#### Borrowing

Books, periodicals, pamphlets and films may be borrowed for two weeks at a time. All books included in the Library Notes Section of *The Engineering Journal* are available for loan. **A fine of 25c per day is charged for each day borrowed items are retained beyond the two-week period.**

A library deposit of $5.00 at par in Montreal is required, for which two items may be borrowed at a time. Temporary deposits (30 days or less) $10.00. Books are sent anywhere in Canada, and carrying charges are payable by the member concerned.

#### Ordering

Any book or pamphlet may be ordered through the library. All publications of affiliated societies, whether books, pamphlets, or periodicals, should be ordered through the library, as reduced rates are applicable on these to all members. Except in the case of library deposits **please make no payments in advance.** Non-members may consult the library, but may not borrow material. Please address all requests to **The Library.**

individual papers are too numerous to detail but many of them concern the shorelines of the Great Lakes and two deal with the coast of the Netherlands as it was effected by the floods of 1953. Other studies have as their subjects statistical analysis of wave records, characteristics of natural beaches, effect of ice on shore development and the shock pressure of breaking waves.

The papers are not indexed but the table of contents partially fills this need.

*__Diesel engine catalog,__ volume 19, 1954-1955. R. W. Wadman, ed. Los Angeles, Diesel Engines, Inc., 1954. 390 pp., $10.00 (U.S.).

Details on the engines and auxiliary equipment produced by the major manufacturers are given in this book. New designs and developments of the past year have been added to this edition and the accessories section has been expanded.

*__The economic almanac,__ 1953-1954. National Industrial Conference Board. New York, Crowell Company, 12th ed., 1953. 740 pp., $3.95. (U.S.).

Statistical tables on population, income, resources, foreign trade, individual industries and many other topics, selected on the basis of their significance to business and the general public, currency, and reliability. A glossary of terms and detailed index is provided.

**Electrical ignition equipment.** F. G. Spreadbury. Toronto, Longmans, Green, 1954. 227 pp., illus., $4.50.

In this book we find a comprehensive study of electrical ignition equipment within the framework of existing conditions which make new and greater demands upon this type of ignition. The use of ignition equipment ranges from driving the small auxiliary engine to propelling large tanks and aero engines, and the author outlines the principles, design and construction of equipment to meet these applications.

Formulae and tables help to illustrate the text which is divided into chapters on the ignition of explosive mixtures, sparks, ignition coils, magnetos and the testing of ignition equipment. Written at an intermediate level, its scope covers most present day ignition systems as well as some details of those that may have wider future applications e.g. electronic ignition systems.

*__The electromagnetic field in its engineering aspects.__ G. W. Carter. Toronto, Longmans, Green, 1954. 360 pp., $6.30.

A systematic, non-mathematical treatment of the theory of electromagnetism with reference to its engineering applications. Fundamentals of conductors, insulators, electric circuit theory, electromagnetic induction, and related topics are discussed, and are illustrated by appropriate problems. The MKS system of units has been adopted.

**Estimating construction costs.** R. L. Peurifoy. Toronto, McGraw-Hill, 1953. 315 pp., illus., $7.95.

This book, which determines unit costs of materials, equipment, and labor, should be useful to Canadians involved in construction work. These unit costs, which in this volume are related only to the preparation of detailed estimates, can be applied to any locality. The information consists of descriptive material, tables and examples. Tables involving labour give the approximate man-hours required to perform a specified quantity of work.

Separate chapters are devoted to various types of construction: earthwork and excavation; highways and pavements; foundations; concrete structures; floor systems; masonry; timber and steel structures; water and sewerage systems. Appendices include compensation insurance rates, costs of owning and renting equipment and a depreciation schedule.

**Fundamentals of transistors.** L. M. Krugman. New York, Rider, 1954. 140 pp., $2.70 (U.S.).

This is a practical manual of transistor information written for the technician and amateur. The first brief chapter outlines the basic physics of semi-conductors then the construction, operation, gain, and impedance characteristics of typical transistors are considered. In the fifth and sixth chapters transistor amplifiers and oscillators are considered with the text supplemented by many formulae and graphs. The basic circuitry, applications and limitations of the transistor are discussed in all these chapters, and the book closes with miscellaneous considerations, including transistor operation at high frequencies.

**Highlights of colour television.** J. R. Locke. New York, Rider, 1954. 44 pp., .99c. (U.S.).

This timely booklet is concerned with a practical system of colour television receiving. It is a qualitative explanation of this mode of television and is based on the recommendations of the National

Television System Committee. It defines colorimetry and discusses the transmitter and receiver with special attention to the problem of producing a colour television receiver which must perform all the functions of a black and white receiver and also provide the necessary circuitry to reproduce the colour information.

***Industrial fermentations,** volume I. L. A. Underkofler and R. J. Hickey, ed. New York, Chemical Publishing Company, 1954. 565 pp., $12.00 (U.S.).

The chapters in this volume, contributed by experienced industrialists and research workers, discuss in considerable detail specific fermentation processes of present or potential industrial significance. This volume covers alcoholic and butanol-acetone fermentations; the production of yeast; and the fermentative production of organic acids. Data given includes historical background, raw materials, microbial cultures, laboratory and plant practice, uses of products, and so forth. There is a bibliography after each chapter.

**Metals engineering design.** American society of mechanical engineers, edited by O. J. Horger. Toronto, McGraw-Hill, 1953. 405 pp., illus., $4.50.

Sponsored by the Metals engineering handbook board of the A.S.M.E., this volume is the result of a survey in 1941 by the Metal engineering division, which revealed the need of a ready reference to the properties and characteristics of metals.

It treats of modern refinements that affect design practices, analytical methods which replace older empirical formulae, and the economic aspects of the determination of one method of processing over another.

Selective bibliographies are included with each paper for more detailed study.

**The National building code of Canada, 1953.** Canada, National research council. Ottawa, 1953. 15 parts, $3.75.

This revision of the 1941 Building code shows many and drastic changes, especially in the arrangement of the parts. Each of the eight parts is complete in itself, requiring little if any cross-references to other parts. The first part gives administrative requirements and refers to local ordinances in allied fields. The second deals with climate and contains twelve climatic maps. The third part includes all the requirements for a building code which are dependent on the use and occupancy of buildings, irrespective of their type of construction. Part four is concerned with the actual structural design of buildings and part five contains all the specifications which have to be used to detail all ordinary building materials. The last three sections deal with general services, plumbing and safety measures.

This new building code will be a necessary reference work for anyone connected in any way with construction in Canada, and the compilers hope that this new Code will be adopted by all those municipalities which have been using the existing one.

**New Brunswick almanac, 1954.** Fredericton, Brunswick Press, 1954. 224 pp. pa. $1.00.

Described as an "attempt to provide a concise and ready source of information about the province of New Brunswick and its institutions, population, judiciary and government at all levels", this is the first issue of this almanac.

Provincial government and private organizations are listed and also registered barristers, dentists and doctors.

Miscellaneous government information, both provincial, federal and educational, cultural and religious organizations and statistics are included.

This will be a most useful handbook.

**Permafrost at Norman Wells, N.W.T.** R. A. Hemstock. Calgary, Imperial Oil Ltd., 1953. 100 pp., loose leaf binding.

Much attention is presently being paid to the subject of Permafrost, but exactly what constitutes Permafrost is a little difficult to define.

In this booklet, the whole subject of distance of frost beneath the surface, terminology, vegetation, break up, soil mechanics and their properties, and building potentialities and hazards are all considered and discussed from actual findings at Norman Wells. Numerous charts, maps and photographs are included with the text, as well as a number of bibliographical references.

This will be a valuable reference source for all engineers engaged in this field.

**Plastics progress, 1953.** Phillip Morgan, ed. London, Iliffe, 1953. 439 pp., illus., 50/-.

The papers and discussions which form the basis for this book were part of the British Plastics Convention held in June 1953. Plastics materials, methods and uses are covered and special attention is given to glass and asbestos reinforced plastics. Two chapters are devoted to unplasticised

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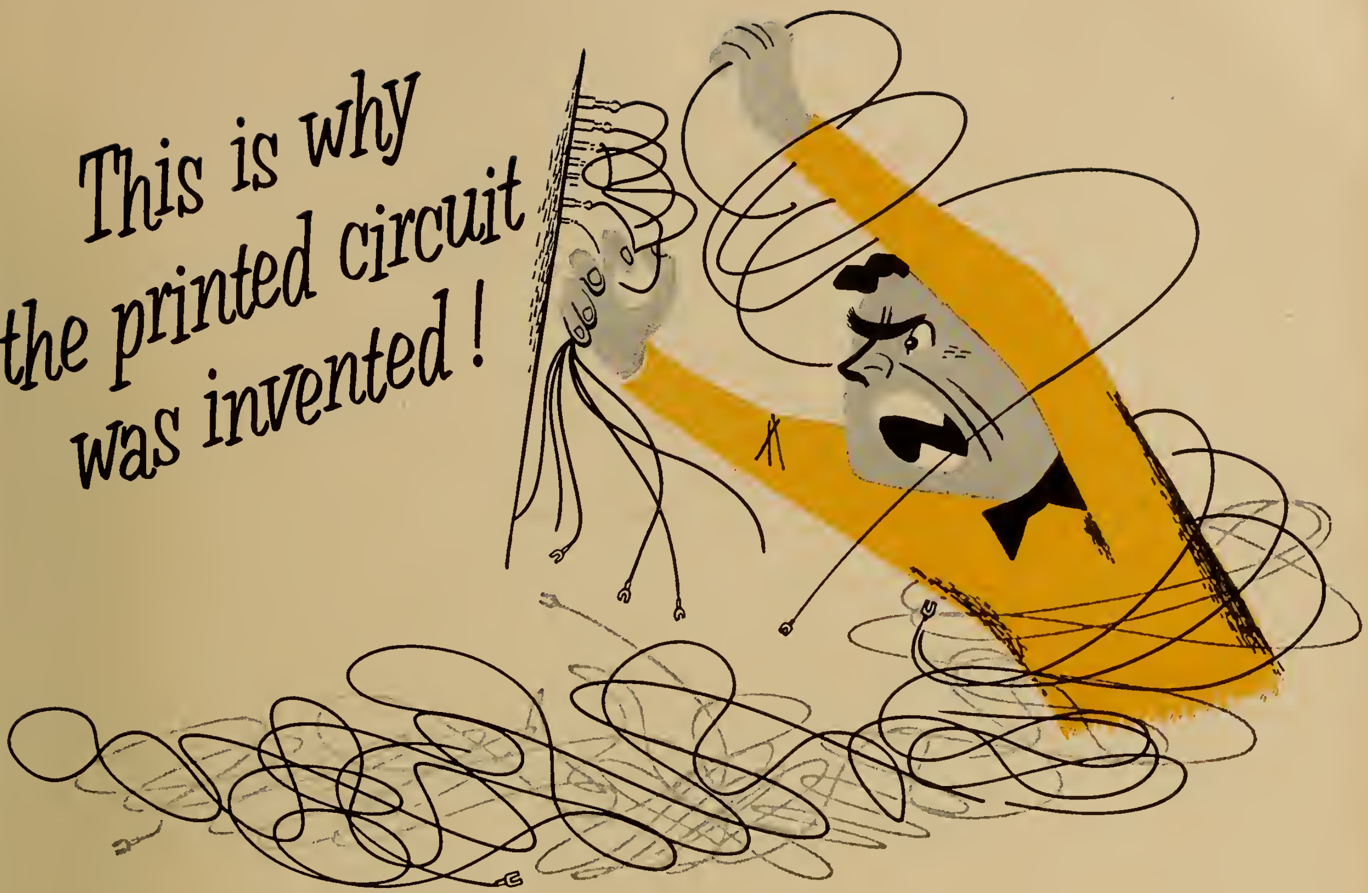

The printed circuit is the inevitable and successful result of inventive man's effort to do old things in new and better ways. The old way of installing an electrical circuit, in such fields as radio, television, hearing aids, automatic signals and other low-power applications, was a slow, expensive hand-process which was susceptible to error. Many a complex system had real nuisance value for the manufacturer. The new way eliminates all this because the circuit itself is etched, or printed, onto a sheet of copper foil bonded to a base material.

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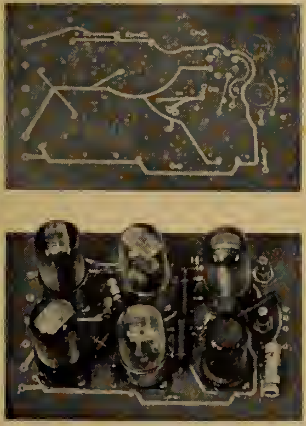

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*(Top) Copper-Clad Phenolite showing the etched conductor pattern for an audio amplifier. (Bottom) Here is the same etched circuit with tubes and other components in place. We have a complete bulletin crammed with ideas and data about our laminated plastics. May we send you a personal copy? Write either address, Dept. AB-10.*

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polyvinyl chloride in various forms, describing its composition, properties, fabrication and uses. Large mouldings and high quality injection moulding are discussed and four chapters describe the new uses of plastics in the fields of cables, vacuum coating, conveyor belting and footwear. A series of papers tells of the latest ideas on selling plastics to the public in the form of tableware, toys, etc. Graphs, photographs, bibliographies and a subject index increase the value of this collection.

***Principles of industrial psychology.** T. H. Ryan and P. C. Smith. New York, Ronald Press, 1954. 534 pp., $5.50 (U.S.).

An introductory survey of the entire field presenting a complete summary of the results of research and practical experiments. It covers selection, placement, motivation, fatigue, and other questions of importance to management, labor, industrial engineers, and personnel directors. The authors point out what the industrial psychologist can and cannot do at the present time and suggest directions for future research.

**Radio receiver design,** part 1. K. R. Sturley. Toronto, British Book Service, 1953. 667 pp., figs., $9.75.

Originally published in 1942, this is part one of the second revised edition, dealing with radio frequency amplification and detection.

Chapter 1 has been completely rewritten with increased stress on fundamentals of transmission and reception, and to Chapter 2 is added information on the calculation and measurement of valve noise.

Ensuing sections give additional information on self capacitance and mutual induction of coils and new material on crystal coupled I.F. transformers, and many symbols have been brought into line with accepted practice.



The very detailed index is a great addition to this volume.

**Slide rule; the autobiography of an engineer.** Nevil Shute. Toronto, McLeod, 1954. 240 pp., illus., $4.00.

Here is a fascinating book written by a man who is a success both as a novelist and as an aeronautical engineer. His experiences as a pioneer in aviation are worth telling to the world and his professional manner of presenting them make this autobiography interesting reading for engineers and the general public alike.

Nevil Shute begins his story with a brief account of his life up to the time when he became a summertime employee of the new De Havilland company, including the rather pathetic tale of the young man whose stammer prevented him from obtaining a commission in the R.A.F. Some mention is made of his early attempts at writing fiction and of his time spent at Oxford. But the greater part of his life history is closely linked to the history of aviation in England during the Twenties and early Thirties. The most exciting single event of that period was the building of the rigid airship R-100 which began in 1924 and culminated in a flight from England to Canada in 1930. Shute was at this time an engineer with Vickers but he later launched his own company, Airspeed, Ltd., and the latter part of his book describes the struggles and accomplishments of the growing business.

The few photographs of early aircraft make the reader wish that there were more, but few other criticisms can be made of this personalized chapter in the romance of aviation.

***Statistical analysis in chemistry and the chemical industry.** A. Bennett and N. L. Franklin. New York, Wiley, 1954. 724 pp., $8.00.

This book presents a selection of the statistical techniques most frequently used in the chemical and allied industries and is written on the level of the chemistry or engineering graduate. Basic principles of statistical inference are developed and more specialized methods — analysis of variance, design of experiments, analysis of counted data, and others — are treated in detail. Most of the examples have been taken from real situations in the chemical industry.

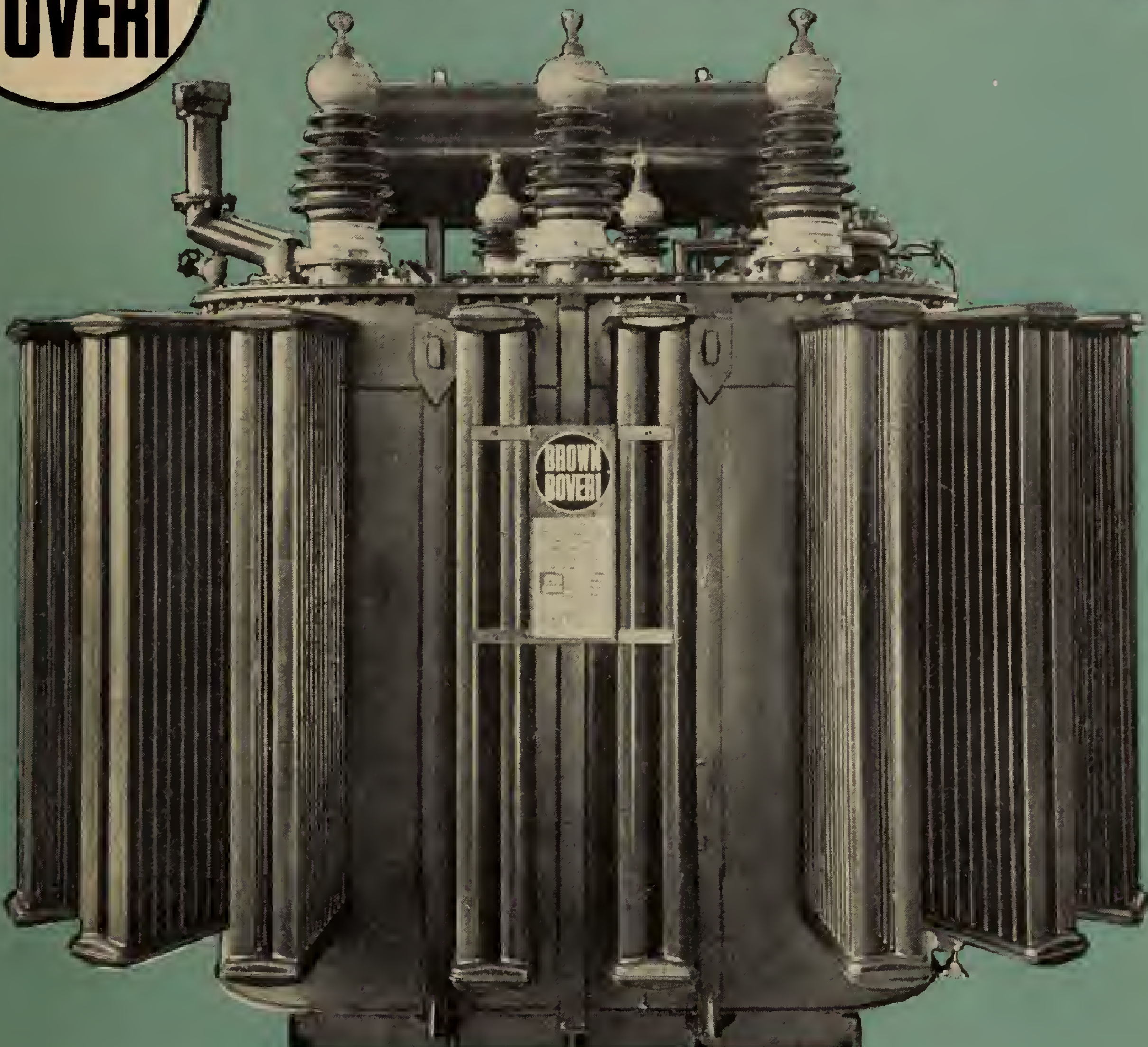
**Statistical methods in electrical engineering.** D. A. Bell. Toronto, British Book Service, 1953. 175 pp., $4.25.

This text is based on a series of lectures given at the University of Birmingham, and is directed to those wanting a work on the theory and applications of statistics of electrical engineering.

For this reason the bias of the book is towards continuous or quasi-continuous distribution. Some of the topics covered in the text are probability theory, qualitative classification, frequency distributions, curve fitting and the principles of quality control.

***The structure of metals and alloys,** 3rd. ed. W. Hume-Rothery and G. V. Raynor. London, Institute of Metals, 1954. 363 pp., $5.50 (U.S.). (Monograph and Report Series, No. 1).

The present edition, like the first, nineteen thirty-six, is written on an elementary level and deals mainly with the structure and composition limits of single phases. Topics covered include electronic background, crystal structure of elements, atomic radii, primary metallic solid solutions, intermediate phases in alloy systems, and imperfections in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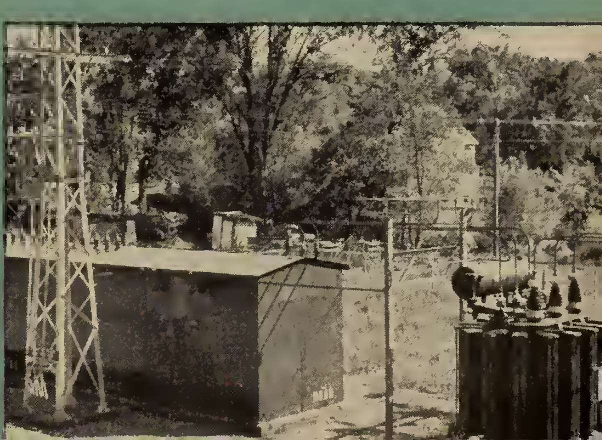

crystals. A new section on steel and cast irons has been added, and the complete text has been brought up to date.

**The theory and practice of reinforced concrete,** 3rd ed., v. I. C. W. Dunham. Toronto, McGraw-Hill, 1953. 499 pp., illus., $8.50.

A new edition of this important book indicates the widespread interest in the subject of reinforced concrete. Many changes have been made in this edition, the most significant being that it has been divided into two volumes. Volume one, which is presented here, contains only the first nine chapters of the second edition, with six new chapters added, and the similar length of the two editions shows the amount of expansion which has taken place. This volume is directed to the undergraduate, while indeterminate structures and advanced material are to be included in a subsequent volume.

As in the second edition the first seven chapters present fundamental principles and concepts: beams, columns, bond stress, bending and compression. The next part of the book deals with retaining walls, footings, large slabs and forms. Because of the developments in prestressed and precast concrete and ultimate-load design, the author has included an introduction to these subjects. Tables and diagrams are again found in the Appendix and the last chapter is devoted to design problems.

**Vegetation and watershed management.** E. A. Colman. New York, Ronald, 1953. 412 pp., illus., $7.00 (U.S.).

The relationship of vegetation management to water control and supply is the central theme of this book which will be an important asset to the fields of water-supply and civil engineering, agricultural engineering, reclamation work, forestry, hydrology and soil science. For those readers who are not concerned with the technical details there are summaries of the research results in the pertinent chapters, and the liberal use of graphs and maps is an additional aid to full use of the information.

Dr. Colman describes the influence of vegetation on hydrologic processes and shows how proper management can increase ground-water supplies, check soil erosion and siltation, and reduce flood peaks. The present-day situation in the U.S. and abroad is analyzed and future opportunities and methods of managing vegetation in watershed lands are outlined.

An eighteen page bibliography and a subject and name index further increase the value of this book.

**Who's who, 1954.** Toronto, Macmillan, 1954. 3,266 pp., $15.00.

Now in its one hundred and sixth year of issue, Who's Who scarcely needs an introduction to our readers.

The very useful list of abbreviations introduces the text of this volume, and is followed by an obituary list from mid December nineteen fifty-two to mid December nineteen fifty-three.

The Supplement lists brief entries for returns received too late for inclusion in the main body of the book, and Knights Gazetted since January first nineteen fifty-four.

The biographies fill over thirty-two hundred pages, and the volume is, as usual, a necessity for practically every library, and a welcome addition to many private reference shelves.

**Wind-tunnel testing,** 2nd ed. Alan Pope. New York, Wiley, 1954. 511 pp., illus., $8.50.

Recent developments in high speed aerodynamics have produced revisions of data and procedures in this new edition. Material on the design and use of low-speed wind tunnels has been rewritten and simplified, and new information on high-speed wind tunnel practice is included.

New chapters cover testing at near-sonic, transonic, supersonic, and hypersonic velocities. The testing of helicopter rotors is described in detail and non-aeronautical uses of wind tunnels are suggested.

The revised work contains numerous photographs and new problems with answers provided in an appendix. References are given at the end of each chapter.

**Workshop calculations, tables and formulae,** 11th ed. F. J. Camm. Toronto, British Book Service, 1953. 186 pp., figs., tables, $1.30.

While this book does not approach the scope of the author's larger work, Newnes' engineers' reference book, it does provide the tables and formulae used by the mechanic and draughtsman. In this new revision complete tables of unified screw threads are included. Other sections include trigonometrical formulae and logarithmic tables, continued fractions, arithmetrical, geometrical and harmonical progressions, physical and electrical units, gearing, Brinell hardness numbers, drill sizes and wire gauges.



## BOOKS RECEIVED

**Alternating-current machines,** 3rd ed. A. F. Puchstein, T. C. Lloyd and A. G. Conrad. New York, Wiley, 1954. 721 pp., illus., $8.50.

**Bibliography of books and published reports on gas turbines, jet propulsion, and rocket power plants, January 1950-December 1953.** E. F. Fiock and Carl Halpern. Washington, U.S. govt. printing office, 1954. 110 pp., .50c. (Supplement to National bureau of standards circular 509).

**Chimie et structure cristalline.** R. C. Evans. Paris, Dunod, Montreal, Fomac, 1954. 331 pp., figs., $17.50.

**Comparative bridge designs.** J. G. Clark, ed. Cleveland, Lincoln arc welding foundation, 1954. 211 pp., diagrs., $2.50 (U.S.).

**Data book for civil engineers, v. 3. Field practice,** 2nd ed. E. E. Seelye. New York, Wiley, 1954. 394 pp., illus., $7.50.

**Electrical transients.** L. A. Ware and G. R. Town. Toronto, Macmillan, 1954. 222 pp., $4.75.

**Electronics for everyone.** Monroe Upton. New York, Devin-Adair, 1954. 370 pp., illus., $6.00 (U.S.).

**Engineers' dreams, great projects that could come true.** Willy Ley. Toronto, Macmillan, 1954. 239 pp., illus., $4.25.

**Formal job evaluation and some of its economic implications.** L. G. Nicolopoulos. Montreal, McGill University. Industrial relations centre, 1954. 43 pp., $1.00.

**A glossary of terms in nuclear science and technology.** U.S., National research council, Conference on nuclear glossary. New York, American society of mechanical engineers, 1953. 9 sections, $7.00 (U.S.).

**Hydraulic systems and equipment.** R. Hadekel. Toronto, Macmillan, 1954. 224 pp., figs., $3.00.

**Linear transient analysis, v. 1 Lumped-parameter two-terminal networks.** Ernst Weber. New York, Wiley, 1954. 348 pp., figs., $7.50.

**La machine-outil, v. 3. Usinage par outils en rotation. v. 6 Usinage par abrasion.** A. R. Métral, ed. Paris, Dunod, Montreal, Fomac, 1954. v. 3. 432 pp., illus., $23.60; v. 6. 168 pp., illus., $11.25.

**Manual on cutting of metals with single-point tools,** 2nd ed. A.S.M.E. research committee on metal cutting data and bibliography. New York, American society of mechanical engineers, 1952. 546 pp., illus., $10.00 (U.S.).

**Metal industry handbook & directory,** 1954 ed. London, Cassier, 1954. 472 pp., 21/8.

**Model analysis of structures.** T. M. Charlton. Toronto, British Book Service, 1954. 142 pp., figs., $3.80.

**The modulor; a harmonious measure to the human scale universally applicable to architecture and mechanics.** Le Corbusier. Toronto, British Book Service, 1954. 243 pp., illus., $5.00.

**Operations research: challenge to modern management.** Harvard university. Graduate school of business administration. Cambridge, Operations

research group, 1954. 120 pp., spiral binding, $10.00 (U.S.).

**Paper chromatography**, 2nd rev. & enl. ed. Friedrich Cramer. Toronto, Macmillan, 1954. 124 pp., illus., $4.25.

**Physique nucléaire.** Théo. Kahan. Paris, Colin, 1954. 224 pp., figs., 250 fr.

**Planning residential subdivisions.** V. J. Kostka. Winnipeg, Manitoba. University. School of architecture, 1954. 127 pp., illus., $3.50.

**Pratique de l'organisation industrielle.** Ernst Hijmans and Eva Hijmans. Paris, Dunod, Montreal, Fomac, 1954. 196 pp., illus., $13.00.

**Principles of road engineering.** H. J. Collins and C. A. Hart. Toronto, Macmillan, 1936. 628 pp., illus., maps, $11.75.

**Proceedings of a conference on the utilization of scientific and professional manpower, October 7-11, 1953.** National manpower council. New York, Columbia university, 1954. 197 pp., $3.50 (U.S.).

**Les réseaux d'égouts données d'établissement et de calcul.** Pierre Koch. Paris, Dunod, Montreal, Fomac, 1954. 348 pp., figs., $14.65.

**Statistical year-book of the World power conference, no. 7, 1950-1952.** Frederick Brown, ed. London, Lund Humphries, Montreal, Engineering Institute of Canada, 1954. 160 pp., $6.50.

**The technique of handling people**, rev. ed. D. A. Laird and E. C. Laird. Toronto, McGraw-Hill, 1954. 189 pp., $4.75.

**Techniques of plant maintenance and engineering, 1954.** New York, Clapp & Poliak, 1954. 291 pp., $7.50 (U.S.).

**A textbook of radar**, 2nd ed. E. G. Bowen, ed. Toronto, Macmillan, 1954. 617 pp., figs., $7.65.

**Traité des routes.** J. L. Escario et B. Escario. Paris, Dunod, Montreal, Fomac, 1954. 1,119 pp., illus., $30.40

**Welding processes and procedures.** J. L. Morris. New York, Prentice-Hall, 1954. 255 pp., illus., $5.00 (U.S.).

## TECHNICAL BULLETINS AND PAMPHLETS RECEIVED

**Association of American railroads:** College courses in railroad subjects, 5th ed., 1954.

**British insulated Callender's cables limited:** No. 335 — Earthing equipment.

**CCH Canadian limited. Income tax acts:** 21st edition, 1954 — Canadian income tax act.

**Calcium chloride institute. Manuals:** SM-1 — Calcium chloride for stabilization of bases and wearing courses.

**Canada. National research council. Division of building research. Bibliographies:** No. 8 — Literature survey of papers dealing with the use of heat for keeping roads, sidewalks and parking areas free from snow and ice, comp. by B. G. White. No. 9 — A selected annotated bibliography of soil mechanics literature, comp. by W. J. Eden.

**Research papers:** No. 9 — An engineering study of glacial deposits at Steep

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**Canada. National research council. Canadian government specifications board. Provisional specifications:** 1-GP-118P* — Paint; interior, alkyd base, white and tints, flat and eggshell.

**Specifications:** 5-GP-0 — Physical testing methods for leather. 5-GP-24 — Portfolios; leather, slide-fastener. 5-GP-25 — Briefcases; leather, frame style. 43-GP-13 — Cushioning materials; cellulosic. 45-GP-3 — Grinders and disc sanders; pneumatic, portable.

**Canada. National research council. Technical information service. Reports:** No. 40 — Marine propellers — a guide to the literature on design and production.

**Eno foundation for highway traffic control:** Driver control; achieving greater traffic safety through efficiency at the wheel, by Merwyn Kraft. 1954.

**Fortune. Reprints:** Anyone for monorail. July, 1954.

**Institute of physics:** Memorandum on gamma-ray sources for radiography, rev. ed., 1954.

**Iowa state college. Iowa engineering experiment station. Bulletins:** No. 176 — Constants for design of continuous girders with abrupt changes in moments of inertia, by R. A. Caughey and R. S. Cebula.

**National fire protection association. Proposed standards:** No. 31-PR4 — Installation of oil burning equipment.

**Pyrene company, limited.** A new development in building.

**Saint Louis university. Institute of technology. Publications:** No. 75 — What differentiates the geophysical engineer, by J. B. Macelwane.

**Shawinigan water and power company:** Highlights of electric power in Canada, comp. by Huet Massue.

**Washington. University. Engineering experiment station. Bulletins:** No. 116, part 5 — Aerodynamic stability of suspension bridges with special reference to the Tacoma Narrows bridge. Part 5—Extended studies: logarithmic decrement, field damping, prototype predictions, four other bridges, by G. S. Vincent.

## STANDARDS REVIEWED

**ASTM specifications, American society for testing materials, 1916 Race Street, Philadelphia 3, Pa.**

**ASTM specifications for steel piping materials,** pa., $3.75.

The 1954 edition of this compilation sponsored by ASTM Committee A-1 contains in their latest approved form the 53 widely used ASTM specifications for carbon-steel and alloy-steel pipe and tubing, including stainless.

Materials covered include: pipe used to convey liquids, vapors, and gases at normal and elevated temperatures; boiler, superheater, and miscellaneous tubes; still tubes for refinery service; heat-exchanger and condenser tubes. Also included are specifications for the following materials used in pipe and related installations: castings; forgings and welding fittings; bolts and nuts. The ASTM standard classification of austenite grain size in steels (E 19) with two sets of charts; also the American Standards

covering wrought steel and wrought iron pipe (B 36.10) and stainless steel pipe (B 36.19) are a part of the book.

In this special compilation 22 of the specifications included in the previous edition have been revised, of this number 17 are tentatives and 5 are standards. A new specification covers ferritic alloy steel forged and bored pipe for high-temperature service.

These specifications are in widespread use and this book is of distinct service to those concerned with pressure piping, power generating, the petroleum field, distribution of water, gas and oil, and to individuals in every industry where these materials are so important.

**ASTM standards on cement (with related information)**, pa., $2.75.

This 1954 compilation of ASTM standards on cement brings together in compact, readily usable form, the ASTM test methods, specifications, and definitions widely used in this field.

Chemical and physical test methods cover: portland cement — autoclave expansion; calcium sulfate; chemical analysis; fineness; heat of hydration; sodium oxide and potassium oxide. Also included are test methods for: hydraulic cement — air content; chemical resistance; compressive strength; fineness; mechanical mixing; normal consistency; sampling; soundness; specific gravity; tensile strength; time of setting; and flow table.

Specifications cover: cement — portland, natural, and masonry.

Appendices include information on analytical balances and weights, a manual of cement testing, a list of selected references on portland cement, and an article on "The Principle of the Methoxyl Method for Determining Vinsol Resin in Portland Cement."

This new edition embodies numerous revisions of existing tests and specifications and includes a new method of test for mechanical mixing of hydraulic cement mortars of plastic consistency. In this special compilation 19 of the standards included in the previous edition have been revised, of this number 10 are methods of test, 7 are specifications, and 2 are definitions.

An easily usable table of contents is included (by subject and ASTM serial designation) and an extensive index.

**ASTM standards on gaseous fuels**, pa., $2.50.

The 1954 edition of this compilation of ASTM standards on gaseous fuels contains in their latest approved form all of the ASTM test methods used in this field.

Sponsored by ASTM Committee D-3 on Gaseous Fuels the test methods cover: measurement of gaseous fuel samples; sampling (natural gas; manufactured gas; liquefied petroleum gases); analysis of (natural gases by the volumetric-chemical method; natural gases and related types of gaseous mixtures by the mass spectrometer; carbureted water gas by the mass spectrometer); gaseous fuels (water vapor content, by measurement of dew-point temperature; calorific value, by the water-flow calorimeter; specific gravity); sulfur in petroleum products and liquefied petroleum gases by the $CO_2$-$O_2$ lamp method; vapor pressure of liquefied petroleum gases.

Of the 12 ASTM standards in this publication, 5 tentative test methods are new, and 5 of the 7 methods included in the previous edition have been revised.

New methods of test cover: sampling manufactured gas; sampling liquefied petroleum gases; analysis of carbureted water by the mass spectrometer; sulfur in petroleum products and liquefied petroleum gases by the $CO_2$-$O_2$ lamp method; and vapor pressure of liquefied petroleum gases.

**ASTM standards on materials for radio tubes and electronic devices and electrical-heating, resistance, and related alloys**, pa., $2.75.

The 1954 edition of this compilation includes in their latest form 44 widely used ASTM standards, including 30 test methods; 10 specifications; and 4 recommended practices.

Materials and subjects cover: electrical-heating alloys; electrical-resistance alloys; electric-furnace alloys; radio tubes, electronic devices, and lamps; heat-resisting alloys; electrical contact materials; and thermostat metals.

This new edition embodies numerous revisions of existing tests and specifications and much new material prepared since the previous edition.

New material includes specifications for: circular cross-section nickel cathode sleeves for electronic devices; two specifications for chromium-iron alloy for sealing to glass (one for 17 per cent, the other for 28 per cent); high-resistivity, low-temperature-coefficient wire; and round chromium-copper wire for electronic devices — test methods for sag of tungsten wire; relative thermionic emissive properties of materials used in electron tubes; hardness of electrical contact materials; and sublimation characteristics of metallic materials by electrical resistance — recommended practices for cathode melt prove-in testing; and conducting time-for rupture tension tests of metallic materials.

A convenient table of contents is included (by subject and ASTM serial designation).

**British standards. British standards institution, 2 Park Street, London, W.I. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.**

**A. 109 and A. 110-Shear bolts and nuts (unified hexagons and UNF threads) for aircraft. 5/-.**

**A. 112- Cadmium plated shear bolts (unified hexagons and UNF threads) for aircraft. 3/-.**

These standards specify the materials, dimensions, finish and testing of shear bolts and nuts for use on aircraft and contain details of the method of identification. A. 112 provides a range of steel bolts cadminum plated to be suitable for insertion in aluminum alloy materials.

**B.S. 192:1954 — Open-ended spanners. 5/-.**

The attributes of open-ended spanners — the steel from which they should be manufactured (and its treatment), their proportions and dimensions form the basis of this latest revision of B.S.192. Since the standard was last revised in 1943, the range of hexagon sizes has been considerably extended by the addition of the several Unified series, but the spanner specification has not been left behind — its tables have also been extended and cater for all.

This 1954 revision, the third since the British Standard for spanners was first published in 1906, also attempts to solve the difficult question of what special marking should apply to the spanners suitable for the new Unified hexagons. The solution adopted is completely new and almost revolutionary; for this new method actually ventures to drop the historic (and vulgar) fraction and proposes simple figures based on the decimal equivalent of the size across the flats. It will be found, therefore, that the contents of the newly revised Standard are interesting and, as they are coupled with a pleasing and attractive layout, it is well worth getting.

**B.S. 2485: 1954 — Tee slots. 3/6.**

In preparing this specification, the British Standards Institution will have done a great deal toward alleviating the irritation caused by the present somewhat bewildering multiplicity of odd tee slot sizes and pitches.

The unregulated array of different widths has had a very adverse economic impact in that the manufacturers of tee bolts have been called upon to make a large number of different sizes to suit the slots found in machine tables, often in small quantities. The differences in many cases were slight and no valid technical reason could be advanced for them.

This new British Standard is an attempt to control this slightly chaotic situation by specifying the dimensions and tolerances of a range of tee slots and tee bolt heads from ¼ in. to 1in. inclusive, and comparing them with their nearest metric counterparts. During the work of preparation, due note was taken of Continental and American practice and thus this Standard should have a world wide interest. The specification for milling cutters, B.S.122, is being amended to provide suitable tee slot cutters.

**B.S. 2467: 1954—Minimum safety requirements for lighting fittings for use with hot cathode tubular fluorescent lamps. 2/-.**

This standard covers those factors which affect the safety and protection of the user of non-portable lighting fittings for use with hot cathode tubular fluorescent lamps where the nominal maintained voltage at the incoming terminals of the fittings does not exceed 250 volts. Included are clauses devoted to design and construction, materials, mechanical and electrical requirements, together with appropriate tests.

**B.S. 2452: 1954—Electrically driven jib cranes mounted on a high pedestal or portal carriage (high pedestal or portal jib cranes). 7/6.**

This new standard is one of a number relating to jib cranes. It applies to electrically driven jib cranes, mounted on a high pedestal or portal carriage, or the level luffing, derricking or fixed radius types, used with hook or grab. It therefore covers the types of ten referred to as 'wharf' or 'dockside' cranes.

As with other British standards for cranes, the object of this specification is to ensure reliability and safety without placing restrictions on the general design of the cranes or on the methods employed in their construction.

*(Continued on page 1379)*

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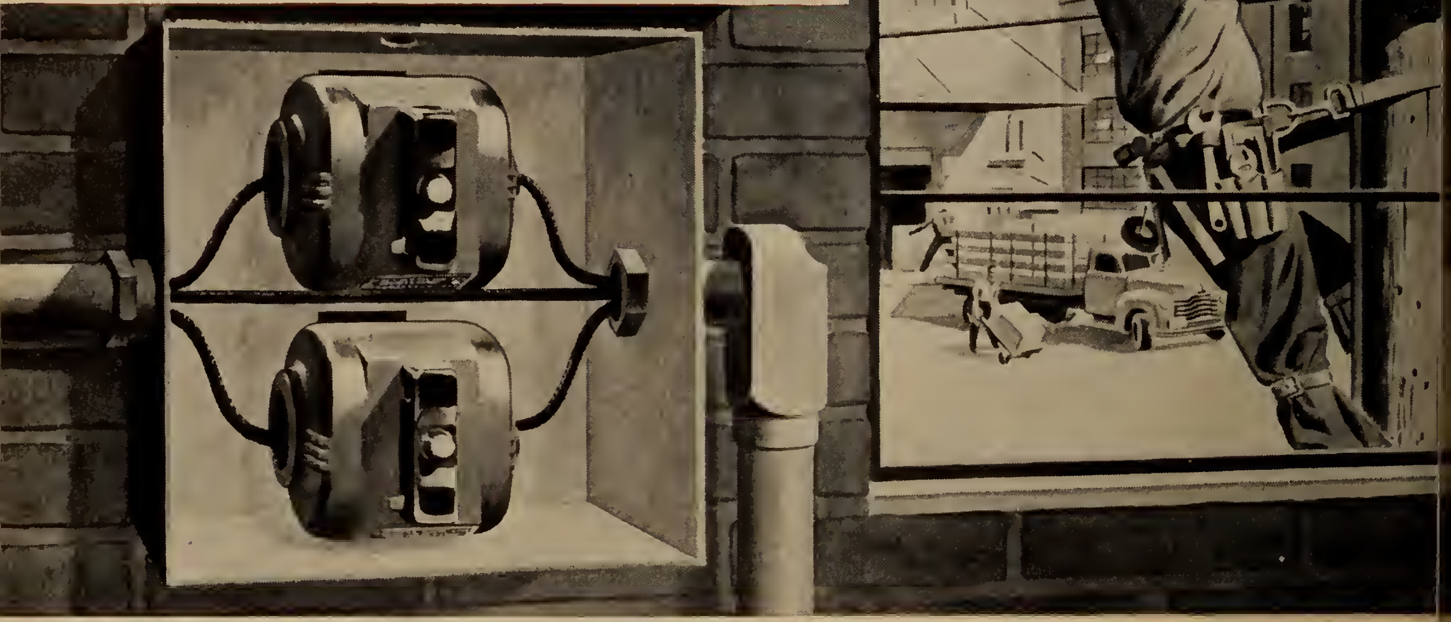

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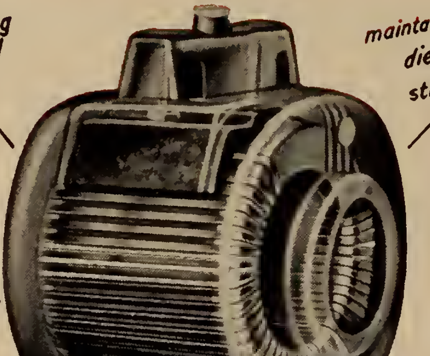


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It can be flat-mounted indoors in any position. Because s-ondary terminals are on top, transformers can be mounted cl e together . . . especially useful in small box mountings. U d outdoors, transformers can be installed on poles without cr s arms or enclosing boxes.

Type JKP-O is a 600 volt window-type transformer wh primary ratings of 200-, 400-, 600-, and 800-amperes.

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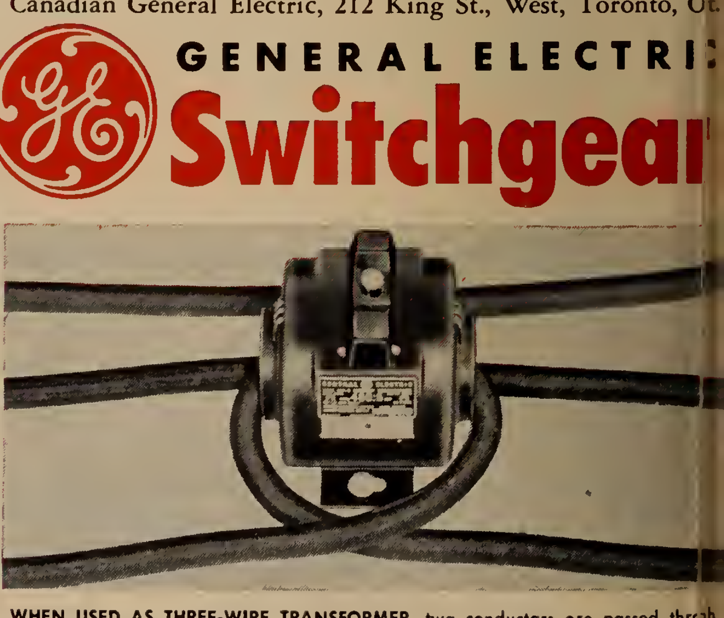

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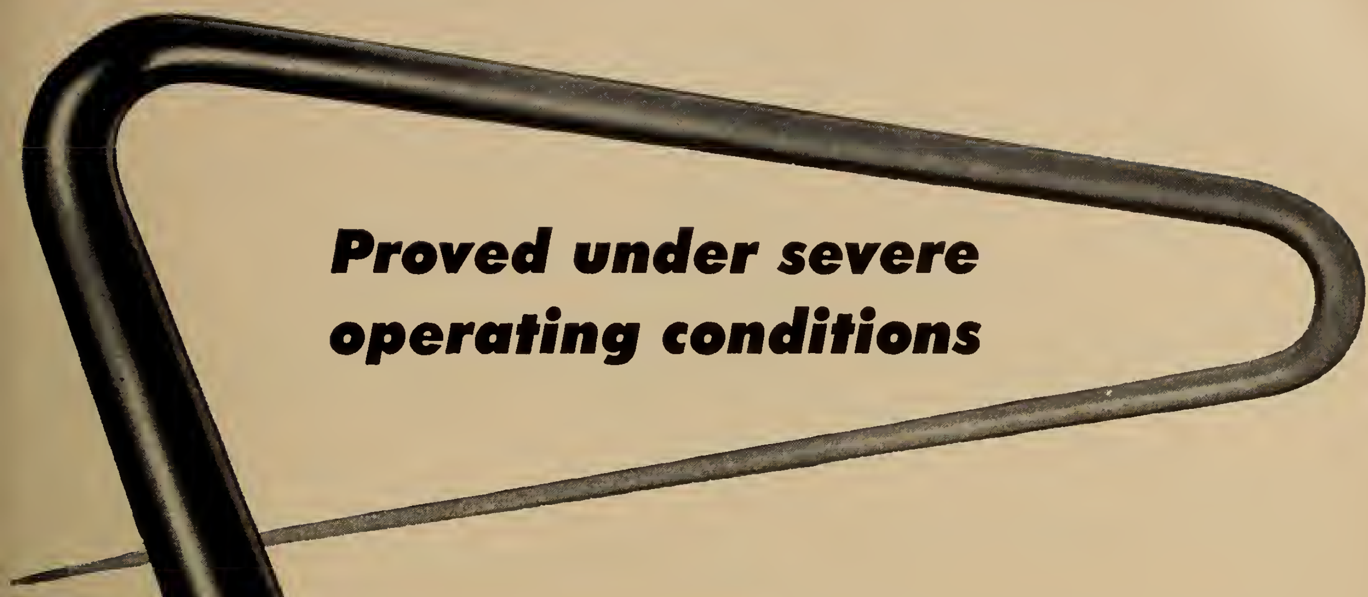
AAD080

**CANADIAN GENERAL ELECTRIC COMPANY LIMITED**



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## Phillips
## ROCKBESTOS
### POWER AND INDUSTRIAL CABLE

**Illustrated Rockbestos A.V.C. Cable.**

- withstands the hazards of extreme heat.
- resists attack by oils, greases and corrosive fumes.
- provides a high safety factor . . . flameproof.
- gives years of trouble-free service.

**CABLE TYPES FOR ALL YOUR NEEDS**

**1. Rockbestos All-Asbestos-Cables.** Designed for 600V use in open wiring at maximum copper temperature 125°C.

**2. Rockbestos A.V.C. Cables and Boiler Room Wire.** Similar to "All-Asbestos" type, but has a varnished cambric insert added for high dielectric strength. Rated for 600V or higher, in exposed or closed installations at maximum copper temperature 110°C. Can be supplied with a lead sheath for excessive moisture or corrosive conditions.

**3. Rockbestos Apparatus Cables.** For generating plants, boiler rooms, mills and other similar locations. Supplied with flexible conductors.

Motor Lead Cables, Switchboard and Rheostat Cables designed specifically for these jobs are also available.

Before installing any power or industrial cable—consult us. There is a Rockbestos Power Cable to suit your specific requirements.

## Phillips
ELECTRICAL COMPANY (1953) LIMITED

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5409-A E.J.

# Business & Industrial Briefs

*A Digest of Information*

*received by*

**The Editor**

## Appointments and Transfers

**Trans-Canada Pipe Lines.** — Appointment of Charles S. Coates as executive vice-president and general manager of Trans-Canada Pipe Lines Limited is announced by N. E. Tanner, president of the company. In that capacity, Mr. Coates will direct the construction and operation of the 2,200-mile pipeline which will carry Alberta natural gas eastward as far as Montreal.

•

**B.A.-Shawinigan.**—The appointment of Geoffrey K. Wright as sales manager of B.A.-Shawinigan Limited was announced by V. G. Bartram, president.

Mr. Wright, who has his office at the B.A.-Shawinigan plant in Montreal East, also assumes responsibility for traffic, advertising and public relations.

•

**Alaska Pine & Cellulose Limited.** — Additional technical service facilities are being established by Alaska Pine & Cellulose Limited of Vancouver, B.C.

W. C. Koerner, president, announces creation of a new post, that of technical service director in the cellulose division.

Leslie K. Bickell, formerly the company's chief chemist, with headquarters at Woodfibre, B.C., has been appointed to the newly-created post and will move to Vancouver. The appointment was effective July 1st, 1954.

•

**C-I-L.**—R. B. Carpenter, assistant works manager at the C-I-L commercial explosives works, Beloeil, Que., has been appointed works manager at the James Island plant in British Columbia to succeed W. S. Thatcher.

Mr. Carpenter was born in Lachute, Que. He attended public and high school in Calgary and Vancouver respectively, and was graduated from the University of British Columbia with a B.A.Sc. degree in chemical engineering.

•

**Garlock's Sales.**—J. B. Sewell, presently vice-president of The Garlock Packing Company of Canada, Ltd., will become general sales manager of Garlock's sales in Canada and the United States on October 1. Announcement of this promotion was recently made by George L. Abbott, president of The Garlock Packing Company, Palmyra, New York.

•

**Shawinigan Chemicals Limited.**—Four appointments in the sales department of Shawinigan Chemicals Limited, in Montreal, were announced recently.

Terrence A. Gill, domestic sales manager until now, becomes administrative assistant for sales; and Gordon H. MacDougall, export sales manager, has been named assistant general sales manager.

Donald O. Tirrell succeeds Mr. Gill as domestic sales manager and Kenneth C. Clarke has been named to succeed Mr. MacDougall as export sales manager.

•

**C.I.L. Paints and Coated Fabrics.**—R. C. Williamson has been appointed manager of the paints and coated fabrics department of Canadian Industries (1954) Limited. He joined C-I-L in 1936 in the general chemicals division. In 1943 he was appointed manager of Alchem Ltd., a C-I-L subsidiary with headquarters in Burlington, Ont. He has been vice-president of Alchem since 1945 and succeeds Leonard Hynes who has been elected a vice-president of the company.

●

**Monsanto Canada.**—Appointment, effective immediately, of Dr. Arthur F. McKay as director of research and development, Monsanto Canada Limited, was announced today by Leo E. Ryan, executive vice-president and operating head of the company.

An outstanding Canadian chemical research scientist, Dr. McKay will direct Monsanto's extensive program of research and development from the Montreal head office laboratories including among his responsibilities the company's research activities in Vancouver.

●

**Sales Appointments at Packard.**—Packard Electric Company Limited has recently announced the appointments of D. F. Martin as general sales manager, G. B. Hunnisett as Ontario district manager and R. C. Short as Quebec district manager.

C. W. Spratt will continue as vice-president—sales, and will act in an advisory capacity.

●

**Allis-Chalmers.**—The board of directors of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., have paid their first visit to Canadian Allis-Chalmers Limited, their subsidiary, at Lachine, Que.

Host to the group was M. C. Lowe, president of Canadian Allis-Chalmers, which has general offices and works at Lachine and also operates a plant at St. Thomas, Ont. Several company officers accompanied the board of directors delegation, which was headed by A-C president W. A. Roberts.

A luncheon arranged at the Sheraton Mount Royal Hotel provided an opportunity for board members to meet some of Canada's business, education and civic leaders.

Guest speaker at this event was J. A. Calder, president of the Canadian Manufacturers Association, who told the attendants that those who warn of recession, depression and the like are suffering from super-heated imaginations.

Since it was the heavy demand for certain goods by overseas countries which provided the incentive for a considerable expansion of Canadian capacity, the decline in demand meant adjustment in both production and prices, Mr. Calder stated.

The group of directors which arrived in Montreal on Thursday, September 9, from Boston, Mass., where a monthly meeting had been held, visited various parts of the city and showed special interest in the Montreal harbour and its installation, particularly in relation to their bearing on the St. Lawrence Seaway development.

●

**Proctor, Redfern & Laughlin.**—E. M. Proctor, M.E.I.C., senior partner of Proctor, Redfern & Laughlin, consulting civil engineers, announces the admission of G. E. M. Proctor, M.E.I.C., and D. B. Redfern into the partnership, and John F. Wyllie, Roy G. Tredgett, Gordon U. Proctor as associates.

The firm, which was founded in 1912, has supervised the design and construction of a wide range of major municipal and industrial projects throughout Canada. (See Personals).

●

(*Continued on page 1350*)

# WATER TUBE BOILERS

## AT DU PONT OF CANADA'S NYLON PLANT, MAITLAND, ONT.

*Aerial view of Du Pont Company of Canada Limited Nylon Plant, Maitland, Ontario.*

The new nylon intermediates plant at Maitland, Ontario, brings the control of manufacturing processes by instrumentation to a new high level in Canada. In the manufacture of the two complex chemicals required as raw material for nylon staple and yarn, an efficient and constantly reliable source of steam is essential. Three Dominion Bridge Water Tube boilers were chosen to meet this need. Details and specifications are shown at the left.

***For particulars of Dominion Bridge Water Tube boilers write for catalogue No. BF-103***

*View of power house.*

**Margison, Babcock & Associates.**—O. Margison, M.E.I.C., announces that the name of this firm will change to A. D. Margison and Associates Limited, consulting professional engineers, effective July 1st, 1954.

The following Associates will continue with the firm: G. R. Beavers, chief engineer, building services department; J. J. Stewart, chief engineer, supervision department, A. G. Keith, chief architect, architectural department; J. E. Margison, chief engineer, process department; D. L. B. Hamlin, chief engineer, structural department; W. A. Stewart, chief engineer, municipal department; H. R. Musson, engineer, thermodynamics section; K. N. Craig, engineer, power plant and piping section; F. I. L. Dyke, engineer, electrical section; R. A. Cunningham, engineer, field supervision section.

Withdrawing as directors and shareholders and terminating their association with the firm as of the 1st July are H. A. Babcock and W. G. Cutler. (See Personals).

# New Equipment and Developments

**Rubber Hose Defies Molten Steel and Flame.**—A rubber hose that has defied molten steel and white-hot flame for more than 270 heats of an open hearth steel furnace has been announced by the B. F. Goodrich Company Industrial Products Division. The hose, armored with wire for strength and protected by asbestos for heat, outlasted the life of the furnace.

Attached to the hollow steel doors of open hearth furnaces, the new hose circulates water inside the doors to keep them from melting under the intense heat. Build-up of slag on hose, a factor which shortens the life of other hose in this service, is reduced by a newly developed hose construction.

Despite the cooling effect of the water, heat generated inside the furnace doors often becomes great enough to change the water to scalding steam. The same type of hose is used to draw off steam and hot water emerging from the circulatory system. The hose has a special heat-resistant tube.

Hose is needed for the unusual furnace door application to permit a flexible connection to the water circulation system so that the doors may be opened to charge the furnaces. A new type of flexible construction used in the new hose permits the use of shorter hose lengths to make these connections. Because of its light weight and flexibility, the new hose may be installed by one man.

**Auto-Transformers.**—The most powerful auto-transformers ever built by the Canadian Westinghouse Company have been ordered by the Quebec Hydro Commission for the giant Bersimis system.

The 150,000, 3 phase, 60 cycle units will be installed at the Charlesbourg transformer station where they will step down power from 290,000 volts to 230,000 volts. Distribution will then be made throughout the Shawinigan area. The 300-odd ton transformers are scheduled for delivery in 1956.

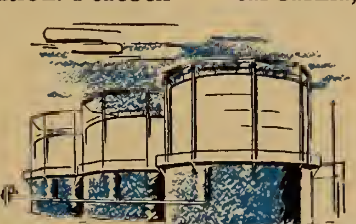
Westinghouse also recently received another transformer order for the Bersimis development. The company will supply 40,000 kva, single phase units in banks of three to step up generator voltage at the northeastern Quebec power site.

**New Locklite High Bay Unit.**—A new ventilated high bay lighting unit, particularly suited to assembly areas, press shops, foundries and other heavy machinery areas where high light output

(*Continued on page 1352*)

# WHERE THERE'S GAS THERE'S PEACOCK

Accurate control of pressures and flow, together with precise measurement, are the most essential requirements for efficient handling of gas at every stage . . . from field to final distribution. Peacock equipment, used throughout the industry, has a proven record for economical, dependable operation in meeting these requirements. Typical installations illustrated above are:



*Top:* Nordstrom lubricated plug valves in metering system at Dawn compressor and storage station of Union Gas Company of Canada Ltd., near Sarnia, Ontario. *Left:* Foxboro Flow Meters and Pressure Recorders in metering house of large Canadian gas distributor. *Right:* Another view of Nordstrom gear operated valves in metering system of Canadian gas company.

PB54-13T

**PEACOCK BROTHERS LIMITED**

MONTREAL

SYDNEY · TORONTO · SUDBURY · WINNIPEG · CALGARY · VANCOUVER per luminaire is required, is now available from the Canadian Westinghouse Company.

The new luminaire—the Locklite—is designed for either mercury or incandescent lamps and numerous construction features make it particularly efficient from both performance and maintenance standpoints.

Ventilation apertures, located between the reflector and the neck extension, enable airborne dust and dirt to escape from the reflecting surface of the unit. The continuous circulation of this dirt-bearing, heated air results in a higher efficiency for longer operation periods and reduces the time required for maintenance.

The Westinghouse Locklite design provides positive action, for the unit will light only when mechanically secure. The reflector assembly is connected mechanically and electrically to the wired hood by a simple clockwise turn. Removal for maintenance is equally easy.

Other features of the new Locklite Unit which Westinghouse cites include a cooler lamp base and holder, complete lamp protection from falling water and dirt through the overhanging design of the ventilation opening and improved light control by the unit's baffle design.

●

**Compact Indicator Speeds Up Measurements.**—A new electronic measuring instrument in many cases 100 times faster and more consistently accurate than conventional galvanometers for making bridge-type measurements has been developed by the Minneapolis-Honeywell Regulator Company's Industrial Division, it was recently announced.

The new instrument, called an ElectroniK Null Indicator, is the first radical departure from the conventionally used galvanometers. Housed in a portable, compact case (which minimizes bench space) the new instrument speeds up resistance and potential measurement by utilizing precision potentiometers and bridges. To operate the Null Indicator it is only necessary to close the switch and balance the bridge. The balance point is indicated by the return of the indicator pointer to zero. By contrast, light-beam galvanometers will lose time while waiting for the pointer to cease oscillating, or come back on scale. In addition, the new instrument is not affected by vibration, one limitation of the conventional galvanometers, nor is it necessary to level the indicator since its operation is unaffected by position. Overloads of several hundred per cent will not affect the new instrument.

The input terminals on the instrument can be used with either pin, spade or banana jacks. The instruments can be used with the case and one side of the input circuit grounded or with the case grounded and the input circuit floating above the ground. An accessible screw driver sensitivity adjustment is provided.

Data Sheet 10.0-12 available from the company gives complete information.

●

**Skyscraper Features Welded Tapered Beams and Columns.** — The new 25-story Equitable Life Assurance Building

(*Continued on page 1354*)

# NOW


Widely expanded facilities available through the addition of the

## *Northern Electric*
**COMPANY LIMITED**
as a Sylvania distributor

The complete line of Sylvania Lamps is now available from coast to coast through the nationwide distribution system of the NORTHERN ELECTRIC COMPANY LIMITED . . . with more than 40 sales offices and distribution houses strategically located to give prompt and dependable service wherever required.

# SYLVANIA
**ELECTRIC (CANADA) LTD.**
Montreal

*Manufacturers of Fluorescent, Incandescent, Photographic Lamps, and Television Receivers* now being erected in San Francisco is the first really tall building to go up under that city's strict 1948 building code. When San Francisco enacted the code in 1948, which specifies shears twice the magnitude of Unified Building Code, it was freely predicted that no more tall buildings would be erected in that city.

According to The Lincoln Electric Company of Cleveland, Ohio, welded design was selected for critical beams and columns, both for economy and architectural reasons.

Limitation to depth of floor beams imposed by embedded duct work made it necessary to carry all lateral loads, including seismic, on the exterior walls. This meant using large columns and spandrel beams. The solution to column and spandrel beam design, complicated by splicing heavy flanges and making beam to column connections, was found in a continuously tapered column and tapered butterfly spandrel beam, both fabricated with the automatic hidden arc welding process. Beam to column connections have full butt welds on the flanges and double fillet welds on the webs. The tapered columns vary from 42 x 1½" webs and 18 x 3" flanges at the base to 12" webs and 16" flanges at the fourteenth story. Welding is being done with Lincoln Fleetweld 5, an E-6010 electrode. If cracking in the root passes of joints in heavy sections is encountered, the root pass is made with LH-70, an E-7016 electrode.

●

**X-Ray Diffraction Unit Accessories.**—A many-fold increase in efficiency, and a drastic reduction of error in the higher frequencies, are two of the many advantages of a new proportional counter tube and proportional counter preamplifier just announced for use with the General Electric x-ray diffraction unit.

Both accessories, acting together, perform linearly over 5 times the range of the argon-filled mutil-chamber Geiger tubes, and about 20 times the range of linearity of typical single-chamber Geiger tubes. The new counter assembly has less than 1 micro-second resolution time.

The new proportional counter preamplifier converts present G.E. Geiger tubes easily to proportional counter operation.

The new krypton-filled proportional counter tube has a much higher absorption efficiency than the argon-filled tube, and has no noticeable thermal sensitivity. Tube failure due to extremely high intensities and voltages has been virtually eliminated.

Because of the high-intensity measurements made possible by the new accessories, the productivity of an x-ray diffraction unit is greatly enhanced, and since the user may choose more efficient technics for greater accuracy at high scanning speed.

The new proportional counter tube is extremely efficient over the wide wavelength range of interest in x-ray diffraction and x-ray spectroscopy. The gain in efficiency of krypton over argon-filled counter tubes is about 4 times for molybdenum K-alpha radiation, 10 times for silver, and a few per cent for copper. For copper, and longer wavelengths, the semimonochromating effect of the argon absorption curve with respect to short wavelengths may be preferred.

Proportional counters are expected to last substantially longer than Geiger tubes, because by omitting the self-quenching gas, the main cause of ultimate failure of Geiger tubes is eliminated.

●

**Silicone Water-Repellent.**—A new silicone water-repellent for masonry—capable of more effective performance on common brick than any previous available material—has been announced by Canadian General Electric Company's chemical materials sales.

Designated Silicone Dri-Film 103 water repellent, the transparent silicone resin is said to prolong the useful life of masonry, reduce maintenance costs, and not only help maintain the masonry's natural beauty but allow it to "breathe" freely after treatment.

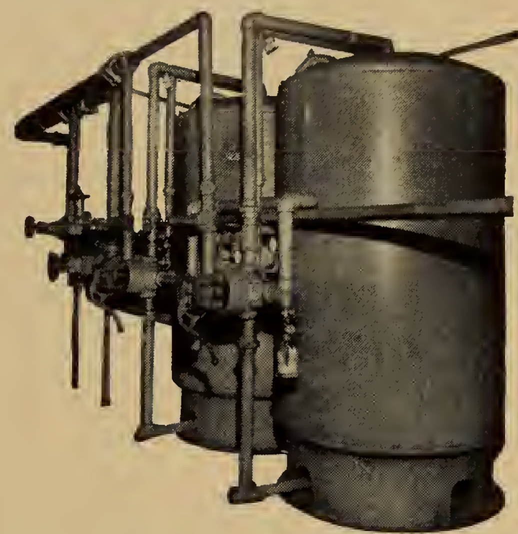
C.G.E. engineers said Dri-Film 103 minimized efflorescence, greatly retards spalling and cracking, and makes possible cleaner exterior surfaces, when properly applied to above-ground brick, concrete, mortar and other masonry materials. The new water-repellent may be applied either by brush or spray; one gallon of diluted material affords a coverage of 90-120 square feet in one coat on most surfaces.

Independent laboratory test results indicate that silicone-treated common

(*Continued on page 1356*)

# Dearborn OFFERS A COMPLETE WATER CONDITIONING AND ENGINEERING SERVICE

Whether you require a manual, semi-automatic or completely automatic system, Dearborn gives you a customized program including (1) the initial plant survey; (2) external and internal treatment recommendations; (3) properly designed feeding equipment; and (4) supervisory service. Here, from a single source, you have all the facilities for maximum efficiency and economical performance in your water conditioning operations.



## ZEOLITE SOFTENERS ▶

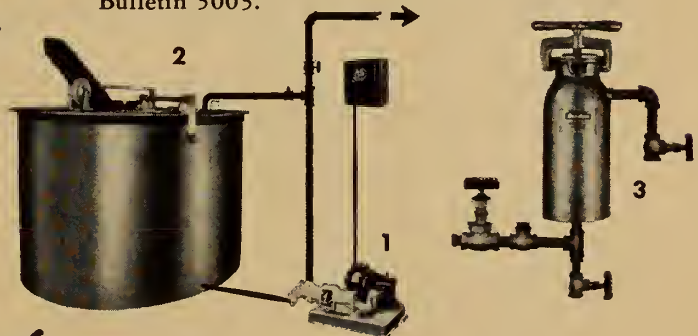
A Dearborn installed 500,000-gallon Zeolite water softener for the treatment of boiler water makeup.

## ◀ DE-IONIZING PLANTS

This Dearborn 2-bed De-Ionizing unit is capable of producing 75,000 gallons of demineralized water per day. Piped throughout with Saran-lined steel. Includes corrosion-resistant ejectors, rubber-lined tanks and valves. On special applications where mineral-free water is required, a Dearborn De-Ionizing plant will reduce the mineral content of water to the equivalent of that produced by evaporation . . . and at a much lower cost. Write for Bulletin 5005.

## INTERNAL TREATMENT ▶

(1) High-pressure pump, (2) hand-agitated chemical tank for delivering treatment directly into the boiler drum, (3) Type H feeder for manual application of either briquette or powdered treatments. Write for Bulletin 5000.




**why you can rely on Dearborn**

Dearborn has specialized in the conditioning of water and the control of corrosion since 1887. This broad experience in water treatment and rust prevention—plus Dearborn's extensive laboratory and research facilities—are at your service . . . at no obligation. You'll find it will pay you to . . .

**know your Dearborn engineer**

**Dearborn** TRADE MARK

**COMBATTING CORROSION EVERYWHERE SINCE 1887**

DEARBORN CHEMICAL COMPANY, Ltd., 2454 Dundas St. W., Toronto 9
Calgary • London • Edmonton • Saint John • Vancouver



brick will only absorb 0.01 per cent moisture after being immersed in water for a one-week period. Common brick was treated with five per cent silicone solids diluted with commercial solvent. This moisture absorption rate is technically superior to all competitive water repellents for common brick.

Since rain splashes and runs off silicone treated surfaces—carrying away dirt deposits—exterior surfaces are kept clean for a longer period of time.

According to company engineers, peeling and flaking of interior walls is also minimized since the new water repellent reduces the passage of moisture through the masonry. They said that silicones prevent water mingling with salts inhering in brick or mortar, thus minimizing or eliminating unsightly white or yellowish salt deposit marks on outer masonry surfaces.

Dri-Film 103 is an addition to Canadian General Electric's current broad line of silicone water repellents.

Further information may be obtained from Chemical Materials Sales, Canadian General Electric Co. Ltd., 940 Lansdowne Avenue, Toronto.

•

**Shawinigan and Firth-Vickers.**—Two pioneer commercial producers of stainless steels, one British and the other Canadian, have just established a transatlantic liaison for exchange of information which is expected to further development in both countries.

The companies are Firth-Vickers Stainless Steels Limited, of Sheffield, England, which, as Thomas Firth and Sons first commercially developed stainless steel in 1913, and Shawinigan Chemicals Limited, of Montreal, through its stainless steel and alloys division, which is the largest and one of the oldest producers in Canada.

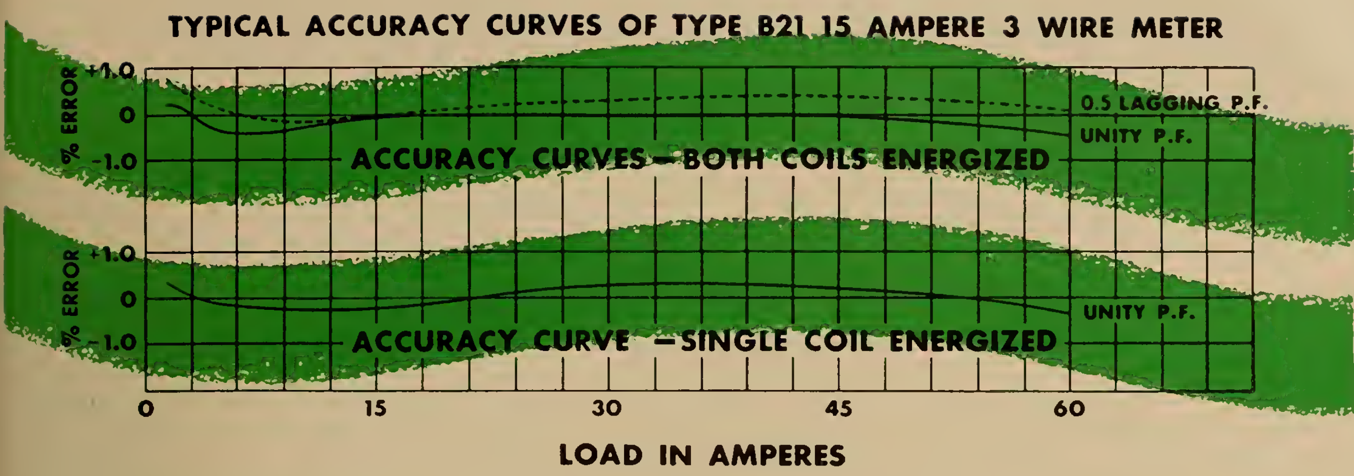
C. K. Lockwood, of Montreal, vice-president of Shawinigan Chemicals in charge of the stainless steel and alloys division, said the agreement covers the exchange of technical information on all phases of foundry practice including melting, moulding, and heat treatment procedures.

•

**Recovering Cast-Iron Swarf.**—To assist in the conservation of ferrous and non-ferrous materials not readily processed by conventional baling equipment, Fielding and Platt, Ltd., of Gloucester, England, has designed and is making a 400-ton automatic hydraulic press which is claimed to be revolutionary in design and to have wide possibilities in the recovery of cast iron. The machine is capable of converting cast iron machinings (swarf) into high-density briquettes, suitable for direct remelting, at a rapid and constant rate of production. It is stated that the machine may also be used for producing briquettes from brass and aluminium turnings and drillings.

In making briquettes from cast-iron swarf, no bending or sintering is required and the press is capable of producing between 300 and 340 briquettes of 85 per cent density an hour, the weight of the briquettes ranging from four to six pounds (1.8 to 2.7 kilogrammes). The length of the stroke of the machine's main ram is 15 inches (38 centimetres) and the specific pressure exerted on the material is 48 tons per square inch (30.4 kilogrammes per square millimetre). The press is of the vertical four-column type, having fabri-

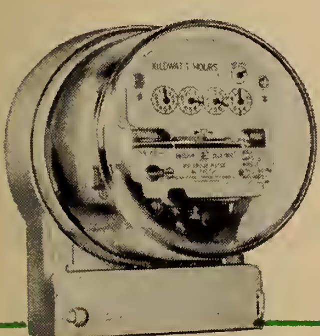
*(Continued on page 1358)*




## GET MORE ACCURATE BILLING OVER A WIDER LOAD RANGE...

The English Electric Type B21 gives greater accuracy over a wider useful load range and a much more consistent performance from meter to meter than has ever been possible before.

The advanced design reduces the damping effect of the current flux and the meter requires less than usual overload compensation.



***These 4 money saving features of the B21 are important to you.***

(1) MORE ACCURATE BILLING
(2) LESS BEARING WEAR
(3) EASIER SERVICING
(4) REDUCED MAINTENANCE

# 'ENGLISH ELECTRIC'

Vancouver, Calgary, Winnipeg, Toronto, Ottawa, Montreal and Halifax
English Electric Company of Canada Limited, St. Catharines, Ont.

PA 5407

cated tables with a mould assembly mounted on the lower table. Oil is supplied by two high-pressure radial pumps, one driven by an 80-horse-power motor and the other by a 50-horse power motor.

Control of the press is effected by push buttons, through direct current solenoid-operated valves of the balanced type for operating with oil. Completely automatic working may be arranged.

Swarf is loaded into a bunker of approximately one ton capacity. From the bunker, the swarf runs by gravity on to a vibrating screen which rejects large pieces of metal or other unsuitable material; these are carried down a small side chute fitted at right angles to the direction of the flow. The screened swarf passes into a receiver at the foot of an elevator which conveys it to a small hopper at the top of the press. A vibrator attached to this hopper ensures that a continuous supply of swarf enters a dispenser which weighs out swarf for one briquette. After filling, the dispenser is tipped by air cylinders for the discharge of its load down a chute and into a mould ready for briquetting.

As soon as the swarf is discharged, the dispenser is returned to its original position, its action being fully automatic and interlocked with the pressing cycle of the machine. There is, however, an overflow pipe for returning surplus material to the lower receiver should the elevator supply swarf faster than the machine can deal with.

When the mould is filled with swarf, the main-ram mandrel of the press enters it and compresses the contents to form a briquette. Pressure is then held in the main cylinder while the mould is raised by four small lifting rams, thus stripping the briquette from the mould. The main ram is then returned to the up, or filling, position, and the briquette is completely released. It is finally ejected from the press and pushed down a small chute by the plunger of a horizontal air cylinder. The mould then returns to the filling position, when the dispenser supplies a new charge of swarf. The total time cycle of the press is approximately 11.5 seconds.

●

**Transformers.** — Together with their monthly Ferranti Distribution Transformer stock list, Ferranti Electric announces that they are now prepared to quote on CSP type transformers.

The Ferranti CSP unit employs "Deion" type lightning arresters at the high tension bushings. A secondary breaker is mounted on top of the core and coils and visible on the outside of the tank is the red warning light and relay reset handle combined in a single unit.

There are internal high voltage protective links in series with the high voltage leads. These protect the transformer feeder against short circuits within the transformer.

When CSP transformers are used, separate lightning arresters and cutouts are no longer required. This provides for an economical and neat appearing installation.

For full information contact your Ferranti salesman or any Northern Electric representative.

●

**Industrial Piping.**—A new general-purpose industrial piping, known as "Armourvin", which is manufactured on automatic machinery, can be run off in lengths up to two miles (3.2 kilometres) long, according to thickness. Armoured with steel wire, it is so strong, the makers claim, that a six-ton truck can be run over the diameter without fracturing the pipe.

The hose is made of flexible plastic, reinforced with tempered steel spring. Since the spring is in the well of the pipe, it can be used to carry most acids and alkalis as well as oil, water and grease, to which it is resistant. It is also so flexible that it can be bent double or twisted tightly without reducing the internal bore. The makers state that it is ideal for connectors, using British Standard pipe or special fittings, and can also be supplied in translucent form for use as a sight feeder. Every length is free from laminations and is of one-piece construction. Makers: Creators Ltd., Plansel Works, Sheerwater, Woking, Surrey, England.

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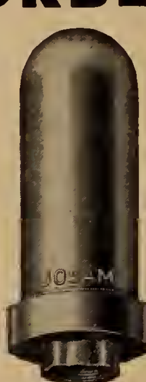
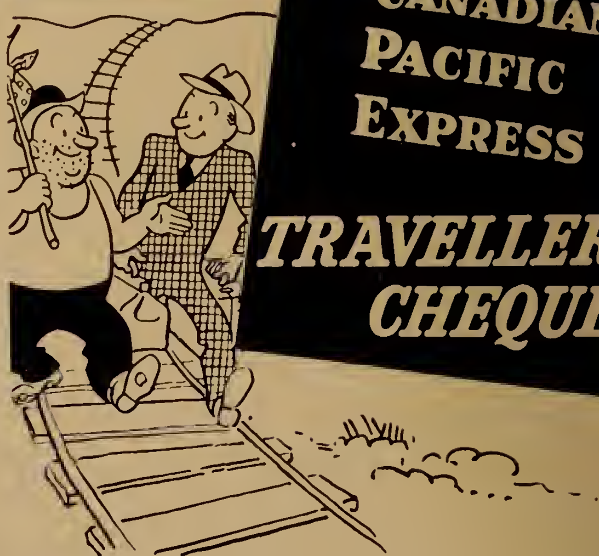








**Drafting Unit.**—Dargue Brothers, Ltd., New Simplon Works, South Parade, Halifax, Yorkshire, England, has produced a new dual reference drafting unit for which many advantages are claimed. It is stated to save not only 50 per cent of drafting time but also 50 per cent of space. The drafting board support quadrants are built integrally with the top of the table and give a clear reference area for each draughtsman at the back of the alternate board.

Four personal drawers, one full-size filing drawer and book-case ends are immediately adjacent to each draughtsman. The board can easily be adjusted for both height and angle. The surface can be provided faced with heat and scratch resisting materials.

●

**New Magnetic Meter.**—A new electromagnetic flow meter, designed for 2″ to 8″ flow lines, has been introduced by The Foxboro Company of Foxboro, Mass. Incorporating all the unique advantages of electromagnetic metering, the instrument is additionally rated for unlimited maximum flows, making practical a number of flow measurement applications impossible with ordinary metering equipment.

The magnetic flow meter will measure the volume flow rate of any liquid of sufficient conductance and velocity. Unaffected by the pressure, viscosity, density or changes in conductivity of the flowing liquid, it is recommended for aqueous solutions, slurries, acids and other corrosives, in addition to food and drug products requiring sanitary processing.

The unit consists of a nonmagnetic flow tube with an insulating liner containing flush-mounted metallic electrodes and surrounded by an a.c. electromagnet. When conductive liquid passes through the tube, an alternating voltage is set up between the electrodes which varies linearly in proportion to the rate of the flow. Lead wires from the electrodes transmit this voltage output to an electronic recorder, producing a chart record in appropriate units of flow.

Over-all accuracy is within ±1% of the scale span from maximum flow down to zero flow despite such factors as turbulence, dirty flow, etc. Meter produces no more pressure drop than a length of pipe equivalent to the meter tube.

Complete specifications are available in a technical report, TI 27-A-71a, available on request from Peacock Brothers, sole sales agents in Canada, Ville Lasalle, P.Q.

●

**Flame-Plated Core Rods.**—Core rods, flame-plated with tungsten carbide, last 30 times longer than steel rods according to tests run by a metal products manufacturer. Steel core rods were no longer usable after 10,000 parts had been produced because of a 0.0001 in. wear limit. A core rod that had been coated with tungsten carbide by Linde Air Products Company's flame-plating process, however, produced 291,905 parts at the last count and showed no noticeable wear. When this flame-plated core rod finally does wear undersize, the tungsten carbide coating may be easily removed and reapplied again, and again. Substantial savings in downtime and replacement costs are thus readily achieved.

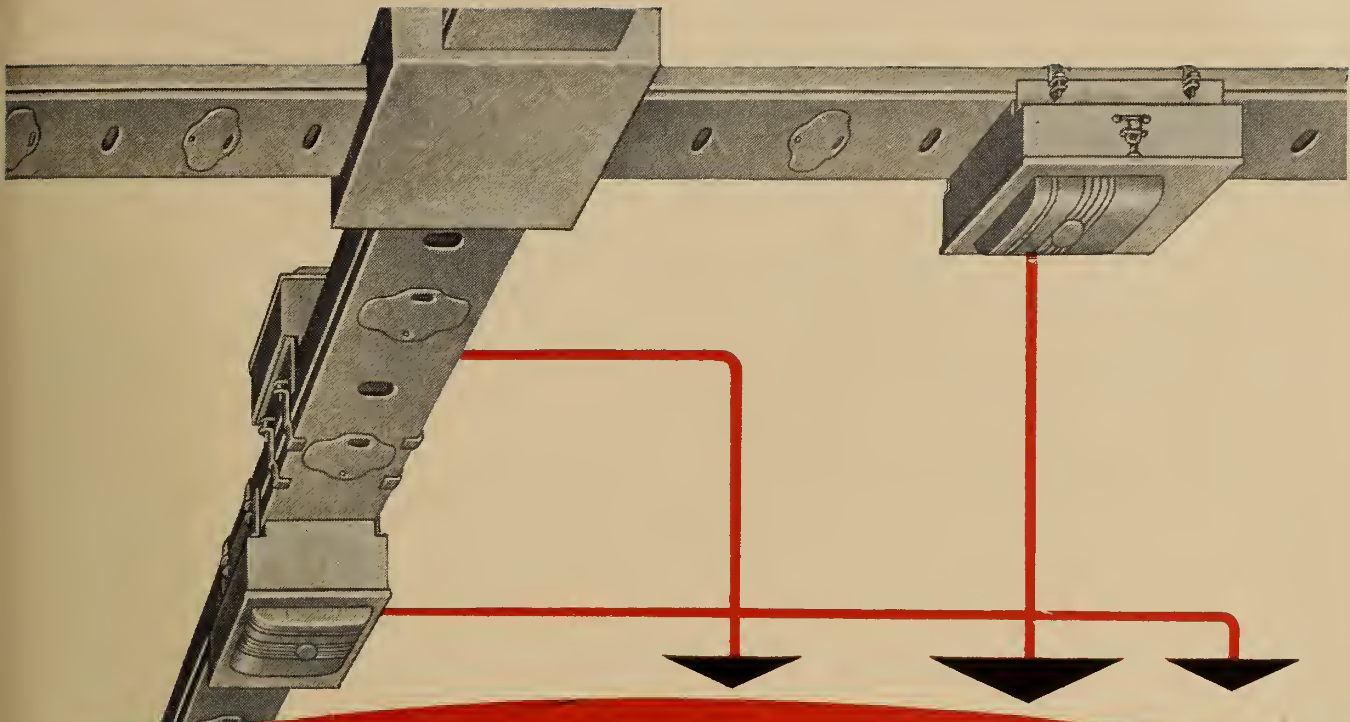
Flame-Plating is a process developed by Linde Air Products Company, a division of Union Carbide and Carbon Corporation, for depositing a thin coating of tungsten carbide on the surfaces of parts and many tools where extra wear-resistance is required. In this manner a tool such as a core rod can be given a highly wear-resistant surface while retaining the toughness of the base metal which minimizes breakage problems. Because the temperature of the part being plated does not exceed 400 deg. F., finished and semi-finished parts can be flame-plated without causing distortion or a change in the physical properties of the base metal. The coating may be left in as-coated condition (similar to fine emery cloth) or finished down to 1-5 microinches rms.

Many parts and tools such as plug and ring gauges, turbine shaft seals, gripping dogs, wire straightening rollers, spindles, and bushings are now being flame-plated with outstanding success. Flame-plating is available in Canada from Dominion Oxygen Company, division of Union Carbide Canada Limited, Toronto.

●

**Canadian Terylene Plant.**—The first Canadian "Terylene" textile fibre plant, is being constructed at Millhaven, Ontario,

(*Continued on page 1362*)



and 1,400 acres of land at that location are being purchased by Canadian Industries (1954) Limited, it was announced today by C-I-L president H. Greville Smith following a meeting of the company's board of directors.

Acquisition of this property and construction of the Millhaven works were undertaken early in 1953 by Imperical Chemical Industries of Canada Limited, which announced at that time that the project would subsequently be offered to Canadian Industries (1954) Limited. Pilot plant production has now begun at Millhaven and it is expected that full operating capacity will be available by next summer.

The $20,000,000 plant, situated on Lake Ontario 11 miles west of Kingston, will be capable of supplying over 11,000,000 pounds of yarn and staple annually to the Canadian textile industry which, until now, has been receiving small quantities of that fibre produced in Great Britain. The large area of the Millhaven site lends itself to the development of other chemical undertakings by the company.

When in full operation the plant will employ about 800 people. Present employees will become part of the C-I-L organization.

The enterprise will be handled within C-I-L by a new department—the Textile Fibres Department—headed by R. B. Winsor, formerly chief engineer of C-I-L and before that assistant manager of the chemicals department. Other senior officials in the department will be D. R. Fraser, sales manager; MacMillan Boyd, assistant sales manager; B. J. Moriarty, technical service manager; Frank Thomson, control manager; Harris Sherwood, works manager at Millhaven with R. M. Beatty production superintendent.

•

**C.G.E's Transformer Plant.**—Whatever the primary source of energy—water-power, coal, oil, natural gas or the atom—its mounting use will entail an increasing use of electrical equipment, Trade and Commerce Minister C. D. Howe said as he officially opened the Canadian General Electric Company's $12 million power transformer plant.

At the opening ceremony, Mr. Howe touched off a 3-million-volt blast of man-made lightning between the plant's impulse generator and one of the first large transformers built there. The blast symbolized the vast voltages controlled by the electrical equipment produced at the plant.

Rated as one of the world's best-equipped engineering and production centres for the design and manufacture of large power transformers, the new plant represents the largest expansion in the 62-year history of the Canadian electrical industry. With 700 workers now on the payroll, it is already Guelph's largest employer, and is ultimately expected to provide work for 1,000 people.

The new facility produces power transformers for the distribution systems of Canada's electrical utilities and industries. These units step up voltages at power sites for transmission to centres of population and again reduce voltages at these points for distribution and utilization.

The plant and its satellite buildings occupy 60 acres of the 207-acre site purchased by the company in 1952, with a large part of the remainder ticketed for future expansion. At peak employment during construction, over 750 workers were employed at the site. The plant's floor space totals 374,963 square feet.

Built as the result of the heavily increased demand for such equipment, the plant represents a significant addition to the nation's capacity to produce capital equipment vital to Canada's expansion and to the nation's defence. It increases the company's power transformer manufacturing capacity by 50 per cent. A. L. Graham is manager of the company's power transformer department.

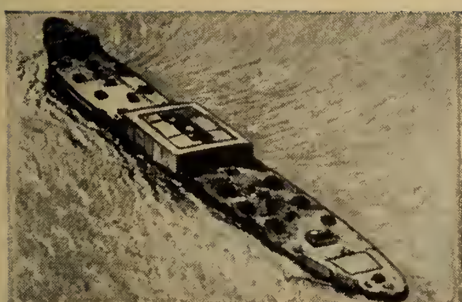
•

**The New Johns-Manville Asbestos Mill.**—The most important single project in Johns-Manville's expansion and replacement program during the past decade is the construction of a new mill at Asbestos, P.Q., Canada, where the company mines more than one-third of the world's supply of asbestos fibre from the largest known asbestos ore deposit in the world, the Jeffrey Mine. This new Mill will replace the present mills, which are becoming obsolete, and which are located in the caving area of the local underground

(*Continued on page 1364*)

**"HAYDITE"***
**THE LIGHTWEIGHT AGGREGATE**
**SO DURABLE . . .**

# 34 years of salt water didn't affect it!



Near Galveston, Texas rests the hull of the "HAYDITE" concrete ship "Selma" launched in 1919 and beached some years later. For 35 years the "HAYDITE" concrete in the hull had endured thousands of cycles of wetting and drying. In 1953, physical examination showed that "... the concrete was in excellent condition and the reinforcing steel showed no deterioration whatsoever even though in most places it had only ⅝ inch cover".

"HAYDITE" aggregate is a pure iron-bearing high silica-alumina lorain shale, produced in rotary kilns at temperatures exceeding 2000° Fahrenheit. This intense heat burns out all foreign matter, and causes an explosive expansion of the shale creating myriads of microscopic, totally-enclosed non-interconnecting air bubbles, each in its own vitreous shell. This is "HAYDITE"—a remarkably durable lightweight aggregate (concrete made with "HAYDITE" aggregate weighs 33% less than sand and gravel concrete) that is chemically inert, has amazing strength, and is highly resistant to both fire and humidity.

**Let us tell you about "HAYDITE" for poured-in-place structural reinforced concrete; for precast roof and floor slabs; for roof and floor fill; for refractory concrete; for guniting applications, and for building blocks.**

**Registered Trade Mark*

## THE Cooksville Company LIMITED

*general sales offices:* 1055 Yonge Street, Toronto
*montreal:* Aerocrete Construction Co. Ltd., 2501 Lakefield Ave., Montreal East

mine. It will provide some additional production capacity and will operate at lower costs.

The New Mill is constructed of steel and concrete, fourteen storeys high and covered with "Transite" sheathing — an asbestos-cement product manufactured by Johns-Manville. The first half of the building is now completed and the first quarter of the machinery is installed and ready to go into operation. The entire project should be completed by the spring of 1956. This new plant incorporates the most modern facilities for the milling and production of high quality asbestos fibres — an essential objective in today's competitive asbestos industry.

**Du Pont of Canada.**—A plant for the manufacture of "Freon" fluorinated hydrocarbons, gases which create the cooling action in air-conditioning and refrigeration systems and are the basic propellants in aerosols, will be erected immediately at Maitland, Ont., by Du Pont Company of Canada Limited, it was announced recently. Maitland is on the St. Lawrence River between Brockville and Prescott.

The plant will be of sufficient capacity to fill all Canadian requirements for these chemicals, now largely imported from the United States, and will use Canadian base materials wherever possible. It is being built adjacent to Du Pont of Canada's nylon intermediates plant which went into production a year ago.

The project is the second announced by Du Pont of Canada since July 1. The first building of a research center already is under construction at Kingston, Ont., beside the company's nylon spinning plant there.

"Freon", Du Pont's trade name for fluorinated hydrocarbons, was first produced commercially in the U.S. in 1931, and was developed to meet widespread demand for a nontoxic, nonflammable, odorless refrigerant to replace the hazardous materials then in use. Following the introduction of "Freon", the refrigerant industry expanded 20-fold in the next 20 years. One of the major uses is in the family refrigerator.

Then, during the war, an entirely new use for the compounds was developed. As the answer to the problem of insects in the Pacific and other tropical areas, "Freon" was used as the propellant in the "bug bombs" employed to kill mosquitoes and other disease-carrying insects. This development in turn led to today's rapidly expanding aerosols industry with a wide variety of household and personal products, from room deodorants to shaving cream, packaged in aerosol containers.

●

# Publications

**For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.**

**Please mention *The Engineering Journal* when writing.**

**Paper on Laticrete.**—A reprint of a paper on the characteristics and performance of Laticrete has been issued by the latex and reclaim division, Dominion Rubber Company, Limited. The paper was originally presented by W. M. MacLean, division sales manager, at the meeting of the chemical and petroleum engineering division of the Chemical Institute of Canada, in Montreal last March.

Laticrete is a unique preparation combining the structural characteristics of concrete with the abrasion and corrosion resistance of rubber, and possessing the ability to bond firmly to concrete, steel, and other materials. It is used for the

*(Continued on page 1366)*

repair of damaged or worn concrete and as a tank lining material. Laticrete also has the properties of being flexible, waterproof, non-skid, and unaffected by oil or by temperature changes.

Installation of Laticrete is said to be easy. The one-quarter inch thickness required for most flooring repairs, resurfacings, or tank linings, makes Laticrete economical in initial cost, and additional savings result from the increased service life in many uses.

Laticrete has also been successfully employed for bedding, acid-proof bricks, or ceramic tile, and as an adhesive for polyester sheets and foamed glass.

Copies of the report are available from company offices in Montreal, Toronto and Winnipeg.

•

**Molecules to Management.**—Reprints of the "Molecules to Management" Symposium which was held during the 37th Annual Conference and Exhibition of The Chemical Institute of Canada in Toronto, June 21-23, 1954, are now available from the Head Office of the Institute, 18 Rideau Street, Ottawa.

Papers included in this eight-page reprint are: "Developing the Managerial Abilities of Employees," by Francis J. Curtis, Monsanto Chemical Company, St. Louis; "Finances and Financial Controls", by C. A Kline, E. I. Du Pont de Nemours, Wilmington; "Training Technical Personnel for Management," by J. B. White, Aluminum Co. fo Canada Limited, Montreal; "Communications and Human Relations," by J. T. McCay, Bois McCay Associates, Montreal; "Recipe for a Good Manager," by O. E. Ault, Civil Service Commission, Ottawa; "Engineers in Management," by K. F. Tupper, University of Toronto.

•

**Cast Stainless Alloys.**—The Alloy Casting Institute, technical association of high alloy foundries, has just published a set of data sheets covering the properties of all the more popular grades of alloys used for corrosion resistant (stainless steel) castings. Consisting of 13 individual data sheets describing each of the cast corrosion resistant alloy grades, the complete set, bound in an attractive file folder, is available from the Alloy Casting Institute, 32 Third Avenue, Mineola, N.Y.

Representing the most complete and up-to-date compilation now available on this subject, publication of these useful data culminates a project begun ten years ago. During this period information has been collected from many sources and in co-operation with other groups, notably the American Society for Testing Materials and the Society of Automotive Engineers.

Each data sheet lists chemical compositions, physical properties, mechanical properties, and includes a discussion of design considerations. The alloys are fully described with respect to metallurgical structure and characteristics, and preferred heat treatments are recommended. The general industrial fields of application are listed together with the various corrosives in which each grade has been successfully employed.

A compilation of data for the heat resistant cast high alloys is nearing completion, and is expected to be published in similar data sheet form some time next year.

•

**Tube Costs and Capacity.**—A publication which has just been released by the Unifin Tube Co. entitled "An Opportunity to Cut Costs and Increase Capacity with Unifin Tubing" is available from the company at P.O. Bcx 7, 1109 York St., London, Ontario. This bulletin gives complete technical and design data on the application of Unifin tube in shell and tube heat exchangers for oil refining, chemical processing and other industries. Equipment economy and operating advantages are clearly demonstrated through case histories. The engineering section gives complete information for design and selection of requirements.

•

**Small Boilers.**—A new bulletin, AD-135, describing the recently announced CB50-80 line of small boilers has been issued by

(*Continued on page 1368*)



the Cleaver-Brooks Company of Milwaukee, Wisconsin.

Bulletin AD-135 completely describes these new CB boilers which are available in 50 to 80 hp. (15 to 150# steam, 30# hot water) for heating and processing. This illustrated bulletin contains complete information of these major advantages—silent operation, fuel flexibility, fast, easy maintenance, automatic safe operation.

Also illustrated and explained are the new hinged front and rear doors, forced draft system, full five square feet of heating surface per boiler horsepower, four pass construction assures a minimum guaranteed efficiency of 80% when operating with oil, and eye level control panel. This four-page, two-color bulletin also includes drawings and specifications on the CB50-60-70-80-hp. models.

Cleaver-Brooks Company, 326 East Keefe Avenue, Milwaukee 12, Wisconsin. Form AD-135.

•

**Booklet on Welding Problems.**—"How to Overcome Your Welding Problems and Improve Your Welding Techniques" is the tile of a new 8-page, fully illustrated booklet, just released by Eutectic Welding Alloys Corp., Flushing, N.Y.

Written for welders by welders it is a practical down-to-earth manual designed for those who wish to increase their welding knowledge and improve their skill. Metallurgists and welding engineers also will find this booklet very useful because they will gain an insight into the many problems facing the maintenance welder.

The many variables the maintenance welder has to face are mentioned and explained; the causes of stress raisers, starter cracks and hard spots are discussed and methods indicated whereby they may be avoided or minimized.

The section on design shows by means of illustrations how weld failures can be avoided if due consideration is given to joint design to allow for multi axial stresses.

Many of these problems are eliminated if the correct welding techniques are used. Drawings indicate how a simple change in joint design will reduce these dangers of weld failure.

The practical welding experience of many years is packed into this 8-page booklet and should be of inestimable value to the welder who takes a pride in his work and wants to know some of the answers to everyday problems.

Copies may be had free of charge by writing to Eutectic Welding Alloys Corp., 40-40 172 Street, Flushing 58, N.Y.

# E.I.C. Annual Meeting

## May 11-12-13, 1955

Royal York Hotel,
Toronto, Ont.

## May 23-24-25, 1956

Montreal, Que.

•

**Pressure Filters.**—A comprehensive and well documented bulletin, No. 2225B, describing Permutit's extensive line of pressure filters and their accessories has been made available. These filters are now being used to remove suspended solids such as dirt, turbidity, iron, oil and color.

Prepared by The Permutit Company, New York 36, N.Y., makers of ion exchange resins and water conditioning equipment, the bulletin should be of interest to all engineers dealing with water problems. Specifications, operating characteristics, outline dimensions and typical installation photographs have been included in this revised edition.

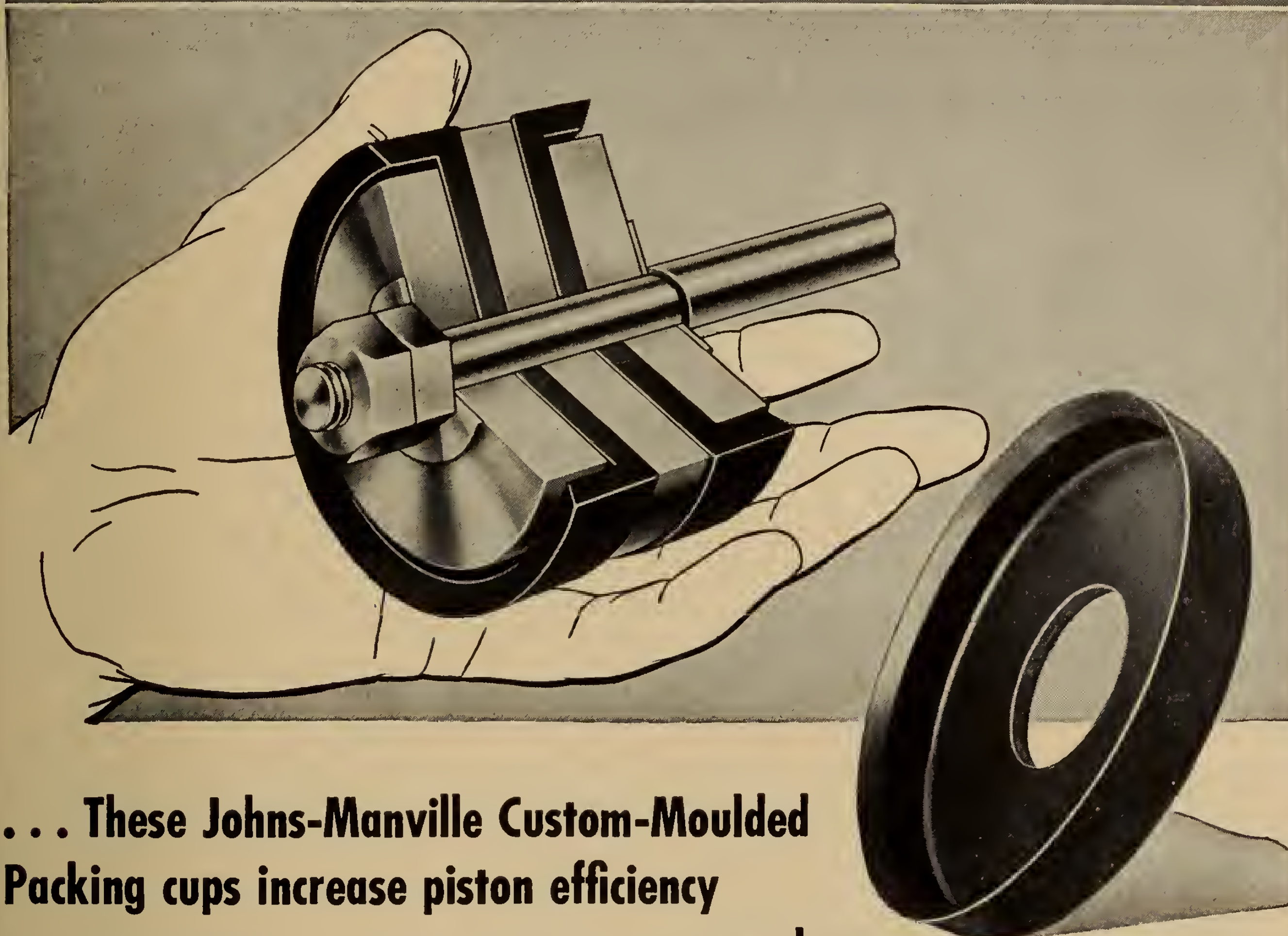
•

**Engineering Handbook for Multi-V Drives.**—A 76-page, illustrated multi-V belt engineering handbook, featuring a convenient guide to the design of standard and high capacity drives, has just been published by the B. F. Goodrich of Canada, industrial products division, Kitchener, Ontario.

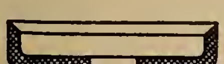
New horsepower rating tables closely

(*Continued on page 1374*)

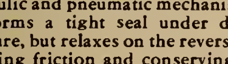
# Looking for a more efficient piston design?



## ... These Johns-Manville Custom-Moulded Packing cups increase piston efficiency ... save space ... save power ... serve longer



**TYPE A** . . . The Type "A" J-M Moulded Packing Cup is the "standard" for use on the pistons of pumps and on various hydraulic and pneumatic mechanisms. The lip forms a tight seal under discharge pressure, but relaxes on the reverse stroke, reducing friction and conserving power.



**TYPE B** . . . This type of cup is essentially the same as Type A, except that the leading edge of the lip is square instead of beveled. This construction provides greater strength where the lip may be exposed to distortion or excessive wear due to openings in cylinder walls.

Johns-Manville Moulded Packing Cups can help you improve piston designs. They provide a highly efficient seal . . . improve equipment performance . . . lower operating and maintenance costs. These custom-made packings are extensively used on all types of slow moving pistons and rams operating under high or low pressures and temperatures.

Johns-Manville Moulded Packing Cups may be used on practically all air or hydraulic-operated cylinders. For instance, those which are in such equipment as reciprocating pumps, hydraulic jacks and presses, pneumatic chucks, governors, lift trucks, grease guns, valves, drilling and boring machinery . . . or on any other equipment where efficient piston design is essential.

You have your choice of a number of styles and compositions of these precision-moulded cups to meet temperatures and pressures encountered in hydraulically operated equipment. Types "A" and "B," shown here, are most widely used on inside-packed pistons with the outside edge or lip contacting the cylinder wall or liner. Other types are available, however, for other services.

If you would like more information on these or other types of Johns-Manville Custom-Made Piston Packings, get in touch with your Johns-Manville Packings Distributor, or write Johns-Manville, 199 Bay St., Toronto.

I-173 JOHNS-MANVILLE JM PRODUCTS

**Johns-Manville PACKINGS & GASKETS**

approximate actual operating conditions and reflect the increased ability of modern belts. The horsepower tables permit the design or re-design of V belt drives at lower cost by reducing the number of belts needed to carry a given load and indicating the potential use of lower cost sheaves. The tables cover speed ratings from 100 to 6,000 feet per minute.

Other subjects covered in the new handbook include: selection of correct multi-V drives, installation and care of V belt drives, principles of V belt design, selection of pre-engineered V-V drives, designing a standard V-V drive not in pre-engineered tables, designing V-flat drives, multi-V quarter turn drives and double-V belt drives. A multi-V belt drive calculation sheet is also included.

A series of 22 simplified, easy-to-read tables cover such aspects of V belt engineering as installation and takeup allowance, belt speeds, length correction factor, calculation of centre distance and a geometry chart for drives. Thirty-one pages of tables are devoted to pre-engineered drives calculated with stock sheaves and stock sizes of V belts. Ninety per cent of two-pulley standard drives can be selected from the pre-engineered drive tables. For further information, please write Public Relations Manager, B. F. Goodrich, Kitchener, Ontario.

●

**Pipeline Construction Equipment.**—Canadian Ingersoll-Rand has announced availability of a 64-page catalogue of compressed air-operated machinery for pipeline construction. The laying of oil and gas pipe in the ground has created a group of contractor "specialists," and the catalogue has been designed for this group, although it is of general interest to all contractors.

The catalogue is divided into three sections for easy reference; rock drills, air compressors, and air tools. The rock drill sections cover the complete line of Ingersoll-Rand drilling equipment, and includes specifications of all the drills. The new "PLM" pipe line mounting, for side-boom tractor or crane mounting, is fully described.

Construction features, weights, dimensions and capacities of all the Ingersoll-Rand portable air compressors is detailed, including the Gyro-Flo or rotary type of portable.

Air picks, diggers, sump pumps, utility hoists, air wrenches and concrete vibrators are all listed in the Air Tool section of the catalogue, and the wide range of sizes of these tools that is available is readily apparent from the listings of specifications.

Write Canadian Ingersoll-Rand Company Limited at 620 Cathcart St., Montreal, Que., or contact your nearest Canadian Ingersoll-Rand branch office for a copy of this catalogue. Ask for Form CF-552.

●

**Liquid Level Gages.**—Catalog No. 246 covers in detail the three standard types of Jerguson convex scale and flat scale Truscale remote reading gages, showing how these gages bring the liquid level down to where it can easily be seen . . . therefore protecting valuable equipment and preventing expensive shutdowns. Included are features of design and construction; description and schematics showing operation; schematics and charts graphically illustrating the three types of datum columns to meet specific needs; illustrations and descriptions of typical applications; and information on visible and audible alarms and Truscale repeaters. Write Peacock Brothers Limited, P.O. Box 1040, Montreal, Que.

●

**Power Tunnel at Kemano.**—"Breakthrough," the drama-packed motion picture on the driving of Alcan's ten-mile power tunnel at Kemano, B.C., has just been released. This tunnel carries water to generators which will furnish the power which is indispensable to aluminum production. Produced in sound and full colour for Canadian Ingersoll-Rand, the film catches all the romance and excitement of underground rock-drilling. At the same time, it records in a concise and understandable manner the complete story of modern hardrock tunnelling practice with "Carset" tungsten-carbide-tipped Jackbits.

The "breakthrough" of this 10-mile, 25-foot diameter giant tunnel represents a remarkable achievement in organization and team work among men, and an impressive tribute to the design and construction of the equipment they used. Working in an isolated wilderness, 400 miles north of Vancouver, Canadian hardrock miners worked 24 hours a day for almost two years to drill, blast and muck some 2,300,000 tons of rock from the heart of a mountain — and shattered world records for driving this size of tunnel. (One crew advanced 61 feet in a single day — more than twice their scheduled target of 26 feet).

Lew Parry Film Productions of Vancouver had seven-man crews on location for the formidable task of lighting and filming the motion picture in the tunnel. To light the drill mounting of "jumbo" at the tunnel face and to film mucking operations it was necessary to carry a thousand pound transformer and a ton of cables and lighting equipment two and a half miles into the tunnel. To light the tremendous powerhouse cavern it was necessary not only to draw all available underground power but to light giant flares as well. Canadian Ingersoll-Rand has arranged to show the film throughout the country and interested groups (mining, construction, educational, service clubs, etc.) are invited to arrange showings with their local Ingersoll-Rand Branch, or by writing to the Film Department, Canadian Ingersoll-Rand Co. Ltd., 620 Cathcart Street, Montreal, Quebec.

●

**Air-Powered Vises.**—A new 4-page brochure describing air powered vises, discusses the many timesaving applications of these versatile units in production holding and pressing jobs. It includes many illustrations and describes how the usefullness of these air-powered vises is multiplied, (1) by using special jaw faces; (2) by unusual mounting in other than standard position; and (3) by using two or more air vises operating in unison from a single foot controlled valve. It also discusses safety and the elimination of operator fatigue with increased production. Copies available from: Van Products Company, 3736 West 12th St., Erie, Pa.

●

## LIBRARY NOTES

(*Continued from page 1323*)

Detailed requirements, including minimum factors of safety, are specified for the design of the crane structure and moving parts, and there is an appendix on the design of struts.

Wire ropes, rope drums and pulleys, lifting hooks and grabbing are dealt with, and an appendix is included on customary types of grab.

There are clauses on electric motors, brakes and electric braking, controllers, protective gear and switches, lighting and heaters, cables and wiring and earthing.

**CP 325 (1953) — Farm and horticultural electrical installations. 15/-.**

This code deals with the provision of electrical installations for farm buildings, nurseries, market gardens and private gardens. It covers such things as consumers' controls and distribution system, lighting of buildings, yards and roadways, heating, motive-power, battery-charging and electric fences.

**Canadian standards, Canadian standards association, National research building, Ottawa, Canada.**

**C.S.A. A82.20: 1954 — Standard methods of testing of gypsum and gypsum products,** 2nd ed., $1.25.

This specification replaces the 1950 edition and in it a number of changes are found which correspond to the latest issue of ASTM standard C26. It now includes an appendix covering the alcohol wash method of sieving gypsum and gypsum products. As in the first edition this standard covers procedures for the chemical analysis and physical testing of the products in question.

**C.S.A. C22.2 No. 1: 1949 — Appendix B — Construction and test of power-operated radio devices,** 3rd ed., .50c.

This appendix supplements the above standard and applies to power-operated television receivers and similar equipment, including remote units, portable units and electronic test equipment designed to be used on supply circuits operating at not more than 150 volts to ground. The tests apply to temperature, dielectric strength, short-circuits and arcing.

**C.S.A. C22.2 No. 13: 1954 — Construction and test of transformers for luminous-tube signs, oil- or gas-burner ignition equipment, cold-cathode interior lighting,** 2nd ed., $2.25.

This specification replaces the first edition issued in 1935 and is divided into three sections. Section A, concerning luminous-tube signs, applies to transformers of portable and stationary types, for potentials up to and including 600 volts low-potential, and 15,000 volts open-circuit high-potential, and includes outdoor and indoor types and reactors, if supplied as part of a transformer. The section on oil- or gas-burner ignition equipment deals with transformers for potentials up to and including 600 volts low-potential and 15,000 volts open-circuit high-potential. Section C applies to transformers for cold-cathode, high-voltage, luminous tubing, for potentials also up to and including 600 volts low-potential and 15,000 volts open-circuit high-potential.

**C.S.A. C22.2 No. 74: 1954 — Construction and test of lampholders and control equipment for use with electric discharge lamps,** $1.25.

Three sections are included in this specification, covering ballasts, automatic and manual starters, and lampholders and starter holders. The first applies to resistor- and reactor-type ballasts for use with electric-discharge lamps of the hot or cold cathode type, involving potentials of 1,000 volts or less and designed to be employed on circuits of not more than 750 volts between conductors. The information contained in the next two sections is to be used in conjunction with these ballasts covered in Section A.

**C.S.A. C22.2 No. 98: 1954 — Construction and test of power-operated radio transmitters,** $1.00.

This is part two of the Canadian electrical code dealing with the essential requirements and minimum standards covering electrical equipment, and includes all types of radio transmitting equipment irrespective of the type of modulation employed. Included in the tests are rating, temperatures, shock hazard and fire test, electrolytic capacitor and dielectric strength test.

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 37 — MONTREAL, NOVEMBER 1954 — NUMBER 11



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"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

*17,500 copies of this issue printed*

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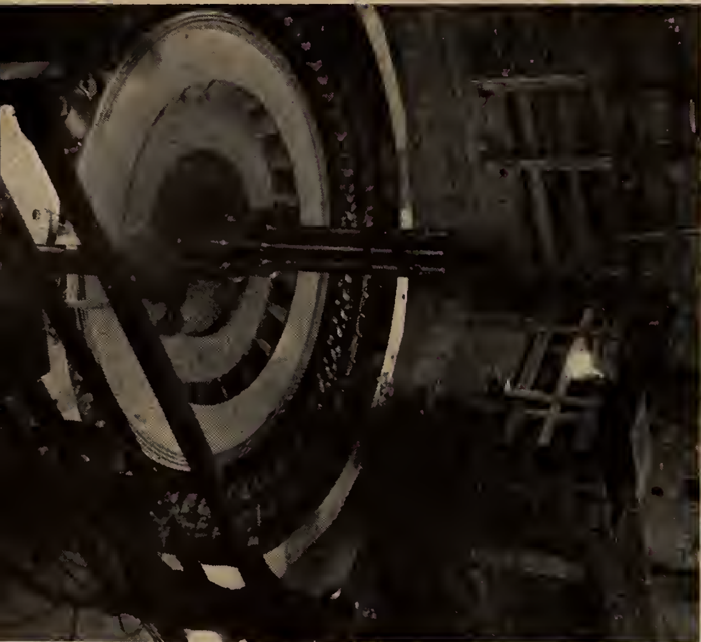
*Indexed in The Engineering Index*

# Westinghouse at Kemano






# THE NECHAKO-KEMANO-KITIMAT DEVELOPMENT

## Introduction

*by* McNeely DuBose, M.E.I.C.
*Vice-President*
*Aluminum Company of Canada, Limited.*

On August 3, 1954, H. R. H. the Duke of Edinburgh, Hon.M.E.I.C., watched the pouring of the first aluminum ingot at the Kitimat Works of the Aluminum Company of Canada, Limited. That operation was the realization, after forty years of thought and effort, of the production of useful power and the development of industry by the diversion of water from the north central plateau of British Columbia directly through the coast range mountains to the Pacific Ocean.

#### General Description

The Cascade Mountains form the coast line of northern British Columbia. Behind them lies a plateau from two to four thousand feet above sea level. During glacial times, this plateau was buried under several thousand feet of ice, which spilled through a number of low points in the mountain barrier and gouged deep glacial valleys on the coastal side. Many of these valleys were cut down to a bottom elevation of a thousand feet or more below present sea level and are now fjords that reach as far as a hundred miles inland from the ocean front, their heads lying deep in the mountains.

One of these deep channels, called Gardner Canal, passes only twenty miles from the western end of a lake, called Tahtsa, which lies on the interior plateau at El. 2,800 and drains east and south through the Nechako and Fraser Rivers 700 miles to the Pacific Ocean. The Kemano River enters Gardner Canal through a smaller fjord, the bottom of which has, over the years, been filled with alluvium to above sea level. Ten miles up the Kemano River, and only ten miles from Tahtsa Lake, the river bed is less than 200 feet above sea level, providing a clear difference in elevation of 2,600 feet below Tahtsa Lake in a horizontal distance of only 10 miles.

The potential power resources of this fjord-plateau area remained a challenge for years, partly because the smallest possible development would be gigantic, with unknown engineering problems, and partly for lack of a consumer to use the power output; the initial investment would be enormous and could not be undertaken without a reasonable assurance of a large initial power load. The search for a user of this power eventually turned to aluminum production. Of all Canadian industries, aluminum smelting uses the most electric energy per dollar of product; it is the largest power consumer in the country; and it requires the assembly of large tonnages of raw materials from various parts of the world, making an adjacent seaport, such as could be provided by a fjord, a practical necessity. So aluminum production was a natural, if not the only, prospect as the developer of this area and the efforts of the Government of British Columbia concentrated over the years on attracting an aluminum industry. Today, the Kemano power station and the Kitimat aluminum smelter stand as evidence of the success of those efforts.

#### Surveys and Stream Flow

The site of the Kemano power station and the route of the tunnel from Tahtsa Lake to it were roughly surveyed by British Columbia government engineers nearly 25 years ago and records of stream flow in various rivers on the plateau have been maintained by the Federal Government since that time. By 1939 the Provincial Government had assembled enough information to publish a series of reports outlining various alternative schemes for developing power in that area, and in 1941 the premier of British Columbia asked the president of the Aluminum Company of Canada, Limited, to investigate the power possibilities of his province, with an eye to establishing an aluminum industry on the west coast. The Aluminum Company agreed, but after a year of preliminary investigation, the war discouraged exploratory work, the company concentrated its attention on the construction of its Shipshaw power development in Quebec and the British Columbia project was shelved.

In 1947 the Aluminum Company was again approached by the British Columbia Government and urged to give further consideration to the establishment of an aluminum industry in British Columbia. The company was willing and preliminary engineering on a number of possible sites was carried out by the company in 1948. In 1949 it was

McNeely DuBose, M.E.I.C.

decided that the most interesting possibility was the Tahtsa-Kemano project, expanded by the addition of a dam on the Nechako River high enough to impound the waters of all the principal lakes on its watershed, including Tahtsa Lake, so that the combined waters of the entire Nechako watershed could be diverted by a tunnel from Tahtsa Lake to the Kemano River. Additional water could be obtained by raising the level of nearby Nanika Lake by a dam at its outlet and its inflow could be diverted to the Nechako reservoir by a short tunnel.

### Smelter and Townsite

At Kemano, there was no room for an aluminum smelter and its accompanying townsite, but at the head of an adjacent fjord, called Douglas Channel, lay the Kitimat valley, several miles wide, extending 40 miles over a low divide to the Skeena River, where there were existing rail and highway facilities. Kitimat offered all the essentials and most of the desirable features for a smelter location. There was ample space, a good harbour for ocean shipping and easy road and rail connections. But its use would necessitate a 50-mile transmission line across the mountains from Kemano.

In early 1951, after two years of engineering work, the Alunimum Company decided to proceed with this development and construction of the first stage of the project was started. It took nearly a year to establish the basic system of access roads, wharves, camp and shop facilities and communications. At present, there have been completed and put into operation the Kenney dam across the Nechako River, one tunnel from Tahtsa Lake to Kemano (a second to be built later), one-half of the penstocks and eventual power station, both underground, a transmission line to Kitimat, an aluminum smelter of 90,000 tons annual capacity, harbour works and part of a townsite at Kitimat. A rail connection to the C.N.R. transcontinental line is approaching completion.

Although Kitimat has been in existence as an incorporated municipality since March, 1953, the first permanent houses were not occupied until the spring of 1954 and much remains to be done there. The planning of the town has been described in various architectural and town planning publications and no further description is attempted among these papers.

### The Engineering Story

The full engineering story behind this event is being told for the first time in the accompanying group of articles. There have been so many engineering problems to be solved that an exhaustive report of all of them would fill volumes, so in this series the emphasis has been placed on those parts of the job which have in them something new or different in the engineering field. This emphasis does not mean that the importance of sound, conventional engineering is underrated; it is the starting point for all innovations.

The conception, design and construction of the Kitimat development has required a wide variety of talents and consultants from various parts of Canada and other countries have been retained for specialized advice on different parts of the project. In addition, the technical staffs of the various suppliers and manufacturers of components of the work have provided that consultation which has come to be an indispensable part of modern engineering projects. The design of the power facilities has been the responsibility of the British Columbia International Engineering Company, Limited, and the smelter and harbour facilities were designed by the general engineering department of the Aluminum Company of Canada, Limited. √

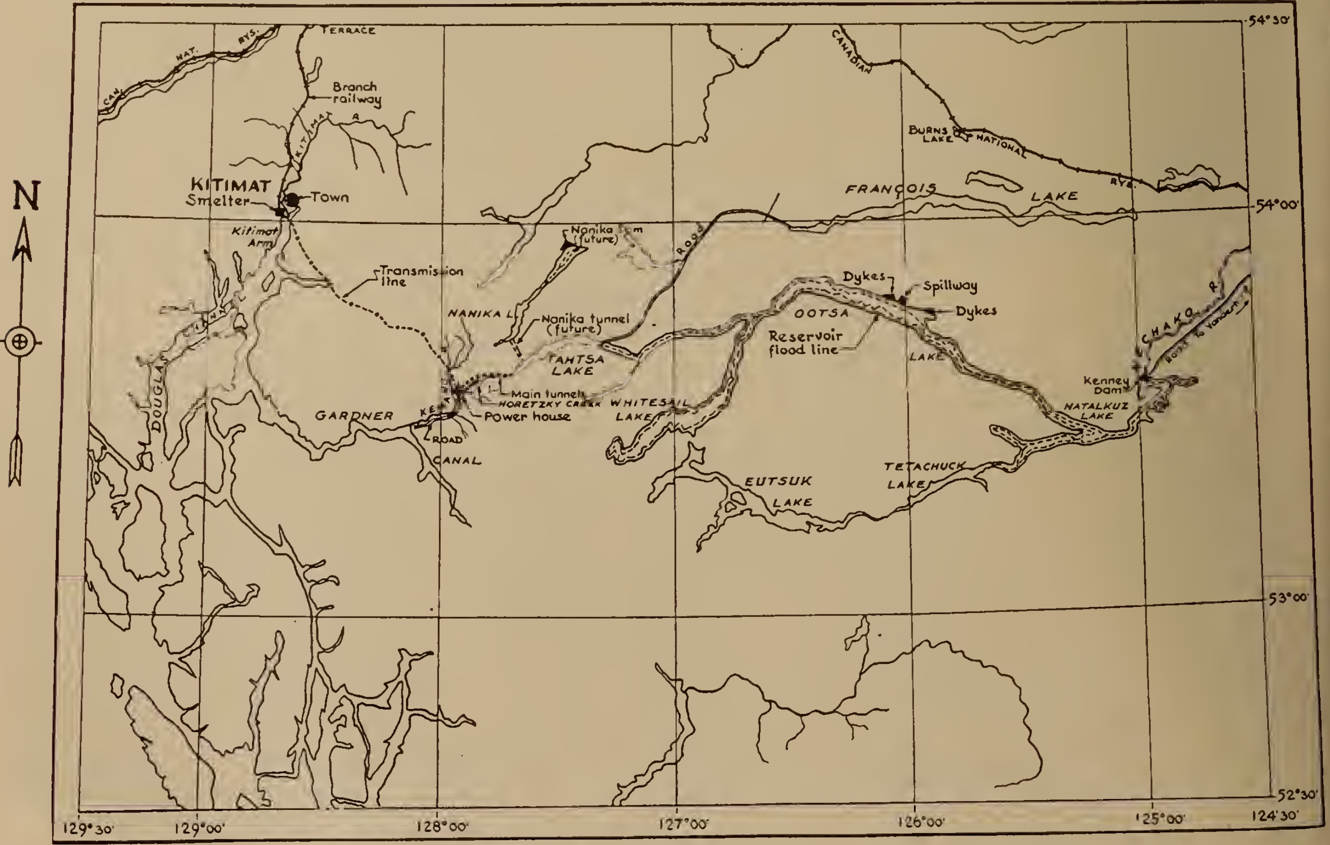



Fig. 1. Map of Kitimat project.

# Hydraulics

## of the

# Kemano Development

*by*

W. W. Wolcott

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**In this paper the author gives a brief summary of the hydrology and hydraulics of the power scheme, ultimately to deliver 1,650,000 horsepower at the smelter in Kitimat. Notwithstanding the relative paucity of precipitation, evaporation and streamflow data, the results of his calculations are believed to be close to those which will be attained in operation.**

At the Alcan project in British Columbia is one of the largest water power sites in the world, where the fundamental requirements of a good water supply at a high elevation relatively near a point of low elevation are admirably satisfied. This fortunate combination of natural conditions was recognized in the early 1920's by provincial government engineers and confirmed by surveys and in reports in the late 1930's. Elsewhere in this series is to be found the history of Alcan's interest in this site,* leading to a field reconnaissance in 1948 and to the subsequent rapid construction of the first stage of development.

Except for a small area in the northeast corner, the reservoir catchment lies entirely in Tweedsmuir Park, about 400 miles due north of Vancouver, B.C. The centre of the area is closely at 53° 30′ north latitude and 126° 30′ west longitude.

**W. W. Wolcott**

The height of land on the west consists of mountain peaks and ridges averaging 8,000 feet above sea level. From these heights the general slope of the catchment is downward towards the east, with most of the change in elevation taking place on the east slopes of the Coast Mountains, so that the remaining drop from the west end of the natural lake system to the main storage damsite is on an unusually easy gradient. The natural lakes which are combined and raised to make the reservoir, are long, relatively narrow, and deep, formed by several periods of glaciation in the area, which left the characteristically complex relief of gravel, sand and boulder till remnants on and around the sedimentary and extrusive rocks.

The Coast Mountains are generally the eroded remnants of a large granitic batholith lying in contact with the older formations to the east.

Since glaciation throughout the catchment area occurred relatively recently and, in fact, is still present at the higher elevations, the land is rather new and lean and of little value for cultivation or even for the production of timber. Some cattle and hay are raised commercially along the north shore of Oostsa Lake, but except for this small portion of the catchment, the cover below tree line is poor quality lodge pole pine, spruce or poplar.

The total area tributary to the main reservoir is 5,450 sq. mi., including approximately 350 sq. mi. of natural lake area.

#### Precipitation and Temperature

Precipitation varies greatly in the 130-mile length of the catchment, with probably 100 in. per annum along the westerly limits and less than 20 in. along the east boundary. For example, the precipitation is now known to total about 75 in. annually including 40 feet of snow at the west end of Tahtsa Lake, whereas snowfall rarely exceeds a total of three feet at Kenney dam.

Until the beginning of construction, the only available records of precipitation and temperature were those taken at Wistaria on Ootsa Lake and at towns along the Canadian National Railway about 60 miles north of the catchment. Average annual precipitation over a period of 25 years at Wistaria was 18 in. The high, low and mean annual average temperatures at this station were 48° F, 26° F. and 37° F. respectively. Although snow fall is was given a capacity of 60,000 cfs.

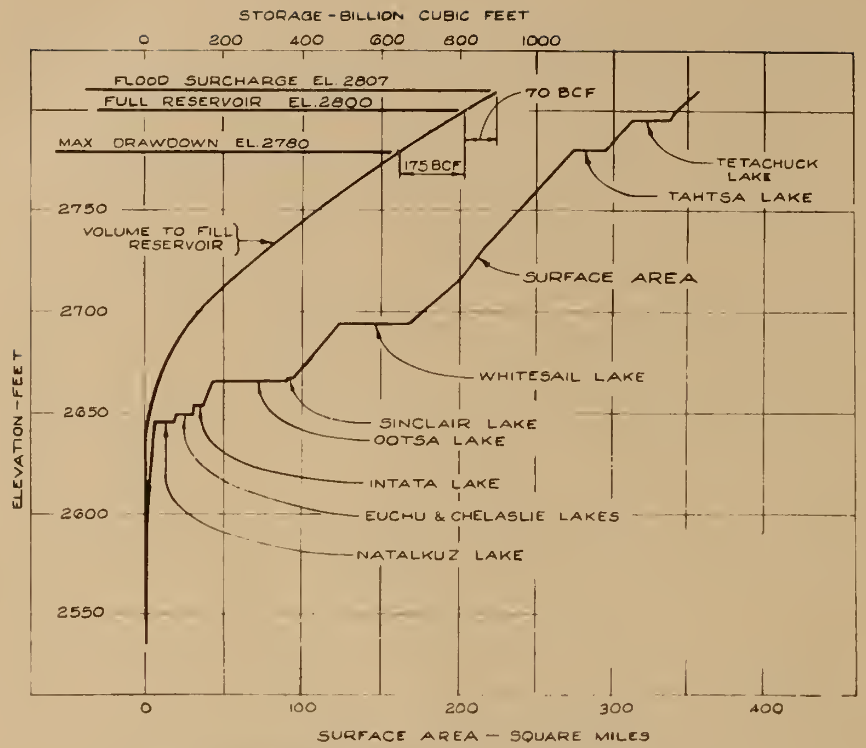


**Fig. 2. Nechako reservoir area and capacity curves.**

very heavy over the coastal end of the catchment, winter temperatures are moderate and ice rarely forms on the lakes until February. At Ootsa Lake and eastward, winter temperatures range much lower and ice does not move out of the lakes until mid-May.

### Runoff

The runoff records for the catchment were obtained by the Dominion Resources Bureau over a period of about 20 years prior to 1948. Gauging stations were maintained, with some lapses during the severe winters, at four key points on the rivers connecting the lakes, with a fifth important station measuring the entire Nechako River discharge about 50 miles downstream from Kenney damsite. The westerly 35 per cent of the catchment supplies about 80 per cent of the total runoff. From these records the following average flows were adopted for use in power project studies:

Minimum water year—4,490 cfs.
Maximum water year—8,510 cfs.
Average water year—6,495 cfs.

The flooded land areas, with reservoir full, will be about 110,000 acres. Net loss by evaporation from this surface area will be about 125 cfs, as calculated from stream discharge and rainfall records.

Firm flow for power generation of 6,080 cfs. from the Nechako catchment was adopted, based on economic considerations of the height of Kenney dam and of the saddle dams, on the size of channel excavation at the outlet of Tahtsa Lake to permit water to flow from the main reservoir into Tahtsa Lake during periods of maximum drawdown, and on considerations regarding the intake structure for power conduits. Three years of stream gauging on the Nanika River indicated a mean flow there of 950 cfs.; thus 920 cfs. from Nanika plus 6,080 cfs. from Nechako give the 7,000 cfs. assumed available for the ultimate project.

Inflow to the Tahtsa Lake basin alone was taken at an average of 930 cfs. for power generation prior to the rise of downstream storage to merge with the Tahtsa Lake natural storage.

The record of maximum floods, as obtained at the several gauging stations mentioned above, was thoroughly analyzed in arriving at a rational estimate of flood flows for the design of control works. The common type of flow probability curve made up from the record of discharges, increased by storage on the natural lakes, gives maximum daily average inflows to the catchment of 60,000 cfs. for the 1,000-year flood and 68,000 cfs. for the 10,000-year flood. Required maximum spillway releases with available storage become respectively 30,000 and 35,000 cfs.; the spillway was given a capacity of 60,000 cfs.

### Reservoir

This large reservoir is created by a major dam on the Nechako River and nine saddle dams along the north rim of the basin. The main spillway is located between two of these saddle dams and about midway between the east and west ends of the reservoir.

When filled to design El. 2,800, the surface area will be approximately 340 sq. mi. and the volume between this level and the surfaces before impoundment will total about 820 billion cu. ft., or 18.8 million acre feet, of which 175 billion cu. ft., or 4 million acre feet, is considered as live storage. These relationships are shown graphically in Figure 2.

This amount of live storage is a maximum requirement from the record to date and may be needed only when the generating plant is developed to its ultimate size, with Nanika Lake water diverted into the main reservoir. Prior to that time, the storage required for reservoir regulation will, of course, be proportional to the number of units operating at the power plant. Draft for Stage I installation with two units operating will be about 1,000 cfs., which is less than the minimum daily flow of record, therefore in an average year, about 3.9 million acre feet will have to be released through the spillway to maintain the reservoir at desirable elevations.

After the reservoir is filled and during Stage I operation, the surface will be maintained at about El. 2,790 minimum and spillage will be confined to the May to November periods when the reservoir is free of ice. Only moderate uniform spillway discharges should be required with this lower reservoir surface elevation.

From the start of plant operation in mid-summer, 1954, until about January, 1956, water for plant operation must come from the Tahtsa Lake basin alone, augmented by an initial surcharge obtained by building a temporary dam at the outlet of Tahtsa Lake to store surplus runoff in 1954.

### Spillway

The spillway consists of two 35 x 35-foot radial gates with sills at El. 2,765 and a 73-foot length of ogee spillway with crest at El. 2,800. With the reservoir surface at El. 2,800, the gated portion of the spillway will discharge about 44,000 cfs. and with 7 feet of surcharge on full reservoir elevation, the computed discharge of the free crest and gated sections together becomes 60,000 cfs.

The location of the spillway at this point will lead to the development of what amounts to a new 45-mile long channel for the Nechako River. In order to direct the releases into the low ground between the spillway and Skins Lake, which is at natural El. 2,731, a starter channel with a bottom width of 50 feet was excavated to El. 2,780 and along one side of this, a pilot ditch was carried 15 feet lower to El. 2,765. Inflow to the main reservoir will be stored, in order to bring the water surface as rapidly as possible to a point where it will feed back into the Tahtsa Lake basin. Beyond this point it is planned to continue storage to El. 2,800, after which spillway discharges will be increased as necessary to hold the reservoir at desired levels. These large and sustained discharges will erode new channels and create delta fans in Skins Lake and in the much larger Cheslatta Lake, 12 miles distant and about 200 feet lower than the present outlet of Skins Lake. The formation of a channel to carry upwards of 20,000 cfs. flows through this route will be one of the several more interesting engineering features of the operating history of the project.

### Hydraulic Conduit

Water supply for power generation is taken from the west end of the reservoir through a conduit system, including an intake structure of conventional type with No. 1 service gate sill at El. 2,725, thence through 10 miles of nominal 25-foot horseshoe tunnel to a connection with a simple surge shaft and with the upper ends of two 11-foot diameter steel penstocks. Each of these penstocks slopes downwards through the end of the mountain a total vertical distance of about 2,386 feet to four turbine manifolds.

The 25-foot modified horseshoe section planned originally for the entire length of the tunnel was used for about three-quarters of the entire length, with the remaining easterly quarter of the bore driven to 22½ x 28-foot and 21-foot modified horseshoe and 20-foot horseshoe shapes. The area of the 25-foot modified horseshoe section with 9 in. of average overbreak would be 563 sq. ft. Actual average overbreak throughout the tunnel was 24 per cent of the cross-sectional area inside neat lines. Calculation of friction losses in this long conduit involved consideration of a tunnel floor which is concrete paved throughout, a total of 15,415 feet of concrete lined sections of waterway area ranging between 490 sq. ft. and 314 sq. ft. and an equivalent gunited length of 21,050 feet. Adopted coefficients of friction for use with Manning's formula are:

For unlined or gunited sections .................. 0.038
For concrete lined sections. 0.014

Normal maximum flow in each tunnel (No. 1 and No. 2) will be 3,500 cfs. or half of the total firm flow of the ultimate development, which includes Nanika water. However, with only one tunnel available for operation, it would be desirable to operate the eight units on the tunnel at full gate, which would draw about 4,800 cfs. through that tunnel. Giving effect to all the variations in flow conditions throughout Tunnel No. 1 as built, the calculated head losses in the tunnel would be as follows:

1. Initial condition—1,000 cfs.................. 7 feet
2. Normal operating maximum—3,500 cfs....... 83 feet
3. Maximum draft—4,800 cfs.................... 157 feet

This leads to a minimum low level of El. 2,642 in the surge shaft under steady flow conditions, or five feet above the roof of the tunnel at that point.

### Surge

The relatively small quantity of water required to damp out surges in the conduit flow resulting from increase or decrease of demand at the power plant, will be provided by a 25-foot diameter shaft on a 48° slope with overflow lip at El. 2,850, or 50 feet above normal full reservoir.

Calculated departures of water surface in the surge shaft from steady flow levels are as follows:

1. Seven units operating, full gate to zero in 60 secs. +200 feet.
2. Five units operating full gate, two units on in 30 secs. −103 feet.
3. Eight units operating full gate, one unit off in 30 secs. +48 feet.

Unit operation at this plant will normally be ideal with respect to fluctuations, since the load is practically constant throughout the year and any routine changes in demand or supply can be planned with ample time for very slow operation of the turbine needles. However, surge calculations are based on 30-second closure of sphere valves or jets and a penstock pressure rise of 10 per cent is assumed for water hammer.

### Penstock

The 11-foot diameter portion of the welded steel penstock is 4,438 feet long from the wye branch at the end of the power tunnel to the first wye branch at El. 210. Using a friction coefficient of 0.012, and making conventional assumptions for losses at bends, changes of section and branches, the total head losses chargeable to the steel lined portion of the conduit are as follows:

Stage I, 1,000 cfs., —21 feet.

Normal full load on four units, 2,000 cfs., —52 feet.

Maximum possible, 2,400 cfs., —75 feet.

For the normal maximum flow of 2,000 cfs. through the penstock system, the following velocities would be obtained:

1. 11-foot diameter section, 21.0 fps.
2. 7-foot 9 in. diameter section, 21.2 fps.
3. 5-foot 6 in. diameter section, 21.1 fps.
4. 5-foot diameter section, 25.5 fps.

### Power Available

Supplied through the tunnel and penstock described above, and giving effect to all losses, the available firm power at the various stages of penstock construction will be as given in Table 1. √

**Table 1: Available firm power at various stages of penstock construction**

| | Discharge, cfs. | Effective head, feet | Horsepower, thousands | |
|---|---|---|---|---|
| | | | At powerhouse low tension bus | At high tension bus at Aluminum plant |
| Penstock No. 1, 4 units, 3 units operating, . . . . . . . . | 1,800 | 2,512 | 438 | 425 |
| Penstock Nos. 1, & 2, 8 units, 7 units operating, . . . . . | 4,200 | 2,402 | 977 | 950 |
| Penstocks Nos. 1, 2 & 3, 12 units, 10 units operating, . . | 6,000 | 2,435 | 1,415 | 1,374 |
| Penstocks Nos. 1, 2, 3 & 4, 16 units, 14 units operating, . . | 7,000 | 2,461 | 1,695 | 1,650 |

# The Kenney Dam

*by*

Harry Jomini, M.E.I.C.

*Resident Engineer,*
*Aluminum Company of Canada, Limited.*

The Kenney dam is the key to Alcan's Kemano power development, turning the waters of the Nechako River from east to west. Largest of its type in the world, its total yardage exceeds four million and its construction involved handling other millions of cubic yards of material not in the dam itself, as well as half a million tons of freight for workers. Its building was not made any easier by its being many miles from any substantial base of supply. The story is well told here by the engineer who was the owner's representative on the dam construction.

The Kenney dam is the largest sloping, rockfilled, clay-core dam in the world. It raises the water some 300 feet at its face and some 17 feet in Tahtsa Lake, the western extremity of the lake-chain system where the intake of the tunnel carrying the reservoir water to the power house at Kemano is located. The dam is situated some 60 miles south of Vanderhoof at the entrance to the Nechako canyon in the Nechako River, one of the larger tributaries of the Fraser River.

### General Topography

From the Coast Range east to the Nechako plateau some 120 miles, there is a gradual sloping off in terrain into what might be classified as a rolling to undulating area, with a number of rugged, but low-range, hills. Elevations range from about 2,300 to over 4,000 feet. The undulating to rolling terrain rises fairly steeply from the lake basin to the hills, reaching 500 to 1,000 feet above the lakes. In places the terrain is precipitous, broken and rugged. The whole district was heavily glaciated; glaciation generally had the effect of deepening and enlarging numerous depressions, which today form the many lake basins. The ice also smoothed and rounded the more rugged relief features. During the recession of the ice, coarse, glacial deposits of an unassorted mixture of sands, clays and stones were laid down over most of the surface. Temporarily blocked drainage created large lakes in many of the present lake basins. Silts, sands and clays were deposited in these large, post-glacial lakes and now form agricultural lands lying along portions of the present lakeshores and rivers.

### Topography of the Job Area

The site of the Kenney dam at the entrance to the Nechako canyon topographically is ideally suited for a dam location. From the top of the gorge, some 80 feet above the river, the rock rises steeply on both flanks to a height of 500 to 600 feet. In proximity to the dam area, on the slope of low-range hills on either side of the Nechako River, there are deposits of clays, sands and gravels. The whole area is heavily covered by pine.

### Project Description

The job necessitated first gaining access into this remote area by building a 60-mile road south from Vanderhoof to the dam site area through bush and muskeg, establishing a camp site and moving in equipment. The dam area, as well as clay, sand and gravel material areas, was cleared. A 32-foot horseshoe tunnel was driven on an arc through 1,540 feet of the canyon wall and the Nechako River diverted through it. Upstream and downstream cofferdams within the dam area were constructed and the canyon dewatered. The next problems were the cleaning of the riverbed and of the canyon sides, on which the dam was to be built, to fresh, clean rock and removing any abrupt changes in contour of the rock foundation, particularly under the clay-core area; the placing of a concrete pad in the canyon bottom and guniting and grouting the area on the walls upon which the clay core was to rest; the developing of a quarry for the rockfill and of clay, sand and gravel pits for the clay core and filters; and, finally, the connecting of all with a maze of haul roads before the actual placing of the fill in the dam commenced.

### Geology

*General Outline*

The Nechako River, on leaving the lowest of the finger lakes, flows northeast across the interior Nechako plateau, following the foot of the south slope of a high ridge of volcanic rock which rises 1,000 feet or more above the plateau. Some 16 miles from the lake, the river makes a sharp bend and flows in a westerly direction for approximately five miles, then makes a right-angle bend to the north, cutting across

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the volcanic ridge and forming what is known as the "Grand Canyon of the Nechako." The canyon forms a deep notch cut directly across the high volcanic ridge.

### *Local Geology*

The rocks exposed in the canyon consist of volcanic flows and tuffs of the tertiary age and it is on these that the dam rests. The volcanic strata are nearly flat, but dip slightly in a westerly direction. The lowest member of the strata series consists of a pile of tuffs and other ash rocks, the upper surface of which is at a depth of about 150 feet below the river at the axis of the dam. The member immediately above this is a coarse, volcanic breccia about 150 feet thick. Over this is a series of highly vesicular, volcanic flows about 200 feet in total thickness and above these are more massive and non-vesicular, volcanic flows of unknown thickness which extend far above the crest line of the dam.

Besides these rocks, there are several large dykes of felsite or feldspar porphyry which strike more or less parallel to the volcanic ridge, or, in other words, cross the Nechako canyon at right angles.

### General Description of Dam

The dam measures 1,500 feet along its longitudinal axis, 1,170 feet along its transverse axis and 317 feet in height, with a thickness on its crest of 40 feet. At full reservoir elevation of 2,800 feet, the water level will be 25 feet below its crest.

It is a rockfilled dam of an earth-diaphragm type in which the load-carrying element is a dumped rock-fill. This fill supports sloping layers of filter material, which enclose the impervious section of the rolled-earth construction. The upstream surface of the upper filters is loaded with gravel and rock to retain the filters and diaphragm in place and to resist erosion by wave action.

The composite structure forms a solid dam with a high factor of safety. The water load on a dam of this type deflects it downstream in plan and causes it to settle vertically. To compensate for this deflection, the entire structure is arched slightly upstream and a camber is provided in the longitudinal profile of the top. The adjustment of the structure to load tends to wedge the main rockfill and impervious diaphragm between the abutments, thus increasing the resistance against further movement of the dam and leakage through the diaphragm.

### Typical Section

The dam consists of a mass of quarry-run rock to El. 2,785, with a slope on the downstream side of 1:1.4 and provided with a series of berms so disposed that a slope line of 1:1.75 will pass through approximately the centre of the width of each berm. On the upstream side there is a slope of 1:1.37.

On the upstream side of the quarry-run rockfill and lying on the 1:1.37 slope, there are three layers of carefully graded filter material. The first layer is a bed of three-to-ten-inch gravel, 13¼ feet thick. Above this there is the second filter bed consisting of three-quarter-to-three-inch gravel, again 13¼ feet thick, measured at right-angles to the slope. On top of this is the third filter layer of zero-to-three-inch sand, which is 15 feet thick.

Overlying these three filter beds is the impervious rolled-fill section, on the same 1:1.37 slope, 50 feet thick at the bottom and 30 feet thick at El. 2,785, thinning down to 24 feet thick at its top elevation, 2,820. The upstream face of the impervious rolled fill is at a slope of 1:1.5.

Placed on the sloping upstream face of the impervious fill there is a sand filter bed five feet thick made up of material passing a ¾-inch screen. This layer of sand, as well as the core, is held in place by a mass of pit-run gravel and quarry-waste rock, with a layer of riprap consisting of quarry-run rock above it.

### Quantities

In the embankment of the dam there is a total quantity of 4,016,893 cu. yd. of materials. Breaking this total into various sections of the dam, the following figures result:

| | Cu. yd. |
|---|---|
| Quarry-run rock | 1,796,512 |
| Gravel, 3-10" | 136,697 |
| Gravel, ¾-3" | 164,680 |
| Sand, 0-¾" | 208,777 |
| Impervious rolled-fill material | 514,671 |
| Upstream sand below El. 2,820 | 74,970 |
| Pit-run gravel | 746,464 |
| Upstream riprap, including cap and downstream slope from top to El. 2,785 | 246,599 |
| Concrete pad under impervious rolled fill | 4,830 |
| Concrete in fault zones under core trench | 1,394 |

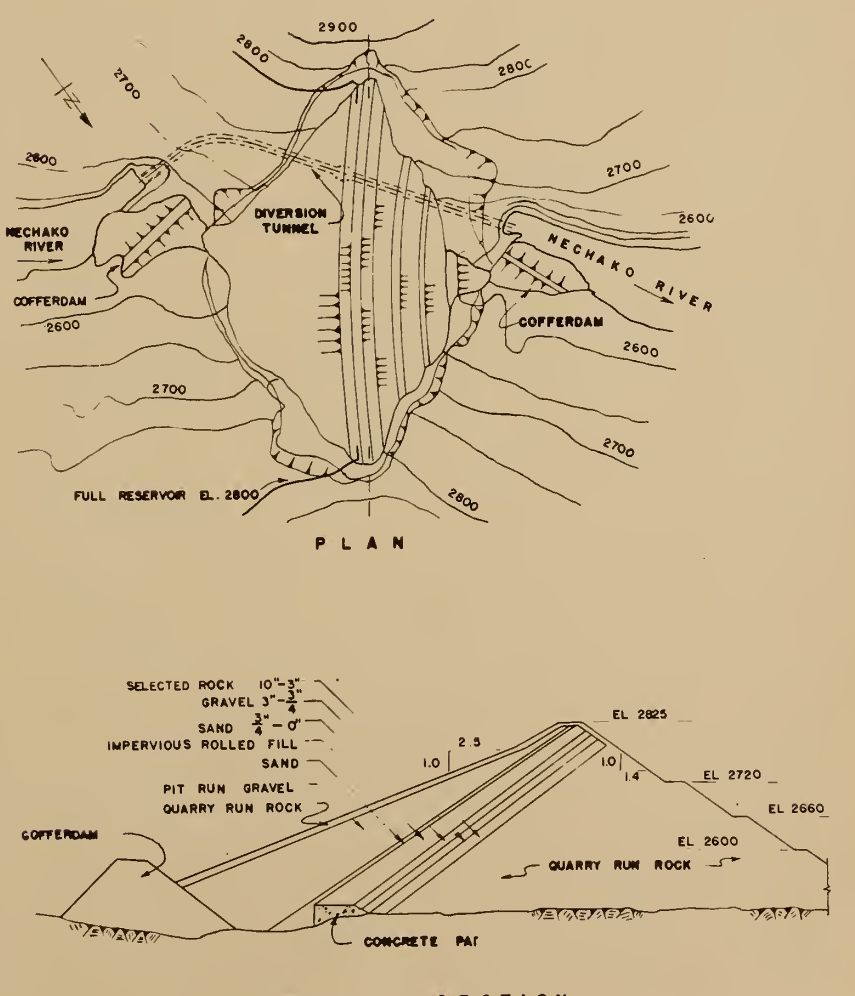


Fig. 3. Plan and typical section.

**Fig. 4. Nechako River before diversion. Stripping in progress and forms for tunnel gate structure in place.**

| | |
|---|---|
| Concrete in fault zones outside core trench | 1,026 |
| Original upstream cofferdam to El. 2,585 | 88,476 |
| Downstream cofferdam | 31,797 |
| Total | 4,016,893 |

### Diversion Tunnel

In order to divert the waters of the river, which normally ran at high velocity through the part of the canyon to be closed, a 32-foot horseshoe tunnel was bored in an arc through 1,538.4 feet of canyon wall, removing some 50,239 cu. yd. of material. Progress on this tunnel averaged 30 feet a day and the rock drillers finished their work in less than two months. Concrete portals were poured on the upstream side and gate guides fitted. The tunnel was lined with concrete 195 feet back from the portal, through what is known as the "transition" stage. This length, as well as that part of the tunnel underneath the core trench was grouted to seal up all possible cracks in the rock and to prevent any seepage or leakage of water.

Considerable attention was given to the sloping of the approach banks of the channel at the entrance to the tunnel portal, and the exposed rock face upstream and adjacent to the portal was gunited to prevent erosion.

### Cofferdams

Cofferdams cutting off the canyon and directing the water flow into and out of the diversion tunnel were built. These consisted of heavy rock placed across the canyon, with sand and silt dumped on their water faces to form impervious seals. A diversion channel to the tunnel portal was cut, a channel blasted in the rock to the river from the downstream portal and the river diverted.

Once this was accomplished, the clay core of the upper cofferdam, with filters back and front, with a mass of quarry rock on the downstream side and with riprap on the upstream face, was finished off and later this cofferdam was churn-drilled and grouted to make it as impervious as possible.

The downstream cofferdam was built on similar lines, but with less care, and without grouting, as, due to the gradient through the canyon, it had only to act as a guide for channelling the water discharging from the tunnel into the river.

### Dewatering Canyon

On the dam site between the two cofferdams, four 6-inch and 12-inch deepwell turbine pumps were installed and the canyon was dewatered. While this was in progress, stripping of the dam site area to a 1:1 slope or flatter was being accomplished by shovels, trucks and bulldozers, removing some 756,791 cu. yd. of earth.

### Trimming Canyon Walls and Dam Site Area

From the area lying beneath the downstream filters to upstream, including the upstream sand filter, all overburden was removed to rock. The canyon slopes were trimmed to approximately a 1½:1 slope and all overhanging cliffs, etc., were reduced to a ½:1 slope. Overhanging cliffs of less than ten feet height were disregarded. The core trench area was excavated to solid rock. This entailed the drilling, blasting and removing of some 104,957 cu. yd. of rock.

### Core Trench Area

The core trench area is the contact area between the impervious clay core within the dam and bedrock.

*Trimming:*

The core trench area was excavated to sound rock from the base to the top of the abutments on each end of the dam. Blasting was permitted, but excavating methods causing excessive overbreak and damage to otherwise acceptable rock was not permitted. This requirement entailed a considerable amount of light shovel work and hand cleaning. In the final stage, the trench was thoroughly hand-cleaned of all loose material. Stresses produced by the fill and water loads on the core foundation area are of small magnitude. Therefore, all excavation and treatment along the core trench were directed toward securing and maintaining imperviousness between the rolled-fill core and the grout curtain in the foundation rock.

Rock excavation was held to a minimum for efficiency in constructing the grout curtain and to provide the specified contact slope surfaces. Blasting was controlled and maintained at a slope no steeper than 1.5 to 1. Further excavation of the rock in the core contact area required after blasting was accomplished by barring only, except for local, narrow trenches, where grout or gunite surface was placed as part of the cutoff in the foundation.

Trenches or large pockets in the vesicular rock strata of the core trench area were filled with grout to the general plane of the adjacent trench area Re-entrant corners and pockets were filled with gunite to a radius of at least 6 inches in plan and profile.

*Core Foundation Pad:*

A core foundation pad in the core trench area was placed across the canyon bottom. This block of concrete in the bottom of the original river channel forms the core foundation in the lowest point in the profile. The pad varies with the contour of the canyon walls from 30 to 60 feet in width, having a vertical upstream face of 35 feet. Lengthwise, the pad is flat on top for 80 feet at El. 2,520. It then slopes at $1\frac{1}{2}$:1 to bedrock on the downstream edge. There are keys at right angles to the length of the 80-foot flat-top surface, trapezoidal in cross-section, with a long base of 14 inches and a short base of 8 inches; the depth is 8 inches and they are spaced at 22-inch centres throughout the upstream and downstream width of the pad.

*Guniting:*

One of the most difficult things to do by usual methods is to get the upper or surface zone of rock adequately sealed off. If the rock is seamy, as is often the case due to blasting or natural causes, but otherwise considered sound, and grouting is used, grout may leak to the surface in the immediate vicinity of the hole, often at lower than desired pressures. This naturally means that more holes are needed nearby to consolidate the surface, so that higher pressures can be used at lower depths. In order to get better results in grouting shallow holes, the surface of the rock at Kenney dam was gunited throughout the whole of the core trench area. Weep or telltale vents were left at frequent intervals along seams or joints. This forced the grout to spread laterally around the hole, particularly near the surface. If and when grout showed at these vents, they were plugged, forcing the grout still farther out in the upper zone of rock. The desired pressure was therefore held with the gunite seal, which meant that the grout spread more thoroughly throughout the depth of the hole.

Gunite need not be thick. It was found that from $\frac{1}{2}$ to 1 inch was satisfactory over fine cracks, the thickness depending on the crack or joint size and shape. As a general rule, gunite need not be applied over solid rock areas, but in this case the foundations did not have large areas of solid rock. There were areas of nearly vertical columnar joints; here the gunite held the grout in the joints.

Gunite served to prevent water from coming up through the rock at unpredictable points under the core and finding a path downstream. In other words, by means of guniting, the full efficiency of the core was maintained in the vicinity of the rock surface.

In order to meet schedules, guniting operations were commenced in midwinter and sections of the core trench area being gunited were totally housed in by canvas. The temperature under cover was kept above freezing by the use of coke salamanders and oil heaters. As one section of the core trench area was gunited and grouted satisfactorily, the cover was moved to an adjacent section.

Before guniting, the rock surface was thoroughly cleaned and all surface water removed. During freezing weather, the temperature of the rock was raised, to thaw ice frozen in the cracks. Gunite was applied as quickly as possible to the thawed and warmed rock, after which the fresh gunite was protected from freezing.

**Fig. 5. Damsite before placing of core material was started, looking upstream.**

It was kept at a temperature of 50°F. for not fewer than two days, then protected with a coverage of insulating material for a period of a week. Water for gunite was heated (during cold weather), to bring the mixture to approximately 50°F. Sand for gunite was free from ice. For best results, it contained only from 3% to 5% moisture. All sand was dried in a sand drier. Bone-dry sand was not acceptable, for it caused considerable static. The gunite mixture used was one part cement to three parts sand.

*Grouting:*

A cutoff curtain was extended down into the foundation rock by pressure grouting from the bottom of the core trench area and under both abutments of the dam. The purpose of the cutoff grouting was to prevent leakage from the reservoir through the foundation of the rolled-fill core. This requirement was satisfied by a continuous, but relatively thin, zone of thoroughly grouted rock.

Grouting was accomplished by a method of sequence drilling and grouting. First, as already explained, the area was gunited. Following this, a series of holes, known as the "first stage", was drilled, 30 feet deep at 20-foot centres, and grouted at from 30 to 50 pounds. The second stage was to drill and grout a series of intermediate holes 30 feet deep, grouting at 50 pounds. The third stage consisted of drilling to 75 feet through the first series of holes and grouting at pressures of from 75 to 100 pounds. The fourth stage consisted of drilling the final deep holes to a depth of 125 feet or greater, between the third stage holes, rather than deepening the latter. Grouting here was done at pressures of from 100 to 150 pounds or better to final refusal.

The principal difference in this program, as compared with usually accepted methods, lies in the location of the final deep holes between the third-stage holes, rather than deepening the latter. This was done to fill any possible sections between the third-stage holes that might not have been thoroughly grouted above the 75-foot depth.

In the grouting operations, 20,198 feet were drilled in rock to a depth of 30 feet and 32,939 feet were drilled to a depth of 30 feet in grout. In opening grout holes from 75 to 150 feet in rock, 21,736 feet were drilled and through grout at the same depth the footage was 2,336.

For pressure grouting of the core trench area, 48,760 sacks of cement were used. There were 684 grout connections or one connection for each hole, and 104 weep pipes were set in the same manner as grout connections, except that the pipe was of smaller diameter.

The total actual area, which was cleaned for the core trench prior to guniting and grouting, including a 3-inch strip on both sides of the trench area, was 24,134 sq. ft., and 18,872 sacks of cement were required in guniting this surface.

### Sources of Fill Material

*Roads:*

To develop sources of fill material and to haul this material to the dam site, some 45 miles of access roads, some of which were constantly changing, were built in and around the job site. These roads had to be of such a nature that, irrespective of prevailing weather conditions, they could carry loads in excess of 25 tons day in and day out, night after night, week after week, month after month, without stoppage of the haul equipment. To prevent congestion of traffic in the dam site area, roads in many cases were one-way, for, with 350 pieces of mobile equipment digging, hauling and delivering fill material to the dam site, traffic at times was as heavy as, if not heavier than, at the corner of Peel and St. Catherine Streets in Montreal. The roar of engines equalled or exceeded that found at any busy city intersection.

*Quarry:*

Adjacent to the left abutment of the dam was a perpendicular face of durable basalt rock, extending in a ridge some 3,000 feet or more, which was considered suitable rockfill material.

*Preparation of Site:*

The quarry site, of almost 200 feet vertical face exposure, was lightly wooded by small pine and other coniferous trees and covered by varying depths of overburden, from a few inches to several feet in the pockets and crevices in the basalt lava flow.

Stripping was commenced in late August and early September, 1951, by bulldozers, draglines, etc., the

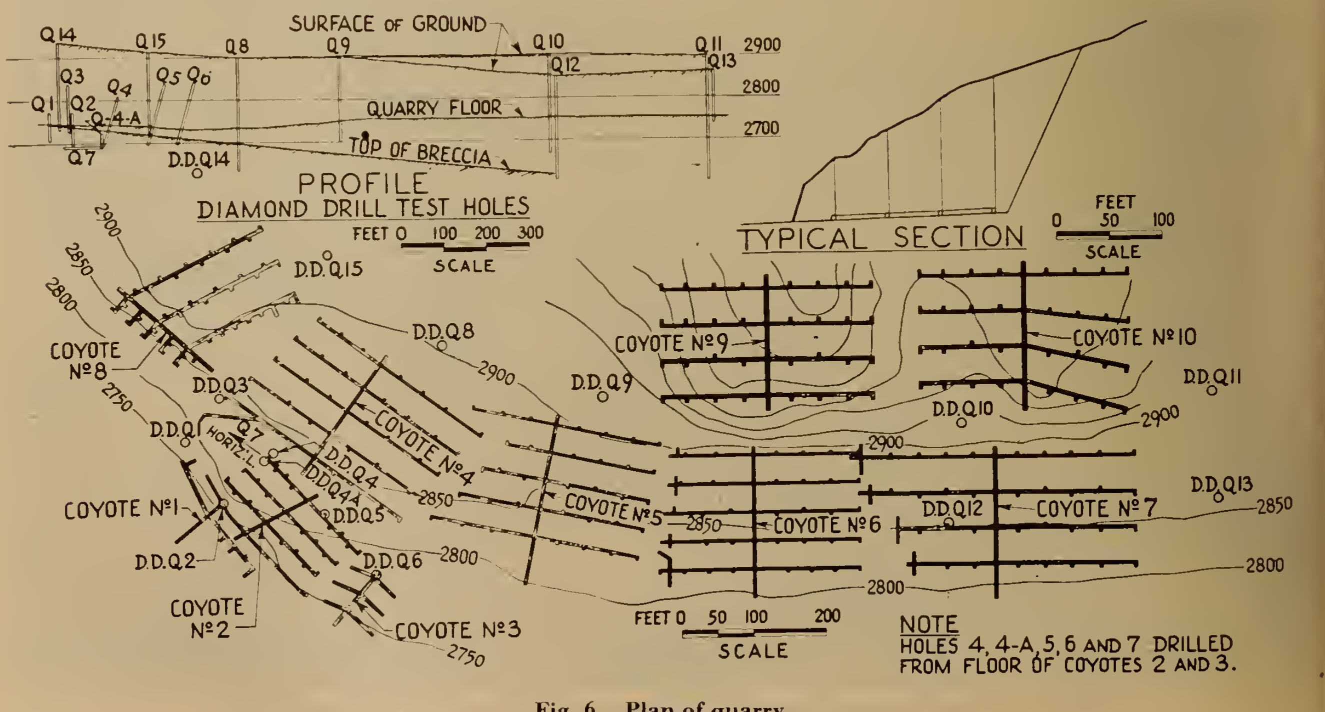


Fig. 6. Plan of quarry.

Fig. 7. Coyote hole blast in quarry.

lighter units crossing the Nechako some six miles upstream from the dam site area by a Klondyke ferry; the shovels and dragline equipment too heavy for the 20-ton maximum load of the ferry were forded across the river under their own power and with the additional aid of two TD-24 caterpillar tractors anchored on the far bank with winch tow lines, which successfully helped pull these heavy units through water up to their running boards.

After the quarry site had been stripped as clean as possible by these heavy units, it was sluiced off by high-pressure water. The first quarry floor was developed at El. 2,692. The face was first prepared by wagon drill equipment and later a 4- x 6-foot coyote tunnel was driven some 150 feet into the rock, loaded and blasted. The broken material was found to contain a large percentage of volcanic ash, breccia and fragments of basalt. The ash was obviously unsuitable and the breccia also appeared to be unsuitable for rockfill. The breccia was composed of fragments of basalt from a few inches to a few feet in diameter, cemented together in the matrix of volcanic glass, chloropal, opal and fine ash or pumice. The basalt fragments were strong and durable, while the cementing materials were not only weak, but some of them, on exposure to the atmosphere, shrank and cracked, thus causing disintegration of the whole rock. So a search was made for other sources of this fill material.

A locality east and north of the first quarry development and about 50 feet higher was examined. Here, high, bare bluffs of basalt extended from about El. 2,750 up to El. 2,950 and along a length of 1,000 to 1,500 feet. It was calculated that this area would yield from one quarry face, upward of 1,000 feet long and 100 to 200 feet high, all the rock required for the entire dam. Diamond drilling upward from the second coyote started at the lower quarry floor level of El. 2,692, as well as surface examination, strongly indicated that the rock in this 200-foot ledge would be entirely of basalt, more or less vesicular. The basalt exposed on surface was fresh, strong and durable, therefore, it was decided to move to this higher level of approximately El. 2,750 in order to establish a working quarry floor as quickly as possible at this new elevation, the second coyote, which had been driven some 918 feet, including main drift and tees, was blasted and any material suitable for rockfill was sorted out and saved, the remainder of the blast being levelled off to form a new quarry floor.

*Method of Quarrying:*

The development of the quarry and the winning of rock was done by a system of coyote hole drifts with a varying number of crosscuts and tees, depending upon the burden. As one coyote was blasted, a second neared completion and a third was already started. This sequence continued along the whole length of the quarry face, starting at the southern extremity and working to the northern end. In all, there was a total of ten coyote drifts with crosscuts and tees driven in the above sequence.

Tunnelling was done by drilling with Swedish-type drill and drill steel rods with tungsten carbide bit inserts. The average life of each steel rod and bit was from 500 to 600 feet. Regrinding of each bit was necessary after from 40 to 60 feet of drilling. The blasted muck was hauled out of the coyote drift by slusher scrapers worked by a double drum, air driven hoist. The blasted material was removed from the coyote portals by bulldozer and spread on the quarry floor.

*Explosive Charges:*

Explosive used in the coyote drifts and crosscutting tees was 40 per cent forcite dynamite. In the coyote blasting, 20 and 65 per cent ammonia dynamite was loaded and detonated by a single primer and primacord, fired through a blasting switch box connected with 220 or 440 volts direct from a heavy motor generator set, or with the camp's main power supply.

Tables 1 and 2 give the comparative quarry loading factors and figures.

*Excavating:*

Rock was excavated from the rock quarry by four shovels with 3½-yd. buckets or 4-yd. rock-type, wide-mouthed buckets. In addition, there were three 2½-yd. shovels. For clean-up work around the shovels there was a fleet of three bulldozers. The shovels loaded the rockfill into a fleet of end-dump trucks of 10- to 17-cu. yd. capacity. On the average,

Fig. 8. Loading trucks in quarry.

this working fleet consisted of between thirty and forty trucks.

A traffic system was set up with a control tower and, as each truck driver approached, a shovel number was flashed from the control tower ordering him to load from the shovel designated. In this way it was possible to obtain maximum loading efficiency from all shovels. The usual procedure was to have one truck loading on one side of the shovel, an empty one ready to load on the other side and a third either moving into position or standing by to move into position. The trucks were spotted under the shovel by the shovel greaser. Bunching or grouping of the trucks around one shovel, causing others to go lean, was overcome by this traffic system. After shovel runners had become used to their machines and to routine loading, all units in the quarry averaged better than a minimum of 150 cu. yd. per hour and as high as a maximum of 300 cu. yd. per hour or better. A four-lane divided highway connected the quarry to the dam site a mile away. This was constantly watered and maintained. Each of the 30 to 40 trucks hauling from the six shovels achieved a 12-minute turn-around from dam site to quarry. One load was dumped every 45 seconds. It was not unusual to see pieces of rock up to 20 tons in weight promptly loaded and placed in the fill as they were.

**Table 1: Quarry Comparative Loading**

| Coyote No. | Factor | First Tee | | Second Tee | | Third Tee | | Fourth Tee | | Fifth Tee | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left |
| 4 | Powder factor | 1.07 | 1.15 | 0.67 | 0.65 | 0.93 | 0.90 | 1.28 | 1.32 | 1.38 | 1.40 |
| | Shear " | 2.40 | 2.40 | 2.61 | 2.64 | 4.00 | 4.40 | 5.50 | 5.50 | 6.30 | 6.30 |
| 5 | Powder " | 1.40 | 1.47 | 0.92 | 0.79 | 0.86 | 0.78 | 1.04 | 1.00 | 1.00 | 1.00 |
| | Shear " | 2.50 | 2.50 | 2.76 | 2.74 | 2.96 | 3.30 | 3.68 | 4.20 | 4.26 | 4.70 |
| 6 | Powder " | 1.86 | 2.21 | 1.06 | 1.07 | 1.21 | 1.21 | 1.53 | 1.37 | 1.43 | 1.43 |
| | Shear " | 2.50 | 2.50 | 2.76 | 2.75 | 4.16 | 3.97 | 6.34 | 5.53 | 6.60 | 6.72 |
| 7 | Powder " | 2.64 | 2.54 | 1.55 | 1.68 | 1.71 | 1.73 | 1.63 | 1.61 | | |
| | Shear " | 2.87 | 3.13 | 3.92 | 4.40 | 5.97 | 6.39 | 7.19 | 7.25 | | |
| 8 | Powder " | 2.45 | 2.29 | 1.29 | 1.37 | 1.51 | 1.42 | | | | |
| | Shear " | 6.20 | 5.21 | 5.16 | 3.18 | 6.68 | 3.33 | | | | |
| 9 | Powder " | 2.46 | 2.21 | 1.23 | 1.21 | 1.24 | 1.25 | 1.47 | 1.55 | | |
| | Shear " | 3.92 | 3.54 | 4.68 | 4.33 | 5.38 | 4.88 | 6.61 | 5.91 | | |
| 10 | Powder " | 1.97 | 2.07 | 1.16 | 1.20 | 1.22 | 1.24 | 1.43 | 1.44 | | |
| | Shear " | 2.63 | 4.55 | 4.56 | 4.96 | 5.70 | 5.50 | 7.75 | 6.81 | | |

**Table 2: Quarry Loading**

| Coyote No. | Tunnel lin. ft. | Drilling, lin. ft. | Rock Produced, cu. yd. | Powder, lb. | Overall Powder Factor, lb. | Powder Used in Drilling, lb. | Total Powder, lb. |
|---|---|---|---|---|---|---|---|
| 1 | 314 | 1197 | 43,963 | 27,050 | 0.615 | 3,150 | 30,200 |
| 2 | 1032 | 4104 | 106,164 | 100,250 | 0.944 | 10,800 | 111,050 |
| 3 | 286 | 1083 | 10,071 | 7,250 | 0.720 | 2,850 | 10,100 |
| 4 | 1844 | 6973 | 303,694 | 253,050 | 0.819 | 18,500 | 271,550 |
| 5 | 1817 | 6897 | 252,591 | 177,900 | 0.705 | 18,100 | 196,000 |
| 6 | 1809 | 6878 | 232,592 | 236,900 | 1.019 | 18,050 | 254,950 |
| 7 | 2095 | 7961 | 295,396 | 380,850 | 1.289 | 20,950 | 401,800 |
| 8 | 1097 | 4161 | 165,958 | 177,500 | 1.070 | 10,950 | 188,450 |
| 9 | 1540 | 5852 | 271,348 | 279,700 | 1.031 | 15,400 | 295,100 |
| 10 | 1566 | 5947 | 331,780 | 325,350 | 0.980 | 15,650 | 347,430 |

***Selection of Rock:***

A rigid control was kept of the rock being delivered. Specifications required that the rockfill be composed of strong, durable blocks of basalt. Soft, laminated or weakly-jointed blocks, or rock displaying any tendency to slack in air or water, were not acceptable. No vegetable matter was placed in the rockfill section of the dam. Earth, rocks, spoil and other quarry fines were permitted in the mass in an amount not exceeding that required to fill the voids in the coarser materials, except that quantity in any one truck load was not to exceed 15 per cent by volume of the total load.

A staff of competent inspectors saw that these specifications were maintained. Any unacceptable loads of rock loaded by the shovels were despatched by signal from these inspectors to a waste-rock dump in front of the quarry. Acceptable loads were signalled by inspectors to proceed to the dam site.

***Downstream Filter Material:***

Material for the downstream filters was obtained from gravel pits in the low-lying hills in the immediate vicinity of the dam. While several pits proved to have suitable pervious gravel, most of the material came from one pit only. The gravel was screened into three grades and stockpiled. The grades consisted of sand of 0 to ¾ inches; gravel of ¾ to 3 inches; gravel, 3 to 10 inches; and crushed basalt rock from the quarry of 3 to 10 inches. Due to the shortage of 3- to 10-inch gravel in the gravel pits, it was necessary to crush and screen 115,650 cu. yd. of quarry rock to make up the deficiency.

Besides the rock crushing and screening plant for the production of this graded rock, it was also necessary to set up a second screening plant and screen out gravel for the ¾-3-inch gravel and the 0-¾-inch sand of the downstream filters. Further, the sand filter adjacent to the impervious clay core having to be free of silt, it was necessary to desilt this material. The specifications called for silt content in the finer sands to be not more than 2 per cent.

To obtain clean sand a washing plant of simple hydraulic design was set up, capable of producing 2,400 cu. yd. per hour. The design was adapted from classifier washers used in mineral dressing industry. It comprised a sand tank whose capacity depended upon the quantity of water overflowing at the separating mesh and the dimensions at the overflow level. In theory, for all practical purposes, all water entering can be considered as overflowing vertically, which gives a rising water velocity of $V=Q/A$ where $A$ is the tank cross-section at the overflow level, $Q$ is the volume of water overflowing per unit of time and $V$ is the velocity. The settling velocities of the sands treated were considered as lying in the Newton Range.

Without some means of adjustment of the overflow, the character of the sand from such a tank will vary widely under the fluctuating conditions of the stream flow normally prevailing. This condition was overcome to a certain extent by installing a cross baffle and by adjusting its distance from the overflow lip. Then that part of the tank on the overflow side of the baffle was figured for rising current. The rising velocity for a given water flow increased as the baffle was moved toward the overflow lip. Sensitivity was increased to the point where the fluctuation in the top level of the sand was small. Scour under the baffle entered as an element determining the size of the overflow. The whole became substantially automatic for a given setting of the baffle over a considerable range in feed volume. Adjustment in the depth of the baffle permitted some control of sharpness of separation. The overflow discharge from the tank went to waste and the bottom discharge through air-operated gates was the finished product. The setting of the baffle and the adjustment of the depth of overflow for sharpness of separation was controlled by sampling and screening the product every twenty minutes.

As indicated, the immediate downstream filter beneath the impervious core was made up of natural wash sands and gravels passing a ¾-inch screen and having the below gradation:

| Tyler sieve size | Percentage finer than Upper limit | Lower limit |
|---|---|---|
| ¾″ | 100 | — |
| No. 4 | 83 | 55 |
| No. 8 | 73 | 40 |
| No. 14 | 61 | 27 |
| No. 28 | 48 | 14 |
| No. 48 | 32 | 3 |
| No. 100 | 17 | 0 |
| No. 200 | 0 | — |

The coarse filter supporting the downstream sand filter, as mentioned, was of screened gravel or crushed stone, all graded and within the respective size ranges already specified.

### Impervious Core Material

High grade clay was found in quantity about a mile from the dam site. The whole area was thoroughly drilled, samples taken every 5 feet of depth and tested for standard Proctor density, Atterberg limits, permeability coefficiencies, moisture content and mechanical analyses. Also, a plasticity chart was made of all holes tested. A thorough and complete knowledge of the nature, properties and characteristics of the clay in all sections of the clay pit was therefore established. The material used as the impervious core was maintained by blending and selection within the upper and lower limits by volume given in Table 3.

Prior to the commencement of delivery of the clay core material, two clay test strips were laid down in the clay pit area and varying thicknesses of lift were spread with a varying number of passes by a sheepsfoot roller on these lifts. Field density tests were run on the material, as well as corresponding laboratory density tests. These tests indicated that a 10-inch lift with 16 passes of a sheepsfoot roller at a unit pressure of 1,100 to 1,200 lb. per sq. in. would give satisfactory compaction of the fill.

Areas of the clay pit were then ripped by a caterpillar tractor and rooter to a depth of two and a half feet and water added with a sprinkling truck to the desired amount, so the material was brought very close to the correct moisture content in the pit; any required final adjustment could be made by sprinkling and raking on the main fill itself. A bulldozer-mounted rake with two rows of teeth 18 inches apart and staggered 9 inches apart followed behind the tank truck, raking the clay material. For sprinkling and moisture control in the clay pit, it was divided into four sections of approximately equal area, each section ripped to a depth of two to two and a half feet and then watered by the sprinkling truck. The section was allowed to stand for at least three to four days, after which it was mixed by bulldozers before the material was hauled to the dam site. A close check was kept on the moisture content and the depth of penetration of moisture in each area in order that additional water could be added if necessary. By working areas consecutively, it was always possible to have material available which had been irrigated for the prescribed time. It was found that the material required three to four days for the moisture to penetrate uniformly throughout and thus ensure a satisfactory fill.

All stones in the material large enough to impede the action of sheepsfoot rollers on the fill in the dam were removed by hand. In general, stones left within the impervious section were limited to a maximum dimension of one-half the thickness of the compacted layer, with an absolute maximum of 6 inches in greatest dimension. Moisture content aimed at was 14 per cent. Production from the pit reached a maximum in excess of 6,000 cu. yd. per day.

In order not to interrupt production of the clay pit during freezing weather by the formation of moisture crystals in the clay, the pit was treated and clay was stockpiled with one per cent of salt, in the early fall of 1952. This was estimated to be satisfactory for use down to a temperature of at least 10°F. and perhaps lower.

Investigation, testing, control and inspection of all phases of producing and placing the clay core material was under the direct supervision of Engineering and Construction Services, Ltd., of Edmonton.

#### *Upstream Filter Material*

*Sand Filter:*

As for the downstream filter, the material for the upstream filter was obtained from natural deposits in the vicinity of the dam site. Sand for this filter was produced from the screened material delivered from these deposits to the screening plant. The material passing a ¾-inch screen was used. The silt and clay particles found in the deposits were desirable and therefore no washing of the product from the screening plant was required.

*Pitrun Gravel:*

Pitrun gravel was produced directly from the material found in the natural deposits in the area and loaded and hauled directly to the dam site.

#### *Riprap Upstream Face of Dam*

*Large Run-of-Quarry Rock:*

For the upstream riprap, large boulders produced in the quarry operations were selected and set aside. This large run-of-quarry rock averaged chunks weighing 2,000 lb. or more.

### Placing of Fill Materials

The placing of fill materials commenced May 10, 1952, the first load of rock being dumped in the rockfill section of the dam. The placing of the clay core material and of the downstream filters commenced on June 17 and was completed on October 20. On October 8, the two 110-ton gates in the concrete gate structure at the upstream diversion tunnel portal were dropped and the Nechako River sealed off. On November 28 the placing of a total of

**Table 3: Approximate limits for impervious core**

| | Grain size, mm. | Percentage finer than Upper limit | Lower limit |
|---|---|---|---|
| Clay | 0.005 | 30 | 9 |
| Clay and silt | 0.05 | 54 | 18 |
| Clay, silt and very fine sand | 0.10 | 60 | 21 |
| Clay, silt and fine sand | 0.25 | 70 | 26 |
| Clay, silt and sand | 1.00 | 85 | 35 |
| Sand | 5.00 | 100 | 50 |

4,016,893 cu. yd. of all types of fill material was completed.

***Rockfill Material — Quarry-run rock:***

The placing of quarry-run rock in the dam was accomplished in seven consecutive stages.

This rockfill was placed by dumping from the greatest height practicable. Lifts or stages were advanced in the initial construction of the rockfill from the south abutment to the north and continued thus until El. 2,730 was reached, when filling from both sides toward the centre of the dam was commenced. The top of each lift was maintained approximately level as the lift advanced and was thoroughly roughened to bond with the succeeding lift.

By selection of loads, the massive blocks were placed on the downstream slope of the embankment. As each load was dumped on the fill, its discharge arc was met by the jets of two air-actuated hydraulic giants so that the smaller sizes in the load were thoroughly washed into the interstices of the larger rock, filling voids, crevices, etc. The total quantity of water supplied for this purpose was twice to four times the volume of the rockfill being placed.

It was originally expected that by dumping the fill from the greatest practicable height the best consolidation of the rockfill would occur. At first, heights greater than 40 feet were specified as desirable, but, it was found that compaction and consolidation of the rockfill from a height of over 40 feet was not particularly advantageous, provided ample sluicing water was applied.

Each portion of that lift which lies outside the downstream slope of 1:1.4, beginning at El. 2,785, provides additional weight to resist earthquake shocks and was placed without sluicing water after the completion of the rockfill.

***Downstream Filters:***

The downstream filter zone was placed against the slope of the main rockfill, the material being placed in horizontal layers not more than 12 inches thick and each layer being suitably compacted by crawler tractors before the next was placed. First, the 3 to 10 inch gravel and crushed rockfill was placed. Against this was placed the ¾ to 3 inch gravel, followed by the 0 to ¾ inch washed sand. Each layer was built up and maintained approximately 5 feet above the adjacent upstream layer.

*3-10-inch Filter* — Both screened gravel and crushed stone were used for this layer, gravel below El. 2,650 and crushed rock above this elevation. At El. 2,650 there was a transition zone of approximately 20 feet in height from the gravel to the crushed rock. Thus, they made up separate areas in the filter and were not mixed. The transition between the two materials was made in steps in the 20-foot height.

Fig. 9. Sluicing dumped rock fill.

*¾-3-inch Gravel Filter* — The placing of the ¾-3-inch gravel followed the placing of the 3-10-inch gravel layer. To accomplish thorough compaction within a distance of 100 feet from the ends of this filter layer adjacent to each abutment, a reduction in the thickness of the lifts laid here was made to 10 inches and each lift was thoroughly compacted by caterpillar tractors, or by hand tampers wherever inaccessible to tractors.

*0-¾-inch Washed Sand Filter* — Particular care and attention was given to the placing of this sand filter directly beneath the core, for, should a crack open up in the core in spite of all trimming precautions, the water flowing through the crack would enter the fill. If this filter were absent, or if it were veined by coarse material, the water would gradually erode a tunnel across the earth section. The material of this filter layer had therefore to satisfy the condition that it should be perfectly cohesionless, thus eliminating the possibility of the formation of cracks across the filter layer, and yet be fine enough to retain any solid particles detached from the walls of the cracked core. The material for this filter was closely graded in order to reduce the natural tendency of mixed grain materials to segregate according to grain size during the process of placing and spreading.

Along the contact between this filter and the second filter layer, particles of the filter were washed into the interstices of the second one by jets of water and a transition layer between the two filters was thus formed.

During the process of placing and spreading the sand filter material, definite steps were taken to make sure that no segregation according to particle size took place. The filter was placed in 10-inch lifts and compaction was performed by single caterpillar tractor; the whole filter was adequately moistened, making the resultant sand fill very compressible. Because the high compressibility was associated with excessive strains in the core compaction of the sand filter within a distance of 100 feet from each end, the sand was spread in layers with a thickness of not more than from 4 to 6 inches and compacted as thoroughly as possible. After the fourth layer of sand filter had been placed, a drill rod was driven with a sledge hammer into the fill for a depth of two or three feet and the number of blows per foot of penetration was noted. These represented the yardstick for measuring the degree of compaction; the measurement was repeated for each 4-foot gain in height of the filter bed. Formation of cracks in this sand filter would defeat its purpose. A distinction was therefore made between those parts of the area to be covered by the filter where the filter layer would be only warped and those parts where it would be seriously bent and stretched. The latter were located in the proximity of the contact between the rock and the filter layer, above those lines where the slope angle of the rock surface increased abruptly in a down-hill direction. In these areas, the sand filter zone, whose normal width was 15 feet, was increased to a total of 16 feet and divided into two layers, each 8 feet thick. For the first layer in contact with the impervious clay core, stockpile sand material in its unscreened state was used. The second was composed of that fraction of screened material which was retained on a 4-mesh screen. Along the contact between the rock and the sand filter the material was hand-tamped. These sections were nicknamed "ball-bearing joints".

*Impervious Rolled Clay Fill:*

After the downstream filter zones were placed to approximately the same elevation for the full length of the dam, the construction of the impervious core or rolled clay fill, which acts like a rubber skin, not failing unless excessively stretched, was started, using equipment and methods standard for rolled earth embankments.

Successive loads of clay were deposited in rows adjacent to one another and approximately parallel to the axis of the dam, the material thoroughly blended in the process of spreading by first being worked over by scraper equipment and then further run out by caterpillar tractors and bulldozers. The fill adjacent to the abutments was built up so that it continued to the top simultaneously with the main body of the clay fill.

The material in the main section of the fill was spread over the embankment in layers from 8 to 10 inches thick, that adjacent to the abutment was spread in layers with an average thickness of at least 2 to 3 inches. Heavy loads were not allowed to track each other on top of the embankment, nor was any unnecessary concentration of travel tending to cause deep ruts, laminations or uneven compaction within the fill allowed. Before spreading any layer, all ruts or unevenness in the existing surface were smoothed out. Before placing each lift the surface was scarified and sprinkled, if necessary, before more material was placed. All oversize rocks were removed from the material. These included any rocks too large to go between the teeth of the sheepsfoot roller and any rock which caused the roller to bump in passing.

The moisture content of the material was kept slightly below, or at, optimum moisture content, varying between 12 and 14 per cent. Methods of transportation which permitted excessive evaporation or change in the moisture content of the material being delivered were not permitted. To maintain uniform moisture content and material of the desired quality, hauling equipment was scheduled so that a uniform rate of delivery of material was maintained.

For compaction, rollers of the sheepsfoot type were drawn by tractors; 16 to 20 passes of the roller at a unit pressure of 1,100 to 1,200 pounds per square inch were made. The roller was not allowed to walk out completely. Approximately 3 to 4 inches of loose material was left on the surface when compaction was correct. Each roller had two drums mounted in tandem, permitting turning on a small radius, and was capable of being propelled in either direction. The teeth of the roller were maintained at least 7 inches long over all and were fitted with hard steel diamond points. Any teeth having a penetrating area of less than 5 square inches each were replaced or were built up by welding. Each drum on the rollers was equipped with cleaner bars. The normal rate of travel was approximately two and a half miles an hour.

Rolling was done in a direction parallel to the centre line of the embankment material and no dumping was allowed in areas where rollers and spreaders were operating. All rollers working in any one area followed the same route. Roller paths overlapped approximately the half width of a roller.

Compaction in the areas of the clay fill adjacent to the abutments and extending from the abutments out into the fill a distance of approximately three feet, as well as in areas inaccessible to the sheepsfoot rollers, was performed by pneumatic tampers. Every precaution was taken to ensure a tight contact of the impervious fill material between the rock and the impervious layer.

Clay processed with one per cent of salt was used above El. 2,809 at each abutment and above El. 2,812 in the centre of the core. This processed clay helped protect the top layer of the core from any frost action in its adjustment to conditions immediately after construction and during the first winter season.

The materials furnished for and the work done on the impervious clay core to meet specifications were subject to rigid inspection. Inspectors on each shift saw that the rollers made the required number of passes on each lift, counting the number of passes in each case and seeing that none of the rollers became dirt-clogged.

On each shift density and moisture tests were taken for at least every 2,000 cu. yd. of fill material placed, as well as in areas where the degree of compaction was doubtful, such as at the junction between mechanical tamping and rolled compaction, in areas where the rollers turned, where too thick a lift was being compacted, where it was suspected that less than the specified number

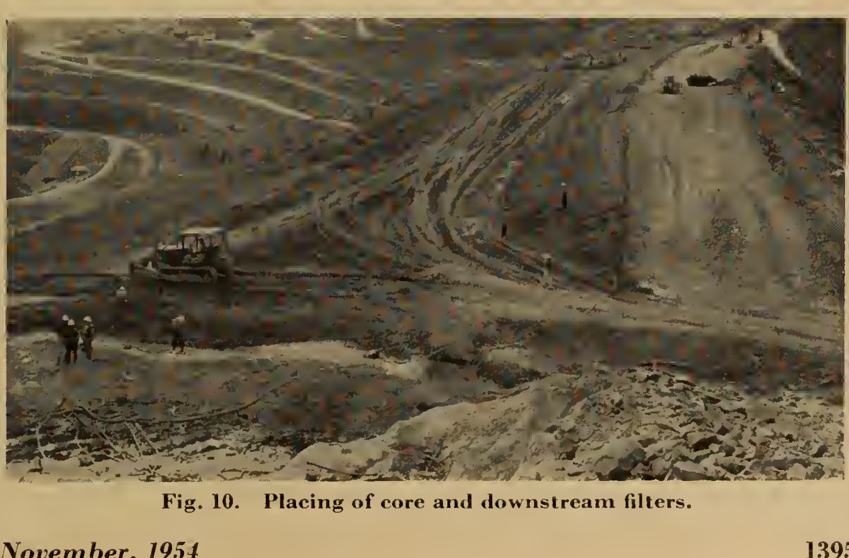

**Fig. 10. Placing of core and downstream filters.**

**Fig. 11. Dam approaching full height.**

of passes were made, where oversize rock which had been overlooked was contained in the fill, where material containing minor amounts of frost had been placed or material placed near freezing temperatures, and in areas containing materials differing substantially from the average or specifications. The inspector in charge of each shift turned in a complete report of activities on that shift, including depth of material placed, the section of the clay pit from which the material was hauled, tests run and the location of the tests. The location of the tests was given on a grid system and the elevation of the tests recorded. Further, the inspectors saw that the material used in the hand tamping operations was free of all rocks down to 2 inches in diameter. Density tests in such areas were performed with a rod having an end area of half a square inch, forced into the soil to get an idea whether it was properly compacted and whether the density was uniform.

The standard Proctor method of soil compaction governed the construction of the core, which included tests for:

- Optimum moisture content.
- Unit dry weight of soil in the embankment.
- Plasticity.
- Permeability coefficient.
- Strength at saturation.

The average dry density of the compacted core was maintained at better than 95 per cent of the standard Proctor density obtained in the laboratory.

In the placing of a total of 514,671 cu. yd. of compacted clay in the impervious core, 541 field density tests, with comparative laboratory tests, were taken as placing progressed. In addition to these tests, 29 test pits were dug between Els. 2,551 and 2,820 and density tests taken in each pit at one-foot intervals to a depth of 8 feet. The test pits served as an additional check on the daily density tests and established if the material had been laid down in too thick layers, if large rocks had been overlooked, if material had been placed at incorrect moisture content or if any stratification was present in the fill. Moisture was checked closely during the entire job and in general was held within two per cent of the desired optimum moisture content.

***Upstream Filters:***

*Sand* — The upstream sand filter was placed in 12 to 24-inch layers, moistened and rolled in the same manner as the downstream filter sand, following the impervious layer as closely as was practical.

*Pitrun Gravel — Quarry-waste Rock* — The upstream random fill, composed of pitrun gravel and quarry waste rock, was placed on top of the upstream sand filter in horizontal layers not greater than 3 feet in thickness and in such a fashion that the upstream sand filter was not disturbed. The permeability of the quarry waste was lower than that of the sand. Therefore, in the event of a drawdown, the descent of the water table in the sand layer or upstream sand filter may lag behind that of the water level in the reservoir. In order to eliminate this possibility by making a permeable fill, the quarry-waste fill located above El. 2,750 was made of material which did not contain more than a trace of particles of sand and silt. As a further precaution, inserted in the quarry-waste fill below El. 2,750, a few layers of pitrun gravel with a thickness of about 3 feet each and spaced approximately 50 feet apart vertically served as weep-holes.

*Riprap* — Quarry run rock was placed on the pitrun gravel and quarry waste fill to riprap all the face of the dam which would be exposed to wave action and erosion from surface drainage during the period of filling to full reservoir and thereafter.

Large, clean chunks of basalt were used for this material, end-dumped from trucks down the face and sloped off to 2.5:1. The top of the dam was capped with this material as well as the upstream face and so was the downstream face to the first berm. To make a 40-foot roadway across the top of the dam, crushed rock was applied over the quarry run material. For fencing the roadway, boulders of the largest size were spaced at intervals of approximately 8 to 10 feet on both sides of it.

#### Settlement and Deflection

For settlement and deflection measurements on the crest of the dam, 13 stations were installed beneath its crest. Settlement and deflection plates were combined and were placed in the top of the clay fill approximately 5 feet below the crest of the dam.

Settlement and deflection plates were also placed in the berm at El. 2,785.0 about three feet below this level in the top of the sluiced rockfill to indicate the rockfill settlement separately.

Tables 4 and 5 record the movement measured from December, 1952, to July, 1954.

#### Tunnel Plug

To seal the diversion tunnel, a 60-foot thick concrete plug was poured into the tunnel, having a 10-foot hexagonal chamber with a 5- x 7-foot connecting passageway for final grouting operations around the plug, 25 feet from its downstream face.

This plug was allowed to set a minimum of 28 days before grouting started. Grouting sequence followed and pressures reached were first, the upstream sealing risers at 30 lb. per sq. in.; second, the downstream sealing risers at the same pressure; and, third, sealing the drain used during construction through the plug at 60 pounds per square inch.

Adequate time was allowed for the grout to set between operations and grout and vent lines not in use were kept open by the circulation of water at low pressure during grouting operations. Finally ring grouting was performed to connect with the main grout curtain of the dam.

A 5- x 7-foot steel door with No. 5 round bars, spaced at 8½-inch centres horizontally and vertically, was placed at the entrance of the connecting passageway to the grout chamber to prevent access from outside. All diamond drill cores obtained during the original investigation of the dam site and during construction were saved for posterity by storing them in the grout chamber. The downstream portal of the tunnel was sealed with earth fill.

**Table 4: Movement in feet at crest from December, 1952.**

| Stations | June, 1953 | | November, 1953 | | | July, 1954 | | |
|---|---|---|---|---|---|---|---|---|
| | Vertical | Down-stream | Vertical | Down-stream | To left bank | Vertical | Down-stream | To left bank |
| 33 + 50 | 0.07 | 0.01 | 0.09 | 0.06 | 0.01 | 0.11 | 0.02 | 0.04 |
| 34 + 50 | 0.19 | −0.03 | 0.28 | 0.10 | 0.16 | 0.33 | 0.18 | 0.20 |
| 35 + 50 | 0.29 | 0.18 | 0.51 | 0.36 | 0.20 | 0.58 | 0.33 | 0.24 |
| 36 + 50 | 0.42 | 0.25 | 0.73 | 0.43 | 0.31 | 0.83 | 0.44 | 0.29 |
| 37 + 50 | 0.77 | 0.39 | 0.92 | 0.58 | 0.23 | 1.03 | 0.72 | 0.04 |
| 38 + 50 | 0.84 | 0.36 | 1.07 | 0.81 | 0.16 | 1.20 | 0.79 | 0.16 |
| 39 + 50 | 0.59 | 0.49 | 1.10 | 0.85 | 0.06 | 1.23 | 0.83 | 0.09 |
| 40 + 50 | 0.58 | 0.39 | 1.05 | 0.69 | −0.07 | 1.18 | 0.73 | 0.00 |
| 41 + 50 | 0.46 | 0.30 | 0.86 | 0.62 | −0.09 | 0.98 | 0.62 | −0.04 |
| 42 + 50 | Damaged | | | | | | | |
| 43 + 50 | 0.31 | 0.24 | 0.55 | 0.41 | −0.13 | 0.62 | 0.34 | −0.04 |
| 44 + 50 | 0.21 | 0.10 | 0.33 | 0.31 | −0.08 | 0.33 | 0.19 | −0.03 |
| 45 + 50 | 0.15 | 0.01 | 0.19 | 0.20 | −0.08 | 0.23 | 0.11 | 0.02 |

All vertical movements are downward. Lake elevation: Dec. 1952: 2,658; June 1953: 2,694: Nov. 1953: 2,715: July 1954: 2,744.

**Table 5: Total movement at top of sluiced rock fill from December, 1952.**

| Stations | June, 1953 | | November, 1953 | | | July, 1954 | |
|---|---|---|---|---|---|---|---|
| | Vertical | Down-stream | Vertical | Down-stream | To left bank | Vertical | Down-stream |
| 34 + 50 | 0.12 | −0.27 | 0.20 | −0.49 | 0.63 | 0.25 | −0.28 |
| 35 + 50 | 0.24 | 0.17 | 0.47 | 0.22 | 0.59 | 0.55 | 0.86 |
| 36 + 50 | 0.32 | 0.15 | 0.66 | 0.35 | 0.49 | 0.76 | 0.36 |
| 37 + 50 | 0.43 | 0.21 | 0.88 | 0.55 | 0.45 | 1.00 | 0.68 |
| 38 + 50 | 0.55 | 0.39 | 1.07 | 0.67 | 0.39 | 1.22 | 0.75 |
| 39 + 50 | 0.64 | 0.27 | 1.12 | 0.55 | 0.26 | 1.26 | 0.56 |
| 40 + 50 | 0.47 | 0.22 | 1.01 | 0.63 | 0.19 | 1.13 | 0.55 |
| 41 + 50 | 0.40 | 0.28 | 0.84 | 0.57 | 0.12 | 0.96 | 0.54 |
| 42 + 50 | 0.33 | 0.22 | 0.70 | 0.46 | 0.08 | 0.77 | 0.48 |
| 43 + 50 | 0.30 | 0.18 | 0.53 | 0.38 | 0.03 | 0.61 | 0.38 |
| 44 + 50 | 0.18 | 0.14 | 0.30 | 0.20 | 0.09 | 0.36 | 0.32 |

### Conclusion

The Kenney dam is unique. With the grout curtain, one might think of it as a rockfill dam above a concrete one. Although no new methods of construction were employed, the speed of its construction might alone be called unique.

Beyond the actual quantities in the dam, millions of yards of material of all types were moved in preparation for construction and in the winning of the materials required. The total yardage moved of all classes, in 12-yard dump trucks, lined up bumper to bumper, would make a line reaching across Canada from Vancouver nearly to Halifax.

To accomplish the moving of this vast quantity of materials, the total bulk of petroleum products used was approximately 4,200,000 gallons.

The job involved flying nearly three-quarters of a million air miles with personnel and stores. Food supplies and other materials brought in by road and rail from all parts of Canada and the United States, added to local purchases, weighed approximately half a million tons.

And, finally, with the rising reservoir, there has been harvested an amount of water equivalent to no less than 359,000,000,000 8-ounce beer glasses! This formerly wasted water is now, thanks to the Kenney dam, available for useful services. √

**Fig. 12. Dam after closure of diversion tunnel, berms incomplete.**

# Kemano, Underground

*by*
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The tunnel and powerhouse construction at Kemano was not only a big job in its own right, but was made more difficult by inaccessibility and rugged terrain. Careful planning, however, assured its completion on schedule; not only that, but some progress records were made. This paper describes in considerable detail just how the work was organized and carried out to accomplish these happy results, largely by the free use of the best available equipment. This job will long remain as an example of what can be done when there is sufficient urge.

The Kemano powerhouse is supplied with water through a conduit system completely underground from the reservoir intake at the east end of the project, through the tailrace tunnel which discharges into a short canal to the Kemano River. This article will deal with the underground excavation, the construction of the conduit system and the installation of conduit equipment.

### Intake

A concrete intake is built at the west end of Tahtsa Lake with its sill at El. 2,725, seventy-five feet below the normal reservoir level and controlled by vertical lift roller gates. This structure was built inside a cofferdam unwatered by well points. The downstream side of the structure connects to the main tunnels through cut and cover transition sections. The structure is completed for two tunnels although only one tunnel is included in the initial development.

F. T. Matthias

### Pressure Conduits

The 10-mile main tunnel drops on a uniform grade to El. 2,595 at the west end. Still deep in rock at this end, the tunnel separates through a steel wye embedded in concrete into two main penstock branches. A full description of the penstock system is included in the paper by W. G. Huber in this series.

The penstock system terminates in a valve chamber which houses a valve for each unit. There are now four 54-inch spherical valves in place, one being for a future unit. At the powerhouse each of the three penstock branches that have been installed terminates at the scroll case of an impulse turbine. The fourth branch terminates just below its spherical valve. The total length of pressure conduit from the reservoir to a case is nearly 58,000 feet.

The ultimate installation contemplates a duplicate tunnel with a duplicate system of penstocks and branches to supply an ultimate of 16 units at the powerhouse.

### Access Adits to Pressure Conduits

Three adits, totalling about 3,100 feet in length, gave access to the four headings that were driven in the main tunnel. One was at the intake site, where the access adit sloped down from the natural lake level of about El. 2,787 to the tunnel invert level of about El. 2,723. It intersected the main tunnel at a flat angle about 1,000 feet from the intake. An adit at Horetzky Creek, near the centre of the tunnel, was driven on an almost level grade to develop east and west headings. At the west end of the tunnel, 2,400 feet above the level of the main construction camp at the foot of the mountain, an adit was driven along the main tunnel line to develop the excavation heading towards the east. Branches from this adit diverged to reach the penstock lines and to give access for excavation of the horizontal penstock runs at El. 2,600.

At El. 1,600 another adit 1,343 feet long was driven into the mountain and branched out to reach the two penstock lines. The horizontal runs at that elevation and the inclined sections above were excavated through that adit.

Excavation of the lower penstock branches, of the horizontal runs of the main penstocks and of the inclined sections was done through the powerhouse, where the permanent tailrace and access tunnels were driven early for construction access and transportation.

### Valve Chamber

To house spherical valves, excavation developed a chamber with a

25-foot diameter arch. The section occupied by valves was 37 feet high to arch concrete and 22 feet high in the section opposite the powerhouse service bay. From the north end of the valve chamber a drainage tunnel, 17-foot diameter arch and 22 feet high, was driven around the north end of the powerhouse to connect to the tailrace. This tunnel carries normal drainage from the chamber. It provides a means for carrying away large amounts of water in case of penstock or valve failure, which otherwise might flow into the powerhouse. Unit 5 penstock tunnel was excavated between the valve chamber and the power chamber to a section of 24-foot diameter arch and 25 feet high to provide clearance to move the penstock wyes into position. In addition, a permanent access tunnel was driven between the service bay in the power chamber and the valve chamber, for transportation of valves and heavy parts.

### Power Chamber

The power chamber, 1,400 feet deep inside the mountain, required an excavation 80 feet wide, 120 feet high to the top of the parabolic arch and 700 feet long. This provides space for eight turbine generator units at the north end, an erection and service bay in what will be the centre of the ultimate powerhouse and a clearance space in Unit 9 position at the south end. At the west side of the chamber are galleries for house services, high voltage oil insulated conductors and control conduits and vaults for the 12 high voltage transformers and spares that can step up the generator voltage to 300,000 volts. To carry the high voltage cable runs to the outdoor switch station, a cable tunnel was driven 1,436 feet, with 18-foot diameter arch and 13 feet 6 inches high. The permanent powerhouse access tunnel enters the power chamber at El. 247 at the top floor of the machine room. This will serve the ultimate powerhouse. It also serves as a ventilation tunnel carrying fresh air into the chamber. This tunnel is 1,346 feet long, has an arch diameter of 27 feet and is 27 feet high, to give clearance to carry future units, penstock wyes, transformers and other large pieces into the powerhouse and under powerhouse cranes. From the spring line of the arch, a ventilation exhaust tunnel runs almost horizontally for 1,380 feet to the face of the mountain and is 6 feet wide by 8 feet high.

### Tailrace Tunnels

From the eight turbine pits in the powerhouse, tailrace tunnel branches 16 feet wide by 21 feet high and aggregating 1,250 feet in length, join a common tailrace tunnel, 27 feet wide by 37 feet high, that carries the discharge water 1,400 feet to the face of the mountain, discharging into an open canal to the Kemano River. The upper 27 feet of this tunnel, together with an enlargement of No. 4 tailrace branch, was driven early in the program and formed the major access and transportation route for power chamber, valve chamber and penstock work. The tailrace tunnels now driven will be duplicated when the power chamber is extended to house the future eight units.

### Tunnels

Between Kemano and Tahtsa, the oldest rocks probably belong to the Hazelton group of Jurassic age and are separable into two divisions: a bedded complex of greenstone, schist, quartzite and amphibolite, and an unbedded complex of diorite and greenstone. The latter complex is intruded near Siffleur Lake by a coarse pink granite, which itself is shot through by trap dykes that in some places are quite extensive.


**Fig. 13. General perspective of tunnels and powerhouse.**


Fig. 14. Surface geology.

All the above rocks are intruded by a narrow, easterly-trending tongue of the Coast Range intrusives, consisting of medium- to coarse-grained granodiorite and quartz diorite, with hornblende and biotite as the principal mafic minerals. The granodiorites are faulted in many places and are cut by numerous dykes of pegmatite, aplite, lamprophyre and trap. Along the faults and numerous sets of joints, alteration and oxidation has occurred. At the Kemano end of the tunnel, the Coast Range intrusion is fairly wide, with no signs of major faulting movement inside the tunnel. The easterly-trending intrusive narrows to less than a mile in width at Horetzky. About two miles east of Siffleur Lake and to the north of the tunnel it apparently pinches out altogether.

#### Powerhouse

The rock surrounding the powerhouse is granodiorite containing many small feldspar, aplite, lamprophyre and diorite dikes. The granodiorite body is part of the Coast Range batholith. A shear zone, containing from three to six feet of oxidized gouge, dipping 40°—43° east, running parallel to the powerhouse centre line and roughly 200 feet east of the wall neat line at El. 205, passes over the powerhouse about 50 feet above the arch. A smaller parallel fault on the centre line at El. 290, dipping 75° east, probably intersected the shear zone about 28 feet west of the centre line and 75 feet above the arch. Secondary fracturing ran parallel to these two dominant faults. Two other faults, striking at right angles to the centre line, dipping 80° south, cut the powerhouse on the northern limit and also through the service bay. The faulting and resulting fracture pattern tended to make the east side of the arch and the west vertical walls weak.

#### General Program

Work on the project started in the spring of 1951, with a completion objective of middle 1954. Planning, mobilization of men and equipment and execution of the volume of underground work to be done in that time was a tough and demanding program under good conditions. In the rugged mountain wilds of British Columbia, with no local population from which to draw workers, no roads nor railroads close to any working point, with heavy snows and with a mile-high inaccessible mountain pass separating the work east and west of the Coast Range, the difficulties were multiplied many times. Access and logistics were major problems, expensive and time-consuming, that demanded management attention and organization far in excess of that normally necessary. Limitations of time dictated full-scale attack on the work at all points at the earliest possible dates.

#### Excavation

Table 1 summarizes the quantity of underground excavation work involved and the construction period devoted to each item of permanent work.

#### Concrete

Concrete work required was no less demanding with limited time available. The main tunnel invert was concrete full length and concrete lining was placed in the 15,422 feet that required steel supports during driving, or was unreliable. The equivalent of about 20,000 feet of tunnel received gunite to protect against unravelling of the live, but broken, rock which contained fine seams filled with clay or with decomposed rock. The rest of the 53,040 feet of tunnel was left without lining, but some permanent rock bolting was done to tie exposed blocky, but sound, rock deep into the walls and arch of the tunnel.

In the power chamber, excavation disclosed joint systems that indicated potential weaknesses in the walls and arch. The arch was of reinforced concrete cast against the rock and supported by deep concrete haunches heavily dowelled into the rock walls. Large sections

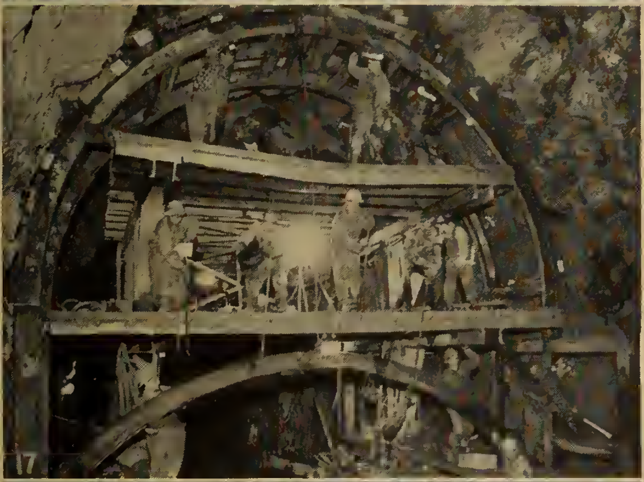


Fig. 15. Three-deck drill jumbo, with platform folded to allow passage of muck cars, doubles as a "cherry picker" car hoist for moving empties over the train to serve the muck loader.

Fig. 16. Drilling at the Tahtsa heading was by Swedish type light drills with "jack leg" pneumatic feeders.

Fig. 17. The Tahtsa heading hit a higher percentage of weak rock than the other three and erection of steel ribs developed into an efficient, systematic operation.

Fig. 18. Electric driven muckers with separate motor drives for belt conveyer and loader did all of the tunnel rock loading.

Fig. 19. Concrete was hauled into the tunnel on railroad cars.

Fig. 20. Dumping of railroad muck cars was done by an elevated outside rail.

Fig. 21. Deep in the tunnel an electric driven booster fan helps keep the air clean.

**Table 1—Summary of Underground Excavation at Kemano**

| ITEM | Excavation Section | | | Total Length (linear feet) | Total Volume (cubic yards) | Construction Operation | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dia. (feet) | Width (feet) | Height (feet) | | | 1951 | | | 1952 | | | | 1953 | | | | 1954 | |
| | | | | | | Apr. | July | Oct. | Jan. | Apr. | July | Oct. | Jan. | Apr. | July | Oct. | Jan. | Apr. |
| Adits — main tunnel: | | | | | | | | | | | | | | | | | | |
| Tahtsa — (East) | | 17 | 17 | 1,078 | 19,895 | | | — | — | — | | | | | | | | |
| Horetzky — (Middle) | 25 | (1) | (2) 25 | 1,570 | 38,944 | | | — | — | — | | | | | | | | |
| Kemano — (West) | 25 | (1) | (2) 25 | 449 | 9,789 | | | | — | — | | | | | | | | |
| Water Tunnels — conduits: | | | | | | | | | | | | | | | | | | |
| | 25 | (1) | (2) 25 | | | | | | | | | | | | | | | |
| Main tunnel (1) | 22 | 55 | (3) 25 | 53,061 | 1,178,557 | | | | | — | — | — | — | — | — | — | | |
| | 22 | 55 | (2) 25 | | | | | | | | | | | | | | | |
| | 20 | (1) | (2) 20 | | | | | | | | | | | | | | | |
| Surge shaft | | | | 372 | 10,179 | | | | | | | — | — | — | — | — | — | |
| Penstocks (2) | 15 | | | | | | | | | | | | | | | | | |
| Butterfly valve chamb. (2) | 23 | (1) | 37 | 92 | 2,707 | | | | | | | | — | — | — | | | |
| Entry tunnels to B. valve chambers (2) | 15 | (1) | 15 | 103 | 1,019 | | | | | | | | — | — | | | | |
| Horiz. at El. 2,595 | 15 | | | 484 | 4,275 | | | | | — | — | — | — | — | — | — | | |
| Adit at El. 1,600 | 14 | (1) | 16 | 1,393 | 11,299 | | | | — | — | | | | | | | | |
| Inclin. to El. 2,595 | 15 | | | 2,450 | 24,181 | | | | | — | — | — | — | — | — | — | | |
| Horiz. at El. 1,600 | 15 | | | 1,343 | 11,487 | | | | — | — | | | | | | | | |
| Inclin. to El. 1,600 | 15 | | | 3,962 | 24,189 | | | | | — | — | — | — | — | — | — | | |
| Horiz. to power house | 15 | | | 620 | 4,284 | | | | — | | | | | | | | | |
| Manifold branches | 9 | | | 1,076 | 8,071 | | | | — | — | — | — | — | — | — | — | | |
| Spher. valve chamber | 23 | (1) | 37 & 23 | 643 | 20,948 | | | | | | — | — | — | — | — | — | | |
| Access tunnel to spher. valve chamber | 16 | (1) | 16 | 101 | 1,329 | | | | | | | — | | | | | | |
| Penstock branches (8) | 9 | | | 824 | 6,056 | | | | — | — | — | — | — | — | — | | | |
| Tailrace branches (8) | 13 | (1) | 21 | 1,245 | 23,202 | | | | | — | — | — | — | — | — | — | | |
| Tailrace tunnel (1) | 27 | (1) | 37 | 1,407 | 55,062 | | — | — | — | — | — | — | — | — | — | — | | |
| Emergency exit tunnel from spher. valve chamber | 6 | (1) | 9 | 101 | 228 | | | | | | | | | — | — | | | |
| Drainage tunnel | 17 | (1) | 22 | 373 | 5,668 | | | | | — | — | — | | | | | | |
| Power House | | 80 | 120 | 700 | 277,900 | | | — | — | — | — | — | — | — | | | | |
| Permanent access | 27 | (1) | 27 | 1,348 | 36,897 | | | — | — | — | — | — | — | — | | | | |
| Ventilation tunnel | 6 | 8 | | 1,403 | 4,226 | | — | — | | | | | | | | | | |
| Cable tunnel | 18 | (1) | 13.5 | 1,436 | 12,826 | | | | | | — | — | — | | | | | |
| Totals | | | | 77,634 | 1,793,218 | | | | | | | | | | | | | |

(1) arch; (2) horseshoe; (3) straight sides.

of the high walls were protected by 45,600 feet of permanent rock bolts, 20 to 40 feet long, anchor wedged deep into the rock. They were designed to hold rock strata in tight contact to prevent movement along shear planes, rather than to resist movement by the shear strength of the bolt. In other sections, concrete was placed to support weak rock. During excavation and concreting 3,763 temporary rock bolts were placed in the powerhouse walls and arch.

Structural concrete in the power chamber carried overhead crane rails on concrete columns from the floor and supported the system of galleries and floors. Prepakt concrete was used for turbine pit-liners and scroll case encasements. Prepakt concrete was also used for nearly all of the embedding and backfill for the penstocks. Table 2 gives the volume of concrete placed underground, including the intake structure.

### Temporary Facilities

The underground work west of the Coast Range had to depend largely on water and plane service for transportation. East of the mountains, air and a combination of truck, rail and barge services handled transportation needs. In both cases roads had to be built to reach into the job areas.

### Access

To serve the east tunnel heading work at the west end of Tahtsa Lake, a road was pushed through in 1951 from Burns Lake on the Canadian National Railways to the east end of Tahtsa Lake, a distance of 105 miles, much of it in difficult

**Table 2: Volume of Concrete Placed Underground**

| Item | Concrete, Cu. yd. | Gunite Cu. ft. |
|---|---|---|
| Intake structure and transition to Tunnel No. 1 | 5,977 | — |
| Transition to future tunnel No. 2 and 165 ft. of Tunnel No. 2 | 3,589 | — |
| Tunnel adits and plugs | 1,673 | 8,883 |
| Main tunnel invert, full length | 34,430 | — |
| Main tunnel arch and walls | 73,044 | 226,320 |
| Surge shaft and butterfly valve chambers | 4,448 | — |
| Penstocks | 37,132 | — |
| Spherical valve chamber | 9,149 | — |
| Tailrace tunnels | 5,080 | — |
| Power chamber | 54,092 | 250 |
| Permanent access tunnel and portal structure | 8,920 | 25,537 |
| Totals | 237,534 | 260,990 |



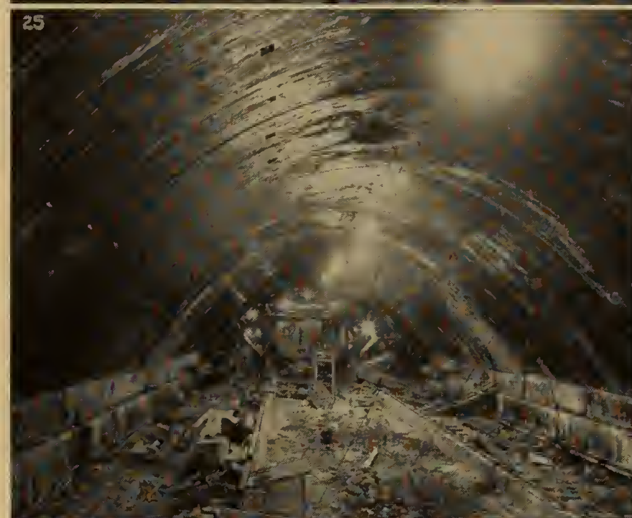





**Fig. 22.** Timbers hung from "bull horn" steel bars carry the walkway and skip for serving the pilot tunnel of the inclined shaft.

**Fig. 23.** The upper half of the pilot tunnel that was "raised" as the first step in excavating the inclined penstock.

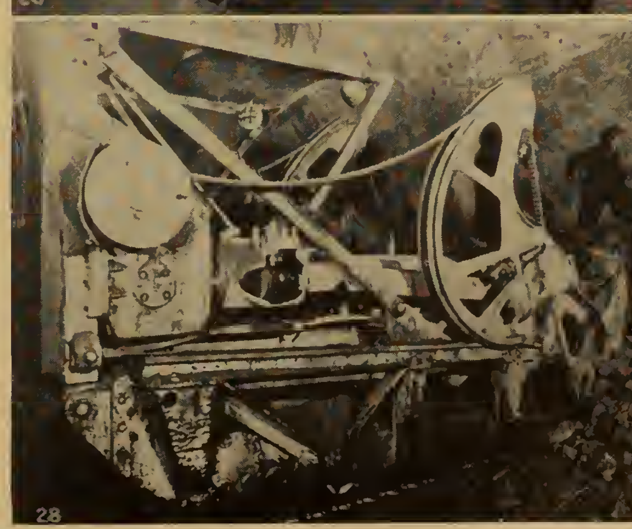
**Fig. 24.** Diamond drill holes from the vertical slots of the power chamber were drilled horizontally 55 feet in each direction.

**Fig. 25.** Power chamber arch concrete was pumped behind a full 80 ft. wide jumbo.

**Fig. 26.** Following arch concrete the diamond drillers put down the 80 ft. long vertical holes for blasting out the main body of the power chamber.

**Fig. 27.** One of the job improvised rigs was this air slusher hoist which dragged shot rock from the penstock branches into the open chamber.

**Fig. 28.** The crawler mounted overhead loader proved its worth in production loading from small drifts and corners.

topography. A diesel engine, outboard propeller barge handled the service down the 18-mile lake to the west end.

For the west side, a road from tidewater through heavy timber to the main camp near the powerhouse was built. This 12-mile road was raised from the Kemano River flats, largely muskeg, by gravel fill, some of it on buried log mats. It is a permanent facility serving the powerhouse area, but had to be built to reach the main camp and the site of the first underground work on the west side of the mountains. Construction of a 25-ton tramway was pushed up the mountain slope to serve the penstock heading at the 1,600-foot level and the main tunnel heading at the 2,600-foot level and to supply the camps built at both points. From the main camp near the powerhouse, a 7-mile road was built up the rugged Horetzky valley, rising to about El. 2,675, to serve the two centre headings and the camp at the Horetzky adit.

### Camps

The main camp at Kemano, Camp No. 5, was built near the powerhouse area and housed 2,450 single employees and 44 families. It included a school, a commissary, a theatre, a recreation building, a reconstituted milk plant, a bakery, a laundry, guest houses, a bank and a post office. The mess hall at that camp could seat 800 and fed three shifts per meal at the peak of camp occupancy. Barracks, offices and many of the family houses were Quonset huts at this camp.

A camp at the tidewater dock, consisting of barracks and mess hall, took care of the men who handled the dock work and adjacent open storage area. It could accommodate 60 employees. Between the dock and Camp 5 and about two miles from Camp 5, a trailer camp for privately-owned trailers and a group of 40 small prefabricated plywood houses took care of most of the families. At peak it housed about 250 families. It contained a commissary, a school and recreational facilities. Frequent bus service connected the beach, the family camp and Camp 5.

The 1,600-foot elevation and the 2,600-foot elevation camps were barracks camps, accommodating 120 and 310 employees, respectively. Starting largely as tent camps hugging on the mountainside, they developed into camps of winterized light frame buildings with aluminum roofs, generally about the size of tents.

The Horetzky Creek camp accommodations included 500 single quarters and 9 family houses, most of them Quonset huts. The West Tahtsa camp provided space for 520 single employees and 44 families. East Tahtsa, at the end of the road, housed 24 employees.

### Construction Plant and Equipment

With underground work in progress simultaneously from four locations on the west side and one on the east side of the mountains and with no ground transportation contact across the mountains, extensive construction plant facilities were required. At the main camp at Kemano plant facilities were provided to serve the general area and outlying activities as far as practicable. West Tahtsa on the east side, of necessity provided complete plant facilities, as it was too removed to get help from any other camp. The Horetzky Creek adit operations depended for major repairs and machine shop work on Camp 5, as did the 2,600-foot and 1,600-foot elevation operations.

### Camp Facilities

Camp 5 at Kemano, in the powerhouse area, served the largest concentration of work and had the most complete construction plant facilities.

### Concrete

Concrete aggregates were of natural sand and gravel, obtained from the bed and banks of the Kemano River near the mixing plant and only a few hundred feet from the powerhouse access tunnels. Aggregates were screened through portable plants and stock-piled over a reclaiming belt that delivered sized materials into the elevated mixing plant bins. Automatic batchers delivered to the two two-cubic-yard mixers or dry batches to batch trucks below.

Most of the concrete for the powerhouse level work was hauled into the working area and most of it was placed by Pumpcrete machines. About 75,000 cu. yd. of mixed concrete were produced and handled in this manner. Nearly all penstock concrete and the concrete around the turbine pits and scroll cases was placed by first placing dry aggregates minus sand, then cement grout and fine sand were pumped into the aggregate. Nearly 40,000 cu. yd. of concrete was of this type. Some of the horizontal penstock runs at the 2,600-foot and 1,600-foot levels, as well as the plugs at the adit tunnels and the surge shaft concrete, were batched and mixed by portable units near the point of use. About 119,000 cu. yd. of concrete for the underground work was produced or batched or aggregates supplied from the Camp 5 camp facilities. About 29,000 cu. ft. of permanent gunite was also placed from Camp 5.

At Horetzky Creek, a similar mixing plant produced most of the tunnel concrete. About two miles of the east end of the tunnel was concreted from the West Tahtsa end. Coarse aggregates were produced by crushing tunnel spoil and sand was hauled from Camp 5 up the steep grades that aggregated a 2,400-foot rise in seven miles. About two-thirds of the tunnel gunite work was done from Horetzky; sand for this work was hauled from Kemano. The total concrete mixed and placed from Horetzky was about 90,000 cu. yd. The major part of the tunnel gunite was placed from Horetzky, about 154,000 cu. ft.

West Tahtsa produced concrete aggregates from gravel bars in the deltas of streams discharging to Tahtsa Lake. Part of the aggregate was crushed to balance sizes, but it was mostly natural. Aggregates were hauled by barge (maximum haul 4 miles) and screened through a portable plant. Batching was done by a portable batch plant and concrete mixing by a one-cubic-yard portable mixer. About 29,000 cu. yd. of concrete was produced and about 78,000 cu. ft. of gunite.

No provisions for aggregate production were made in the 1,600- or 2,600-foot areas. Small amounts of concrete were mixed at these points, mostly by truck mounted, dual drum, half-yard paving mixers.

Other plant facilities were provided as shown in Table 3.

### Construction Equipment

Construction equipment was exchanged freely among the four work areas west of the mountains, but no interchange of heavy equipment was practical between West Tahtsa and the other areas. Movements from West Tahtsa would have involved 18 miles by barge, 120 miles by road, about 250 miles by railway to Prince Rupert, 100 miles by salt water and 10 to 17 miles by road to reach Kemano, about 500 miles in all to move equipment from one point to another 10 miles away in a straight line.

Major equipment used at each point is shown in Table 4.

### Main Tunnel Excavation Methods

Even with the main tunnel opened with four headings, the schedule was tight and high-pressure work had to be organized for each heading. The general procedure for tunnel driving was similar at the three west headings. Conway muckers (100 or 75 hp.) were used to load, and combination battery and trolley locomotive-drawn trains of 6 cu. yd. (with built-up sides for 7 cu. yd.) mine cars were used to haul the material out over 36-inch-gauge 60-pound rail track in each heading. Drilling was done from built-up steel jumbos travelling on rails. These jumbos carried a cherry picker car-changer to feed empty cars ahead of the train to the mucking machine.

At all four headings five cars loaded with muck were considered a normal train-load. The work was organized to run on a 6-day week, three 8-hour shifts per day, but in the early days of driving adits and getting the headings under way much of the work was carried out on a 7-day week basis. At the Tahtsa heading a side rolling car changer was used, otherwise the same mucking procedure was followed.

After studies of the relative merits of the Swedish-type light drill, as compared to the normal North American heavy drifter drills, had furnished no conclusive evidence of the superiority of either for this type of tunnel driving, the contractor decided to use the light Swedish-type drill and drill steel rods with tungsten carbide bit inserts at the Tahtsa heading. At the other three headings, 3½-inch-bore drifter drills with 4-wing Type 2 tungsten carbide detachable bits were used. Experience was not conclusive in indicating any clear advantages of one type of drilling equipment over the other, as rock conditions were not sufficiently similar for a valid comparison.

**Table 3—Construction Plant Facilities at Centres Supporting Underground Work**

| Construction plant facility | Kemano Camp 5 | 1,600-foot elevation | 2,600-foot elevation | Horetzky | West Tahtsa |
|---|---|---|---|---|---|
| Warehouses | Main | Sub-Kemano | Sub-Kemano | Sub-Kemano | Main |
| Machine shops | Main | None | None | Small | Main |
| Electric shops | Main | None | Tunnel equip. & battery | Tunnel equip. & battery | Main |
| Carpenter shops | Main | None | None | Minor | Main |
| Compressor plants, stationary installed | 6 Diesel & electric | (Air piped from Camp 5) | 9 Diesel portable units, 5,000 cfm. | 6 Diesel, 6,600 cfm. | 4 Diesel 4,400 cfm. |
| Diesel electric generating plants | 4,500 kw. | Power from Camp 5 | Power from Camp 5 | 14 units 2,800 kw. | 1,375 kw |
| Welding and blacksmith shops | Main | Minor | Minor | Minor | Main |
| Drill shops | Main | None | Minor | Main | Main |
| Administration offices | Main | Minimum | Minimum | Minor | Main |
| Equipment repair shops | Main & heavy-duty | None | None | Minor | Main |

### Driving Methods

All main tunnel headings were driven full face. The three west headings were drilled with 3½-inch drifter drills on 48-in. sliding cone aluminum power-feed shells, permitting the use of 4-foot steel

**Table 4—Major Excavation and Concrete Equipment for Direct Work Underground—Typical Amounts**

| Item | Kemano Camp 5 | 1,600-foot Elevation | 2,600-foot Elevation | Horetzky | West Tahtsa |
|---|---|---|---|---|---|
| Dump trucks, | 9—6 cy. Dumptors<br>10—Mack & Euclid 12 cy. | None | None | Euclid, Ford Mack & Dumptors Aggr. haul from Camp 5. | 8 to 10 Euclids |
| Railroad locomotives, | 3—Battery | 1—Battery | 1—Diesel<br>5—Battery-trolley | 1—Diesel.<br>14—Battery-trolley | 4—Trolley & battery<br>3—Battery |
| Railroad muck cars, Side Dump, | 8—1-cy. | 2—7-cy. | 42—7-cy. | 47—7-cy. | 38—7-cy. |
| Mucking machines or Loaders, | 5—Crawler Eimco<br>1—Pneu. Eimco, rail-mounted<br>2—Hopper loaders (inclined penstock) | 2—Hopper loaders from incline penstock | 2—Conway 100 | 2—Conway 100<br>1—Conway 75 | 2—Conway 100<br>1—Conway 75 |
| Shovels or draglines, | 2—1½ cy. shovels<br>1—2½ cy. shovel<br>1—¾ cy. shovel | None | None | 1—1½ cy. shovel | 1—2½ cy. shovel<br>1—1½ cy. shovel<br>1—¾ cy. shovel<br>1—Truck crane |
| Tunnel drill jumbos, | 3—mounted on rail tires and Athey wagon | None | 1—3-deck with drill mounts | 2—3-deck with drill mounts | 1—3-deck platforms only |
| Car changers, | None | None | 1—Cherry picker on drill jumbo | 1—Cherry pickers on 2 drill jumbos | 1—Side roller passer |
| Special jumbos, | 2— or penstock excav. & raise<br>2—for welding<br>2—for misc. service | 2—for penstock excav. & raise<br>3—for welding<br>2—for misc. service | 2—rubber tired for scaling cleanup and gunite | 2—rubber tired or scaling cleanup and gunite | 2—rubber tired or scaling cleanup and gunite |
| Blast hole drills, | 20—Diamond drills<br>15—Copco<br>5—Leyner drills | 8—Stopers | 35—Leyner drills, detachable carbide bits | 53—Leyner drills, detachable carbide bits | 54—Copco, with jackleg feeders, carbide chisel bits |
| Crawler tractors, | 8—Tractors<br>2—Crawler scrapers | 1—Tractor | 2—Tractors | 4—Tractors | |
| Ventilation blowers, | 3—Diesel 16,500 cfm.<br>4—Electric 200,000 cfm. | 1—Diesel 9,500 cfm. | 2—Diesel 20,000 cfm.<br>2—Boosters | 4—Diesel 40,000 cfm.<br>4—Boosters | 2—Diesel 20,000 cfm.<br>2—Boosters |

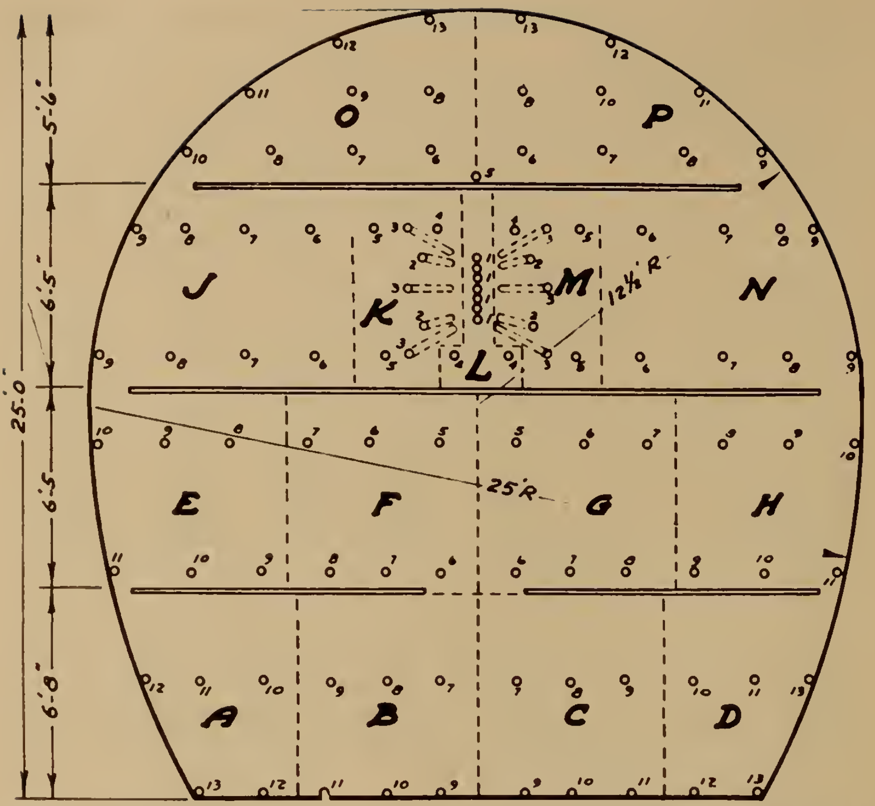



**Fig. 29. 25 foot diameter horseshoe tunnel burn cut, drilling and blasting pattern.**

changes. At each of these headings a steel jumbo, with three working decks, had vertical columns, arms and standard-type dump and swing equipment, on which, usually, twelve drifter drills were mounted. The top deck of each jumbo also carried drifters mounted on jib-type booms. Drilling patterns were varied to fit the character of the rock. For the 25-foot wide arch, horseshoe-shaped tunnel, 102 to 108 holes were normally driven to a distance of 11 to 13 feet past the heading, resulting in an advance of from 10 to 12 feet per round blasted. Where rock was weak, the rounds were shortened and steel supports were erected close to the heading.

The steel used with the drifter was 1¼-inch in diameter, cut into 5 ft. 8 in., 9 ft. 8 in., 11 ft. 8 in., 13 ft. 8 in., and 15 ft. 8 in. lengths, with Type 2 threads and lug shanks. The bits were 4-wing 2-inch detachables with tungsten carbide inserts. A new 2-inch bit was always used on the 5 ft. 8 in. starter steel. Gauge changes reduced by 1/16 inch per change, from 2 in. to 1 15/16 in. and so on to 1 11/16 in. in diameter, before the bits were discarded. Bits were ground normally after 60 feet of drilling, but with the hardest rock encountered had to be ground after 30 feet. The life of a bit varied from 240 feet to 600 feet with 8 to 10 grindings. All drilling was powered by compressed air piped from a central diesel or electric powered plant at each heading, at 100 psi. About 4,000 cfm. were required for drills and accessory equipment for each heading.

For the Tahtsa heading, the Swedish-type drills utilized a chisel-type bit with a tungsten carbide insert permanently set in the ends of 7/8 in. diameter drill rod; the bits were ground as required. Starting holes were 1.34 in. diameter for 2.65-foot-long starting steel and through successive changes available of 4.25 ft., 7.90 ft., 10.50 ft., 13.50 ft., and 15.75 ft. The bit diameter reduced to 1.14 inches for the long steel. Depending on the hardness of the rock drilled, the average life of each steel and bit was from 400 feet to 600 feet. Grinding of the bit was necessary after from 40 feet to 60 feet of drilling. Each bit was ground 8 to 10 times before being discarded. The drill jumbo for these drills had working decks from which the jack-leg drills with pneumatic feeders operated.

The normal shift working crew at each of the three west headings was:

| | |
|---|---|
| Walkers and shifters, | 2 |
| Miners and helpers, | 31 |
| Mucking machine operators, | 1 |
| Motormen, | 2 |
| Electricians and mechanics, | 2 |
| Typical shift crew, | 38 |

At the Tahtsa east heading, the normal crew was:

21 Machines on a Jumbo:

| | |
|---|---|
| Shifters and walkers, | 2 |
| Miners and helpers, | 22 |
| Mucking machine operators, | 1 |
| Motormen, | 4 |
| Electricians and mechanics, | 2 |
| Typical shift crew, | 31 |

16 Machines on a Jumbo:

| | |
|---|---|
| Shifters and walkers, | 2 |
| Miners and helpers, | 18 |
| Mucking machine operators, | 1 |
| Motormen, | 4 |
| Electricians and mechanics, | 2 |
| Typical shift crew, | 27 |

Only one driller was required to operate the light Swedish type drill, whereas it required two men, a driller and a helper, to operate the heavier drill machines.

Blasting was by electric delay detonators exploding 1½-inch by 8-inch 40 per cent giant gelatine dynamite. The time interval of the delay caps used is shown in the following table:

| No. of delay | Explosion time from ignition sec. | Length of cap in. |
|---|---|---|
| Instant | 0.0 | |
| No. 1 | 0.8 | 2 |
| No. 2 | 1.25 | |
| No. 3 | 1.70 | |
| No. 4 | 2.20 | |
| No. 5 | 2.75 | |
| No. 6 | 3.35 | |
| No. 7 | 4.00 | |
| No. 8 | 4.65 | |
| No. 9 | 5.35 | |
| No. 10 | 6.10 | 3½ |
| No. 11 | 7.00 | |
| No. 12 | 8.00 | |
| No. 13 | 9.15 | |
| No. 14 | 10.40 | |
| No. 15 | 12.15 | 4¾ |

After blasting, heavy-duty 22 x 60-inch reversible ventilation fans exhausted the fumes through 24-inch diameter vent pipe for a short time, then pumped fresh air into the heading, forcing the fumes back and out of the adit. Within half an hour, the air was generally clear enough for the crew to return to the heading and start loading the rock out. This operation was similar for all four headings.

Each foot of tunnel advance brought out about 21 cu. yd. of rock, solid measure. Thus an average

10-foot round required loading out 210 cu. yd., or 40 to 50 car loads. The 6 cu. yd. side-dump cars used averaged slightly less than 5 cu. yd., solid measure, per load.

The mucking cycle started with an electric battery and trolley locomotive moving up to the heading towing five empties and pushing one. The front car was delivered to and coupled with the mucker. While the mucker loaded the car the locomotive spotted the last car of the train under the car changer which hoisted it high enough to clear the train on the track. The loaded car was picked up by one locomotive and hauled clear of the car changer, then the empty was dropped by the car changer to the track in front of the train and pushed up to the mucker by the train. This was repeated until five cars were loaded and, while one empty car was spotted at the mucker, the loaded train moved out and a train of empties moved in.

Tunnel driving, using the equipment and methods employed at Kemano, demands teamwork, training and careful timing. With inexperienced miners it takes months to train a crew to really good performance; in fact, few tunnel jobs last long enough to reach real teamwork proficiency. After a year of tunnel driving at Kemano, month by month progress showed marked improvements. The previously recognized record for driving a 25-foot tunnel was broken in the summer of 1952 and new records were established three times more before December, 1952. After the annual Christmas exodus, many trained miners did not return to the job and it took about six weeks for the crews to get back to pre-Christmas proficiency. In the week of February 21, 1953, one crew advanced 282 feet in six days, with a record advance in one day of 61 feet. When it is recognized that one 10-foot round advance per shift, or 30 feet per day, is excellent progress, this average of 47 feet per day for a week appears even more spectacular.

Production rates are shown in Table 5.

### Concrete

Except for the two miles at the east end of the tunnel and the adit plug at the west end, all tunnel concrete was placed from Horetzky. Curbs were formed and placed the full length to form a screed guide for invert and a support for wall and arch forms. Mixed concrete was delivered in dump bodies mounted on rail cars for all of the tunnel concrete, the concrete being mixed in a central plant at the adit portal. Paving finishers were used on the invert. The procedure from the east heading was similar, except that concrete came from a portable plant.

Arch and walls were placed in telescoping steel forms. Concrete was delivered from the cars to elevating skips feeding into pneumatic placers and was delivered to the forms through pipe. At the east end of the tunnel, some wooden forms were used and wall and arch concrete placed progressively. Concrete plugs at the adits were heavily grouted.

Gunite, generally about one inch thick after thorough scaling and cleanup, was placed from special jumbos.

### Penstocks Excavation

Drilling and blasting was similar to main tunnel procedure except that, at the powerhouse level, a truck-mounted jumbo was used to carry drilling equipment and loading was by 1½-cubic yard overhead tractor loader into trucks, which hauled out the muck. At the 1,600-foot level, locomotive and car equipment was used, with a 75 hp. mucker loading cars.

### Inclined Sections

The two sections of the two penstocks, one between the powerhouse level and the 1,600-foot level and the other between the latter and the main tunnel grade of El. 2,595, were each driven from the bottom up. A pilot raise, 6 feet wide by 10 feet high, at the bottom centre of the 15-foot diameter section, was raised from each level. A horizontal timber partition followed the driving upward, making the bottom half of the pilot raise a muckway and the top half a manway and service compartment. Steps on the timber and a narrow-gauge track gave access to the heading face. The steps provided access for labour; on the track, a car was pulled up the track by a 50 hp. hoist at the bottom. The timbering and hoist sheave were kept as close to the heading face as possible. The last few feet to the heading face were reached by walkway steps.

Each muck chute was trapped at the bottom and muck was drawn off by air controlled gates discharging into trucks. Most of the time the muck chutes were kept full, but it was found that water and fines accumulated and built up high pressures on the bottom of the timber. This could be cured only by drawing off all of the accumulation.

Originally, it was planned that drilling and timber separator erection go on simultaneously. Supplying materials for both operations was found to be delaying to both and that fact, together with the hazards attending one crew working above the other, led to more of a 'batch' operation. The same crew drilled and blasted a few rounds, then dropped back and erected the timber. Each of these operations consumed about the same time for the crews.

On completion of the pilot shaft the timber was removed. Working downward, railway track was laid and a small jumbo, carrying drill

**Table 5—Main Tunnel Excavation Production Rates**

| Heading | Best week four headings =962 ft. driven | | Horetzky East | Tahtsa West |
|---|---|---|---|---|
| | Kemano East | Horetzky West | | |
| Driven | 14,750 ft. | 11,910 ft. | 12,940 ft. | 13,440 ft. |
| Time driving | 479 wkg. days | 442 wkg. days | 487 wkg. days | 524 wkg. days |
| Average daily advance | 30.80 ft. | 26.83 ft. | 26.45 ft. | 25.7 ft. |
| Length unsupported | 14,440 ft. | 8,729 ft. | 9,037 ft. | 6,886 ft. |
| Number of steel rib supports | 54 | 366 | 446 | 1,229 |
| Best month's advance | 1,073 ft. | 925 ft. | 864 ft. | 929 ft. |
| Best week's advance, 6 days | 261 ft. | 282 ft. | 274 ft. | 272 ft. |
| Best day of best week, 3 shifts | 55 ft. | 61 ft. | 55 ft. | — |
| Approximate average cycle time, one round | 6 hrs. 55 min. | 7 hrs. 0 min. | 7 hrs. 44 min. | 7 hrs. 9 min. |
| Total volume | 320,000 cu. yd. | 280,000 cu. yd. | 300,000 cu. yd. | 230,000 cu. yd. |
| Dynamite used | 1,410,000 lb. | 984,000 lb. | 1,062,000 lb. | 657,000 lb. |
| Total length of drill holes | 1,709,514 ft. | 1,574,350 ft. | 1,596,545 ft. | 1,425,886 ft. |
| Labour per linear foot, Heading and supporting crews | 43.0 man-hr. | 43.3 man-hr. | 44.7 man-hr. | — |

Fig. 30. Working out from the center the main body of the power chamber excavation was blasted by shooting off slabs 80 ft. high.

mounts at top and sides, drilled the blast holes for the enlargement. The shot rock slid down the shaft and was loaded into trucks through the same gate controlled hopper that was used during the excavation of the pilot raise. Both No. 1 and No. 2 penstocks were completed to this extent. Progress of this slashing operation per heading was about 30 feet per day.

The eight penstock branches, 9 feet in diameter, totalling 816 feet, and the eight tailrace branches, 16 feet wide by 21 feet high, totalling 728 feet, were accessible from both ends. These small, narrow tunnels were drilled from portable platforms. The small penstock branches were excavated largely by slusher scrapers dragging the rock into the powerhouse area, where overhead tractor loaders discharged it into trucks. In the larger tailrace branches, overhead tractor loaders loaded trucks at the heading. A novel adaptation of slusher scraper was employed by mounting the hoist on a truck chassis, which made an easily portable unit.

### Steel Liner

Starting in October, 1953, 4,600 tons of steel liner was then placed in Penstock No. 1 and its branches. The 11-foot diameter steel sections varied from 7/16 to 1 15/16 inches thick. Sections received from the manufacturer were 14 feet long at the bottom; the upper sections were 28 feet long. At the 1,600- and 2,600-foot levels, automatic welding installations combined two sections.

In the tunnel, carefully aligned steel beams were erected on which to skid the sections down the incline. From the welding yard a small railway dolly carried the penstock liner into the head of the incline. As the dolly rolled over the vertical curve, it dropped below the skid beams which then picked up the pipe section on the saddles welded to them. A 200 hp. hoist at each level controlled the slow movement of pipe down the shaft to position.

Welding of the pipe sections was done from platforms erected on the inside of the pipe. All welds, including the preassembly welding, were preheated and low-temperature stress relieved. Penstock branches at the bottom were welded from both inside and outside.

### Concrete

For the backfill concrete between liner and rock, coarse, clean aggregate was hauled up the tramway to the 1,600- and 2,600-foot levels, dropped down the incline in skip cars that dumped to hoppers erected about 100 feet above the top of the liner steel in place. From these hoppers the aggregate was dropped through 10-inch steel pipe that was kept full, and the aggregate was released by burning out openings just above the backfill level. Manual shovelling and high pressure air jets distributed the rock around the pipe and then cement grout and fine sand were pumped in. In the last section to receive backfill, 2,000 feet of incline was filled in one operation. Drains were installed around the pipe discharging into the horizontal run below. Similarly, in the lower horizontal runs of the penstock and around the branches, rock was placed by a specially designed blower.

Cement grout was pumped under

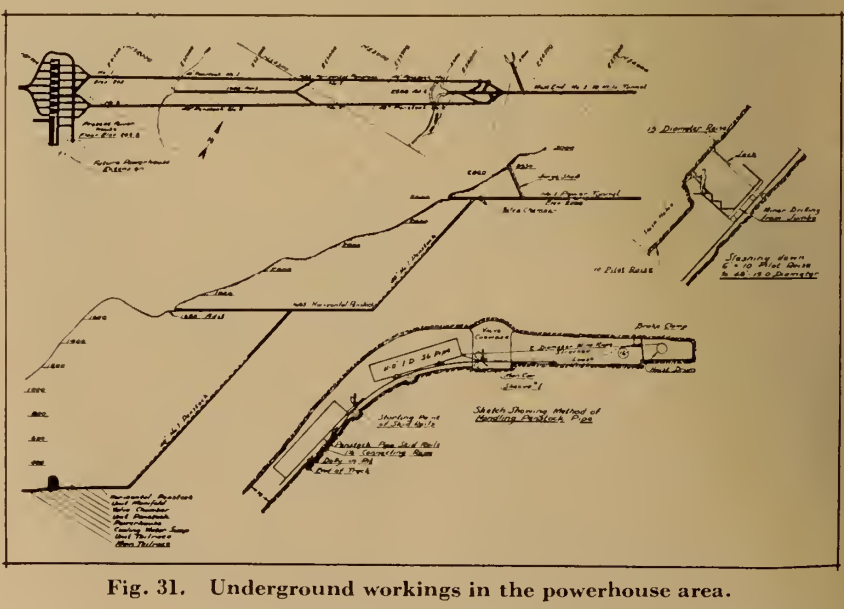


Fig. 31. Underground workings in the powerhouse area.

**Table 6—Performance Data—Penstock Pilot Raise, Penstock Branches and Tailrace Branches**

| Item | Penstocks 1 and 2 (One full crew alternated between No. 1 and No. 2 for each elevation section) El. 210 to 1,600 | Penstocks 1 and 2 El. 1,600 to 2,600 | Penstock branches | Tailrace Collecting branches and drainage tunnel |
|---|---|---|---|---|
| Length | 3,937 ft. | 2,429 ft. | 1,324 ft. | 1,469 ft. |
| Section | 6′ wide x 10′ high | 6′ high x 10′ wide | 9′ dia. | av. 17′ x 22′ |
| Volume | 8,740 cu. yd. | 5,268 cu. yd. | 3,852 cu. yd | 20,008 cu. yd |
| Dynamite, 40% | 112,000 lb. | 57,300 lb. | 42,000 lb. | 108,400 lb. |
| No. rounds | 579 | 370 | 192 | 168 |
| Av. round | 6.80 ft. | 6.56 ft. | 6.89 ft. | 8.75 ft. |
| No. working days | 257 | 189 | 125 | 235 |
| Labour, direct | 88,000 man-hr. | 74,000 man-hr. | 15,200 man-hr. | 38,200 man-hr. (total) |
| Blast holes | 150,000 ft. | 82,900 ft. | — | 136,400 ft. |
| Timber platform | 202 mbm. | 124 mbm. | — | — |

pressure into the dry fill through prepared fittings in the liner shell, working from the bottom upward. Pumping through one set of fittings continued until grout started coming through the next higher fittings. Grouting up each incline was a continuous bottom to top operation. As the head from the bottom increased, additional pumping stages were set up, with each stage below the top stage discharging into a re-mixing tank before being picked up by the next stage.

The final stage of the operation was to diamond drill through the grout fittings into natural rock. The cores indicated good quality backfill and the holes were used for pressure grouting to seal the backfill concrete into the natural rock and to fill up any spaces that might have developed between liner plate and concrete. In the sections of penstock tunnel where poor or broken rock was known to exist, grouting was extended into the rock to add strength to it. The lining, backfill and grouting was completed in early July, 1954.

Table 6 presents performance data on penstock excavation.

### Powerhouse and Valve Chamber Excavation

For the powerhouse and valve chamber excavation, diamond "long-hole" blast-hole drilling was employed. Excavation of the powerhouse, with its 80-foot wide parabolic arch roof 120 feet above the top of the turbine pits, would have presented serious problems of timing if done by the conventional drilling-blasting-mucking cycle. Also, the need for true, trim excavation lines such as have been obtained by the "long-hole" method on other jobs was an important factor in the decision to employ this method at Kemano.

The top two-thirds of the tailrace tunnel was driven into the powerhouse to the centre line of the turbine units and was extended in a 27-foot by 27-foot drift the length of the powerhouse. The small 6 by 8-foot permanent ventilation tunnel was driven into the powerhouse at spring-line level. At right angles, a 10 by 12-foot drift was driven along the 700-foot length of the present powerhouse directly above the tun-

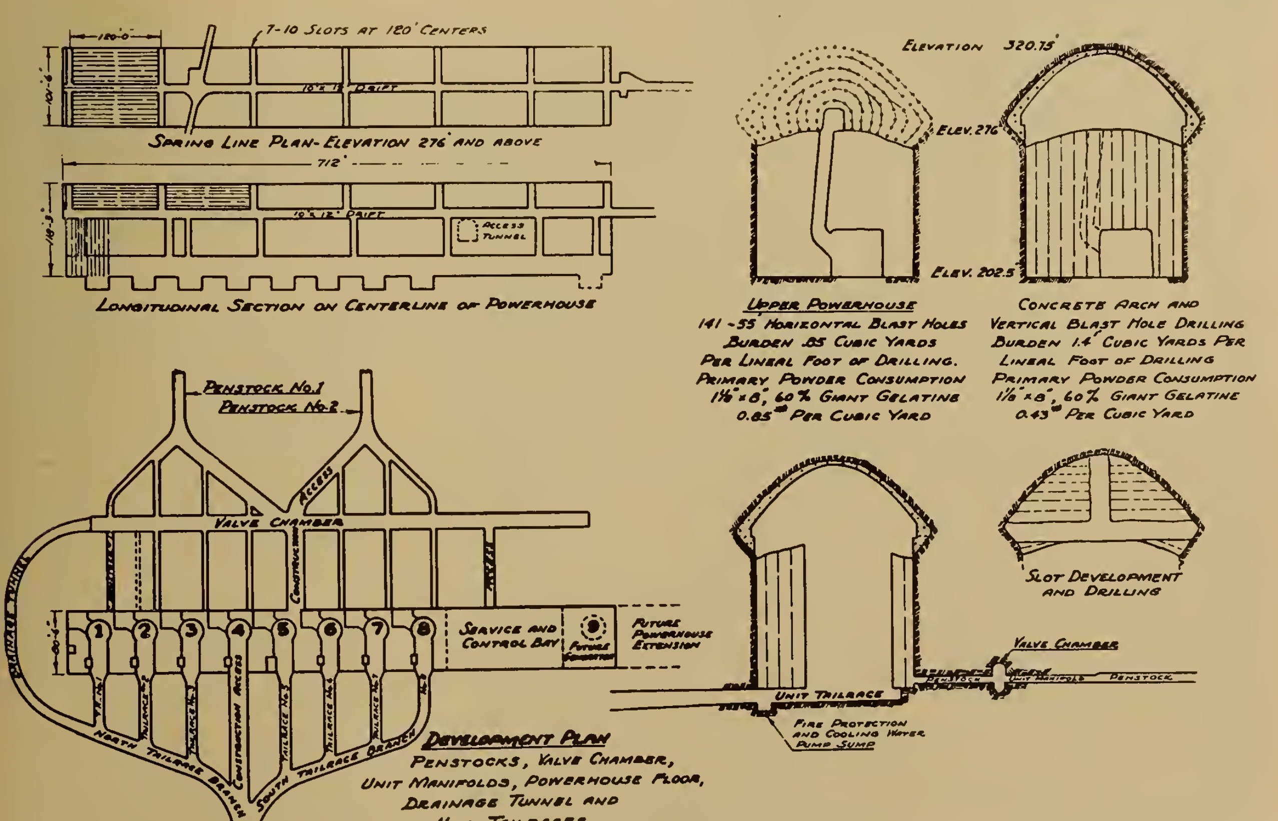



**Fig. 32. Excavation procedure, powerhouse area.**

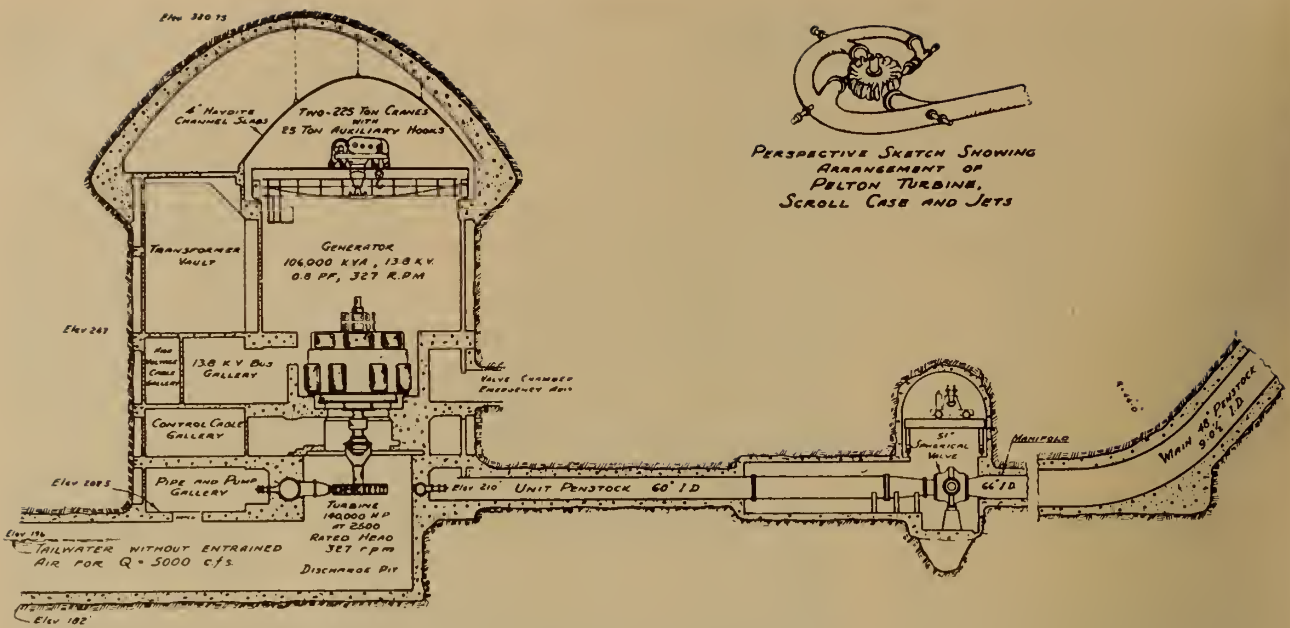



**Fig. 33. Transverse section showing general arrangement of powerhouse, generator, tailrace, penstocks, manifold, and spherical valve chamber.**

nel below, and was continued south to the ultimate end of the powerhouse for a total distance of 1,142 feet.

Seven vertical shafts were raised to connect these two longitudinal tunnels. From the upper powerhouse tunnel, seven 10-foot-wide slots were enlarged above the spring-line at 120 feet centres to two feet outside of the desired trim line of the arch. From these slots, horizontal diamond-drill blast holes were driven 55 feet in each direction.

As soon as the first three slots were drilled, blasting and mucking started. Successive rings were blasted down, expanding from the upper tunnel. The muck was pushed into the vertical shafts by tractors and loaded by power shovels into trucks in the lower powerhouse tunnel. The last shot on each section was in the trim holes along the arch line, resulting in the least possible blasting shock to the remaining rock. In one section of the powerhouse, successive blasts from the tunnel upward disclosed weak, shattered and blocky rock. Here the centre 20 feet was carried up clear to the arch line, and the arch heavily roof-bolted before any further blasting was done at the sides. Progressive widening of the opening with light shots and roof bolting made the arch secure until the arch concrete was in place.

Upon completion of the excavation and of the placing of concrete in the arch, the main body of the powerhouse rock was diamond-drilled with 80-foot long holes. Blasting first caved down the area over the longitudinal tunnel at the bottom and this slot was expanded toward the walls. After a few shots, enough space had been opened to permit muck loading by a standard 1½-cubic-yard shovel fitted with electric drive. Muck was hauled out by diesel trucks to fill an area along the Kemano River for flood and erosion protection. While the cost per foot of hole drilled was higher for diamond drilling than it would have been for normal blast-hole drilling, the method permitted uninterrupted work in one area, while blasting and mucking went on without interruption in other areas. This resulted in much more efficient use of manpower and equipment than for the normal drilling-blasting-mucking-clean-up cycle. Experience in long-hole drilling and blasting in the powerhouse led to the adoption of the same methods in the smaller valve chamber with good results.

#### Access and Tailrace Tunnel

The access tunnel to the powerhouse enters at the generator floor level and the portal is well above the surface of the natural ground. This made it much less desirable as an access route for excavation, but it became increasingly important for moving in and installing powerhouse equipment. The tailrace tunnel invert grade is deep below the general excavation level of the powerhouse and at the portal it is deep below surrounding ground. To improve its value as an access route into the powerhouse and to avoid water problems, the initial excavation was only the top two-thirds, leaving the lower bench to be taken out as the last step in construction. Both the access tunnel and the tailrace tunnel were drilled from truck-mounted jumbos, and standard ¾-cubic-yard crawler shovels loaded the muck into trucks. The access tunnel is 27 feet wide by 31 feet high. The tailrace tunnel is 27 feet wide and 37 feet high.

#### Cable Tunnel

The generators will feed power directly through heavy busses to 300,000 volt transformers inside the powerhouse. Oil-insulated conductors will carry the power through an 18-foot wide by 13½-foot high tunnel, 1,437 feet long, and on through a concrete formed box section to the transmission line terminal. This tunnel was excavated by an overhead tractor loader and the muck hauled out by trucks.

#### Concrete

A variety of concrete handling and placing schemes were employed for powerhouse concrete and for the access cable and tailrace tunnels. The turbine pit liners and scroll cases for the three initial 140,000 hp. units installed were encased in Prepakt concrete. All other concrete was conventional, mixed in the

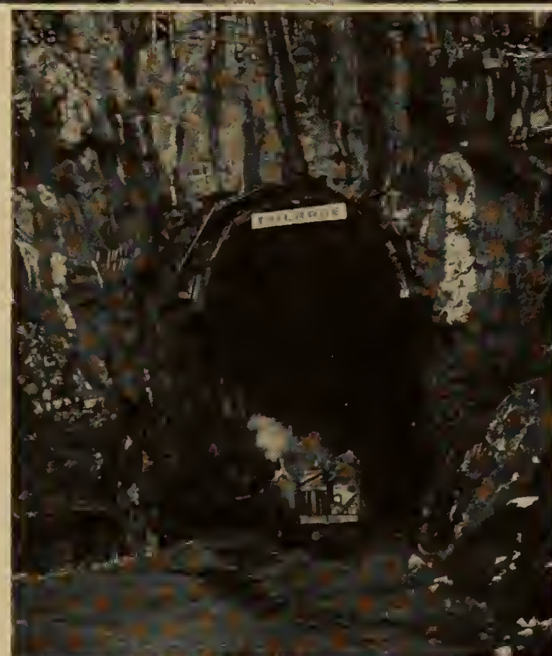
Fig. 34. Weak rock and tailrace branch intersections were protected by concrete. (Top Left)

Fig. 35. Motor generator installation at the Horetzky camp. (Top Right)

Fig. 36. The tailrace tunnel carried most of the excavation from the powerhouse. At the portal it is 40 ft. high. (Center)

Fig. 37. In early June 1954, structural work in the power chamber was complete and unit installation was nearing completion. (Lower Left)

Fig. 38. The north end of the valve chamber with four spherical valves installed. (Lower Right)



### Table 7—Power House Excavation

A ACCESS DEVELOPMENT

Ventilation tunnel to power house at El. 277, size 6 x 8 ft. and 1,505 ft. long, completed September 29, 1951.

Upper longitudinal tunnel in power house at El. 277, size 10 x 12 ft., and 1,142 ft. long, started October 20, 1951, completed June 23, 1952.

Upper section tailrace tunnel at El. 203, size 27 x 27 ft., length 1,407 ft., was completed into power house December 22, 1951.

Lower longitudinal tunnel in power house at El. 203 size 27 x 27 ft., and 700 ft. long, driven between December 29, 1951 and March 14, 1952.

Seven 8 x 8 ft. muck raises and two 4 x 6 ft. ventilation raises driven between lower and upper tunnel.

Seven slots, 10 ft. wide and 2 ft. beyond the cross section of the power house arch excavated by expanding on drifts at right angles to long centreline of power house.

B. LONG HOLE DRILLING AND EXCAVATION

| Item | Power house | | Access development & miscel. excavation |
|---|---|---|---|
| | Arch | Bench | |
| Volume | 80,000 cu. yd. | 139,000 cu. yd. | 59,000 cu. yd. |
| Diamond drilling | 89,853 ft. | 90,816 ft. | — |
| Labour: | | | |
| —Drilling and blasting | 48,500 man-hrs. | 49,800 man-hrs. | — |
| —Scaling and temp. bolts | 12,600 man-hrs. | 9,100 man-hrs. | — |
| Dynamite | 56,000 lb. | 62,000 lb. | 242,000 lb. |

**Fig. 39. During the early spring helicopters were the only means of service to West Tahtsa.**

central mixing plant outside and most of it was hauled in by Dumpcrete. Placing in forms was generally by Pumpcrete, although some of the powerhouse concrete was handled in buckets by the temporary and permanent overhead powerhouse cranes.

Concrete for the powerhouse arch was carried into the power chamber through the tailrace tunnel and lifted by a tower skip to Pumpcrete hoppers at the spring-line bench, which delivered it to the full section forms supported on a jumbo frame. The concrete tower was installed in one of the vertical shafts excavated to drop muck from the power chamber bench to the transverse tunnel at El. 202.

#### Logistics

The tunnel and powerhouse construction, involving nearly 1,800,000 cu. yd. of underground rock excavation, the placing of nearly 240,000 cu. yd. of concrete and of over 200,000 cu. ft. of gunite and the installation of 420,000 hp. of turbine generator capacity, was a major job under any conditions. Isolation of the work, difficult communication between different working points, and the need to transport virtually all labour from Vancouver or farther made the supply services and transportation major operations. Nearly 30,000,000 manhours were used for the total hydro-electric development, of which about 70 per cent was for underground work and supporting services. The total cargo moved by barge or ship to Kemano was over 300,000 tons, most of it for underground work. Nearly 40,000 tons were moved 600 miles or more to the east side by train or truck, hauled 105 miles on job-built access road and 18 miles by barge before it reached its point of use.

To maintain supply service, the contractor set up a railway, road and port shipping depot in Vancouver. Purchasing activities were concentrated in Vancouver and bills were paid from Vancouver. Accounting, final receiving, engineering and other administrative service headquarters were located at Kemano. Labour was transported to the job by boat or plane in about equal numbers. Thirty thousand passengers were carried by plane, most of the trips under direct charter contract and most of them for support of underground work. √

**Fig. 40. The 25-ton tramway carried men and cargo from Kemano Camp 5 to the camps at the 1,600 and 2,600 foot elevation.**

# Kemano Penstocks

*by*
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The Kemano penstock is one of the largest, if not the largest, to operate under a head as high as it carries. To establish a satisfactory basis of design, a number of tests — of the steel, of welding methods, of the division of load between rock and lining and the like — were carried out. Construction methods were also in some respects unique, and never easy, owing to the rugged character of the terrain. Careful planning, well described in this paper, brought the work to a successful conclusion.

Each of the penstocks, No. 1 and No. 2, to the Kemano powerhouse of Alcan's new British Columbia hydroelectric power and smelting plant, will supply four 140,000-150,000 hp. vertical-shaft impulse turbines under a gross head of 2,600 feet. Normal flow in each penstock will be about 2,000 cfs. with a maximum at full gate on the turbines of about 2,400 cfs. Since the principal load for the power plant will be the smelting of aluminum at Kitimat, and since this process requires the maximum of reliability in the supply of electrical energy, all parts of the hydraulic conduit were designed to minimize outages for inspection or maintenance.

These penstocks connect the west end of Power Tunnel No. 1 to the inlets of the turbine distributor scrolls. In the present Stage I of the development, excavation was completed for both penstocks, but only No. 1 to serve units 1 to 4, inclusive, has been equipped with lining and controls. This penstock consists of about 4,450 feet of 11-foot ID section, made up of a horizontal section at El. 2,596, a sloping run of 1,200 feet, a horizontal run at El. 1,685, then a 2,000-foot sloping run to approximate turbine scroll level at El. 211. Static head at full reservoir varies from 200 feet on the upper end to 2,590 feet at the powerhouse level.

**W. G. Huber**

The sloping sections are at an angle of 48° to the horizontal and the lengths of the horizontal runs are determined by this angle versus the natural profile of the ground and the requirements of rock cover above the conduit, which was fixed for design at 40 per cent of the hydrostatic head at any point.

The penstock is located in a tunnel rather than on the mountain surface in the more conventional manner because of the extreme roughness of that surface; the resultant protection against bombing, or snow or landslides; the economy of plate steel; reduced maintenance; and because the powerhouse itself is placed well under the mountain and at least some large portion of the penstocks would therefore have to be underground in any event.

#### Adopted Diameters

No great refinements were attempted in economic studies leading to the adopted diameters, because reliable cost figures could not be developed for work in this remote region where construction had to be started simultaneously with investigation of the site. Surge effects were investigated for the combination of a ten-mile tunnel and this long penstock for one unit off with eight units operating and for two units on with five units operating. Although the turbine design permits a relatively slow opening and closing of turbine nozzles, water hammer of 10 per cent maximum head was assumed in penstock design, which corresponds roughly to a 12-second closure of the jets. This leads to a maximum dynamic pressure on the line of 2,850 feet head, or 1,235 psi. Turbine governors are set to open in 30 seconds and to close in 60 seconds, and sphere valves are governed to open or close in 30 seconds.

Earlier project estimates were based on one 15-foot diameter, thin walled penstock for each power tunnel and each eight units, but it was felt that this would be too great a departure from any known practice and experience with under-

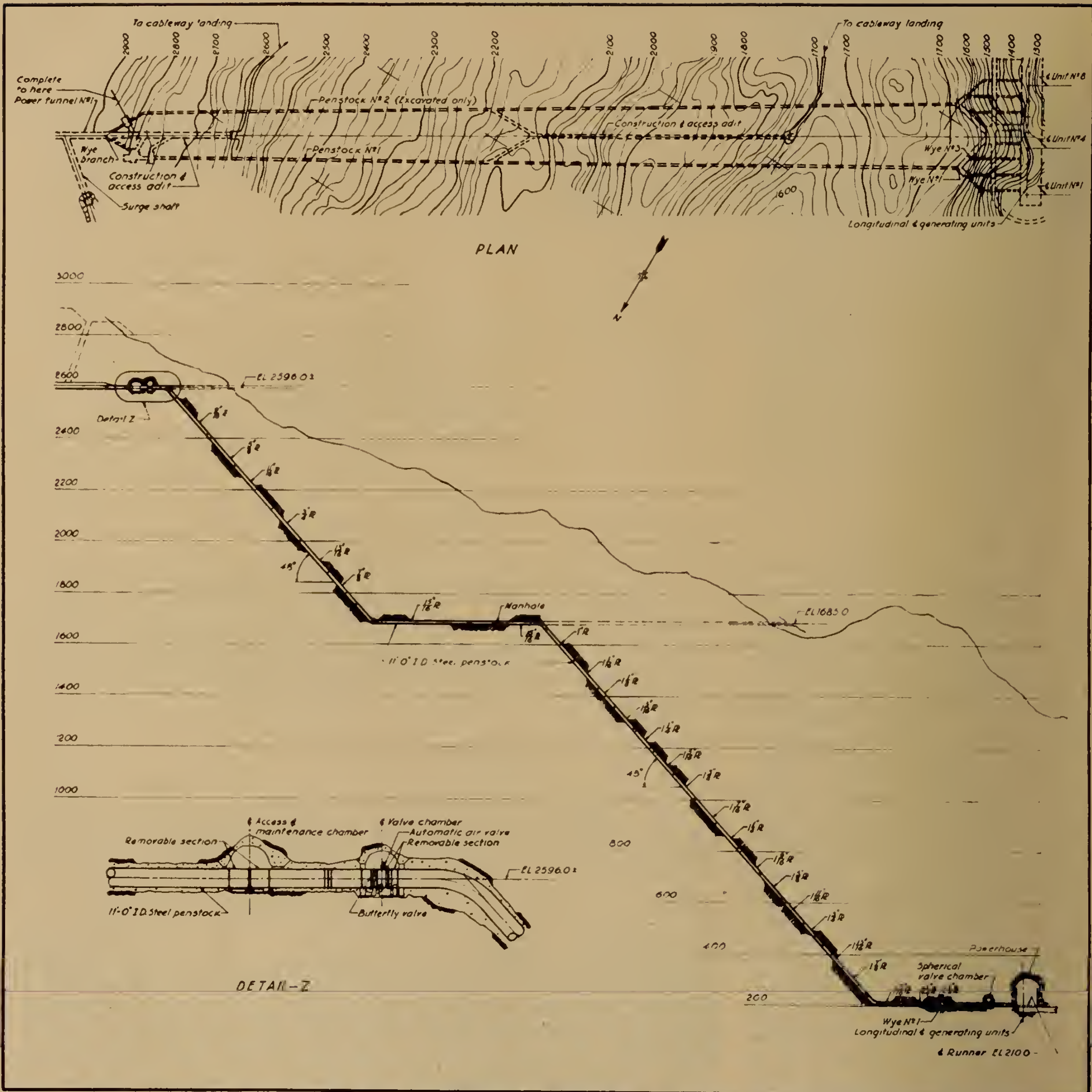


**Fig. 41. Profile on the centerline of Penstock No. 1.**

ground pressure conduits. The approximate hydraulic equivalent of one 15-foot diameter or two 11-foot diameter lines, with thicker plate and valve controls at tunnel level, was adopted although even it is far beyond anything attempted hitherto.

### Plate Thicknesses

Plate thicknesses and other details of the design and construction of this pressure conduit were carefully studied in the light of extensive investigations, particularly in Norway and in Switzerland, on the distribution of load as between steel liner and surrounding rock. Mathematical analyses of such a combination can afford much exercise for those theoretically inclined and will take many forms and produce as many different answers, but any analysis can give little more than a rough approximation of the distribution, because of the many variables introduced by natural site conditions and the practicalities of construction. These include the jointing, stratification, attitude and residual stresses in the surrounding formations, the variation in strength and in modulus of elasticity of the rock, shrinkage and other imperfections of the concrete envelope and variations in the cross-sections and even in the steel quality of the liner itself. Experience elsewhere shows that in such combination the rock takes a permanent set under initial loadings, with corresponding modification of contact conditions under subsequent and long term loading.

### One Theoretical Approach

One reasonable theoretical approach is to consider the surrounding rock as a thick walled cylinder enclosing a "cracked" zone immediately adjacent to the liner, with this cracked zone assumed to act as a series of columns between the exterior of the liner and the uncracked rock cylinder. Another analytical method which indicates that conduit pressures are effective only a very short distance out from the liner, involves application of Poisson's ratio to calculated compressive stresses in the rock along the extension of a horizontal diameter of the penstock. Under this assumption, the concrete encasement serves only as a strut between the active liner and the opposingly active rock, through which a portion of the hydrostatic load is transferred outwards until it is balanced by internal stresses in the rock and strain reduces to zero. For the two points along the conduit where test measurements were made, the distribution computed by this method is approximately 25 per cent on the steel and the remainder on the rock. Initial proof-testing work on Penstock No. 1 included measurements of steel stress in 11-foot diameter sections at Els. 1,685 and 210 by two sets of SR4 strain gages and mechanical extensometers designed to measure diametral change. Load distributions calculated from readings of the SR 4 gages were as follows:

| | | |
|---|---|---|
| El. 1,685 | Steel | 36 per cent |
| | Rock | 64 per cent |
| El. 210 | Steel | 32 per cent |
| | Rock | 68 per cent |

Correlation of electrical and mechanical gages at El. 210 was excellent, but at El. 1,685 observed values were erratic. It is evident that any formula must include a provision for temperature differentials as well as a "shrinkage constant" for the encasement.

### Exploratory Tunnel and a Hollow Sphere

As soon as an exploratory tunnel had been driven into the approximate region of the underground powerhouse in 1951, a hollow sphere of ½-in. plate 10 feet in diameter was concreted into a side adit and tested under pressures up to 3,600 psi. Numerous gages were employed in this experiment to obtain a measure of the modulus of elasticity of rock and of the action of a thin wall closed vessel when backed up by concrete and rock. Despite some unsatisfactory results with the electrical resistance gages, the modulus of elasticity of the rock was determined to be about two million psi. The wall of the vessel did not rupture while carrying a calculated 18 per cent of the total pressure load, a result which supported the basic concept that a thin steel shell, backed up at all points by concrete and sound rock of sufficient thickness, will form a safe watertight conduit under high pressures.

The adopted plate thicknesses actually constitute a compromise of factors including retention of shape during handling, resistance to external hydrostatic pressure when the penstock is empty and limitations for welding round-about joints from one side only. Emptying of the penstock should occur only infrequently and could be done at a very slow rate, also a permanent drain system from the annular space outside the liner is provided. However, the long term reliability of this feature was questioned by some consultants, therefore it was required that at all points the plate thickness should be great enough to withstand external hydrostatic pressure equivalent to the vertical distance from the centerline of the pipe to the surface of the mountain. Minimum thickness of the 11-foot diameter pipe was taken as 9/16 in. for convenience in handling and the maximum thickness, for manual welding from one side only, was taken at 1-15/16 in. Between these limits the thicknesses of plate were increased in increments of 1/16 in. down to a point near the manifold, where provision was made for welding from both sides and thicknesses were increased to 2¼, 2½ and 3-1/8 in. at the field junction with Wye No. 1. From this point downstream, the support assumed to come from the rock was decreased

**Fig. 42. Lifting penstock liner section by cableway from Kemano valley to El. 2600.**

Fig. 43. Lowering liner section down penstock raise.

until the steel liner would take all hydrostatic loads at normal free pipe stresses. This led to plate thicknesses of 2¾ in. for the five-foot diameter turbine branches.

### The Wyes

The wyes, or sections at the branches of the manifold, are proportioned to carry the entire water loads independently of the backfill and were shop tested to 1,435 psi. or 115 per cent of the maximum design pressures. Wye No. 1, 11 feet in diameter, 7 ft. 9 in. diameter and 7 ft. 9 in. diameter at 90° included angle, is a hollow sphere 12 ft. 3 in. ID. of 3-11/16-in. A-212 plate, pierced for stub branches of A-212 and A-201 plate, the latter to assure higher quality of field welds to the connecting straight runs. A special car and railway routing were necessary for transport of this 50-ton weldment, which was 12 ft. 10-3/8 in. wide by 17 ft. 2-3/8 in. high as loaded. The two 45° wyes, 7 ft. 9 in. diameter by 5 ft. 6 in. diameter and 5 ft. 6 in. diameter are of the more conventional "pants" construction, reinforced longitudinally with heavy plate "U" girders and transversely at the crotch. The A-212 plate is 2-5/8 in. thick with stub ends of 2¾ in. and 2¼ in. A-201 plate. Each wye weighed 40 tons.

### Ductility and Weldability

After extensive welding and punch press tests and consultation with experts in the metallurgy of steel, it was decided that ductility and weldability were the most essential properties for the conduit liner. Accordingly, the following qualities of plate were selected:

Less than 1 in. thickness—
ASTM A-285 Grade B Firebox
One in. and greater thickness—
ASTM A-201 Grade A Firebox.

Design of details and plans for installation of the penstock liner were based on the realization that uniformity of support for the liner plate and elimination of stress raisers and embrittlement are of paramount importance. Any voids or other lack of uniformity in the backfill concrete, or physical break in the surface of the liner, or local application of heat to the steel without subsequent stress relieving were considered as potential weaknesses and to be avoided by all possible means.

Although the steel liner is proportioned to carry full external hydrostatic pressures as a cylinder supported at all points of the periphery, a drainage system was added as mentioned above, to tap the annular space between the outside of the liner and the concrete encasement. One system, consisting of two longitudinal headers, each with branches to the liner wall, extends from the butterfly valve chamber to El. 1,685 and the second system extends from this intermediate point to a discharge near the sphere valve chamber at El. 210. Pairs of branches are spaced an average of 41 feet along the pen-

Fig. 44. Welding circumferential joint in liner plate.

stock. This annular space will be extremely small until the penstock is emptied after having been under load for a period sufficient to produce a permanent set in the surrounding rock. Such a drainage system, if free to discharge at all times, will act as a telltale with respect to water tightness of the penstock liner, that is, a sudden change in the amount of discharge might indicate some accession of penstock water. However, continued flow of ground water through the concrete envelope to the drain headers will tend to fill them with carbonates. This and the difficulties of keeping a drain line open during construction are the principal reasons why some engineers will not place dependence on pipes for relief of external hydrostatic pressure on encased steel penstocks.

Rings of grout holes were spaced at about 10 feet centers along the length of the pipe and used first for placing intrusion grout and finally for pressure grouting of the concrete-rock contact and the rock itself. Closure of these grout holes was accomplished by a flush head machine screw plug tightened down against a copper washer and seal-welded with a high ductile rod. Sections of the liner, or "cans", as furnished by the fabricator came equipped with a "half and half" butt strap to act as the backup strip when welding the underground field joints, and with full length shoes or runners to support the pipe on tracks when being lowered in the shafts. These shoes were perforated to admit concrete. Also, at regular intervals along the sloping sections of the liner, lugs are provided to resist any downhill creep of the pipe due to changes of temperature and stress in the metal.

**Fig. 46. Placing coarse aggregate outside liner.**

### Penstock Details

Low-head control of penstock flow is provided by an 11-foot diameter oil-pressure actuated butterfly valve at the tunnel level, El. 2,595, and just upstream from an automatic air valve which will vent the conduit when emptying or filling. Power for oil pumps and lights is supplied through cable from the powerhouse, where the butterfly valve will normally be operated by push button on the main control boards. Between the butterfly valve and the 20 x 11 x 11-foot diameter wye branch at the end of the tunnel proper, a 24-foot section of Penstock No. 1 is provided with flanged ends and an intermediate expansion joint, which make it possible to disconnect and roll back this section to admit personnel and light vehicles. The adits here and at El. 1,685 which are required for the future completion of Penstock No. 2 and for permanent access to penstocks and valves, will be accessible by the 20-ton aerial construction tramway, or by helicopter from the Kemano River level.

At El. 1,685, the plug in the branch gallery is cored out to form a 70-foot long tunnel leading to a 20 in. diameter manhole into the penstock, for inspection and maintenance from this level. Here, as at El. 2,600, lugs are located on the crown of the liner for attachment of skip hoisting tackle.

Control of high pressure flow is afforded by 51 in. diameter double seal sphere valves in a separate chamber at the powerhouse level and by the turbine nozzles with associated jet deflectors. Valve operation is by conventional piston type servomoters using penstock water, and control is local manual, or electrical, or remote from the station switchboard. The Venturi effect created by the increase in conduit size downstream of valves is utilized for an automatic valve control involving a flowmeter. Downstream seal of the sphere valve can be renewed with penstock full

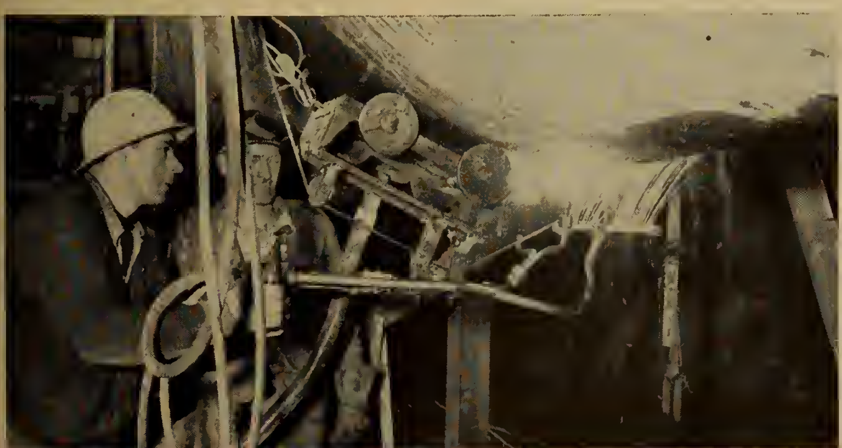

**Fig. 45. Low temperature stress relieving of field weld.**

by removing a 3-foot length of penstock just below the valve. Between this point and the inlet to the turbine distributor scroll, two couplings are employed at penstock joints to simplify closure in construction and to act as contraction joints when the pipe is opened at the sphere valves. It follows that hydrostatic thrust at these valves is taken into the upstream rock by tension in the penstock branches and at the turbines this thrust goes through the encasing concrete to the powerhouse rock.

Table 1: Characteristics of the metal as furnished in the completed liner

| | A-285 Psi | A-201 Psi. | Manually applied weld metal, low hydrogen E-6016 |
|---|---|---|---|
| Yield point | 31,100 — 41,400 | 29,800 — 44,000 | 67,200 — 77,000 |
| Ultimate strength | 52,100 — 64,900 | 49,600 — 66,500 | 79,500 — 86,000 |
| Ductility, per cent in 8 in. | 26 — 39 | 25 — 37 | 22 — 25 |
| Reduction in area, per cent | — | — | 47 — 67 |
| Impact resistance Charpy V-notch, 40° F. Foot pounds | 9 — 10 | 10 — 77 | 45 — 65 |

Table 2: Edge preparation for circumferential field joints

| | Type | Total angle | Root opening *in.* | Root face |
|---|---|---|---|---|
| Above ground automatic | Double-vee | 60° to 90° | 1/32 | ¼ *t* |
| Underground manual (t= ¾ and greater) | Single-vee backed up | 30° | ½ | 0 |

### Backfill of Pipe

At the upper and lower ends of the penstock, the plate thicknesses are sufficient to carry internal hydrostatic pressures as a free pipe at normal stresses and the concrete encasement serves only to protect the outside of the steel pipe against corrosion and to provide a continuous support. Between the extreme ends of the entire penstock, part of the internal pressure loads must be shared by the rock, in order to keep steel stresses near accepted working values for the material. Consequently, the concrete encasement or backfill between pipe and rock will protect and support the steel and act also as a compression member transferring part of the internal pipe load to the rock. To meet this requirement, the concrete must be durable, of medium but uniform strength and completely free of air voids or segregation, which would lead to concentrations of stress and to excessive strain in the steel. The concrete backfill averaged about 3 feet in thickness. Essential tightness of contact at pipe and rock surfaces called for a minimum of curing shrinkage in the concrete, which was achieved by the use of low heat cement and by intrusion of the mortar fraction of the mix into coarse aggregate previously placed around the pipe. This in effect gave a low pressure grout filling of all voids wherever the technique was used. Observed temperature rise during hydration was about 25°F. from a placing temperature of approximately 50°F.

As a check on the quality of backfill, about 1,000 cores were taken after 21 days age, and normal grouting methods used to fill these core holes and consolidate zones of fractured or water bearing rock. Conventional wet mix concrete was pumped into parts of the horizontal runs where it was difficult to place dry coarse aggregate and where grouting along the crown contact would have been necessary with either method of placement. Hole packers were specified to prevent the grout at pressures of 75 to 300 psi. from entering any space between the liner and the concrete.

Fig. 47. Removable section at head of penstock.

### Construction

Although the adopted plate steels are well known and almost standard throughout North America for unfired pressure vessels with welded joints, an extensive program of testing was carried out to develop welding procedure, and to investigate stress conditions and ductility in and adjacent to heavy welds, the impact resistance of the proposed steels and the efficacy of low temperature stress relieving. Operating temperature of the metal will range between 40°F. and 55°F. The average results obtained in these investigations indicated that the weld metal is somewhat stronger than the plate, but about equal in ductility; that low temperature stress relief of field joints would improve the gradation of locked-up weld stresses; and that a single vee butt joint would be as satisfactory as the three-weld stepped joint used by some European engineers for thick plate welded from one side. The metal as furnished in the completed liner had characteristics as given in Table 1.

Pipe sections were fabricated in the shops complete with skid shoes, grout plugs, handling lugs and edge preparation for field welds, in shipping pieces not more than 28 feet long, or 20 tons in weight. Oven stress relief was the final operation on each can. Total angle of vee for the double-vee submerged arc shop welds was 60° for A-201 and 90° for A-285, 9/16 to 15/16 in. thicknesses which were built in a separate shop of the same firm. Edge preparation for circumferential field joints are given in Table 2.

While part of the field welding was underway in shops at the intermediate and upper portals, excavation of shafts and installation of skid tracks were advanced from two levels. The large notch in the end of Mt. DuBose offered the only practical intermediate access to the penstock site, though at El. 1,685 it is at about the upper third point of the total rise.

Here the 16 x 16-foot adit and branches totalled 1,200 feet in length, with transport service by rail to the cableway landing near El. 1,600. A similar arrangement was made near the west tunnel portal (El. 2,590), and space for construction plant and material storage was developed as muck became available from excavation.

The rock along the penstock site was explored in 1951 by diamond drilling from the mountain surface to obtain some knowledge of conditions to be expected in construction. A few dikes and shear zones were encountered in drill holes, but the most valuable information obtained was confirmation of other evidence that ground water would not be troublesome.

Design size of the full bore was fixed at 15 feet diameter to allow something less than two feet average space outside the steel liner. However, when the shafts were enlarged to full size by slashing down from the upper ends, resulting overbreak gave a shaft of approximately 17 feet equivalent diameter. Size of such an annular space is of course a compromise between construction convenience and cost of backfilling the space. In spite of careful advance planning, it was necessary to do a great deal of work outside the liner and the extra space undoubtedly reduced labor costs by permitting easier access. Generally, rock and ground water conditions were favorable as expected from results of earlier exploratory drilling. In the final cleanup of shaft excavation, all timber supports were removed just ahead of aggregate placement. Steel rock supports were placed when slashing down the raises.

#### The Aerial Tramway

Transport of all materials for penstock construction above the powerhouse elevation was accomplished on an aerial cableway of nominal 20-ton live load capacity, equipped with several skips for different services. Miscellaneous materials, equipment and personnel were carried in a box skip with plate steel floor and sides. A rail mounted frame was substituted for this box skip when transporting liner sections, lashed on two dollies, to the intermediate and upper adits and a hopper was attached to the cableway carriage for transport of concrete or aggregate. As mentioned above, the longest section of 11-foot diameter liner to be handled by skip was 28 feet and the heaviest about 19 tons and 14 feet long.

In order to economize on underground manual welding, each pair of cans as delivered by the aerial tramway was welded by submerged arc process in a shop at the respective portals, so that a double length was transported from these shops to be placed in position in the shaft, with half the required circumferential field joints completed. Shops were complete in all details, with rolls, transfer dollies, preheat, inside and outside welding heads and stress relieving equipment. Welds were examined by centering X-ray apparatus in the pipe with film covering the entire outside circumference of the joint.

#### Installation of Liner Sections

The double length liner sections were moved to the head of the shaft on dollies and when ready to start down the sloping shaft, the load was secured by hoist ropes on the dolly and on the pipe section itself. As it passed through the vertical curve, the leading pipe shoes came to bearing on the skid track in the shaft and the dolly dropped into a recess between these skid rails. When in contact with the adjoining lower section, the specified root opening was maintained by small bars spaced around the periphery. For lowering of pipe sections and handling of numerous welding, radiographing, concreting, and grouting skips, two hoists were required at each adit level, one of 40 tons and the other of 5½ tons capacity.

Installation of the liner sections up the shafts was started soon after the respective lower elbows had been positioned and encased with concrete. With transport established, a pipe section was lowered and tacked into place every 22 hours on the average.

To keep pace with this relatively fast rate of pipe delivery, it was necessary to weld circumferential joints simultaneously from several skips. Calculated volume of welds placed manually with 5/32, 3/16 and 1/8 in. E6016 low hydrogen

Fig. 48. Wye No. 1 eleven foot inlet at upper right.

rods is 20,300 cu. in. for joints at El. 211 between the elbow and turbine scrolls; 40,200 cu. in. from El. 211 to the upstream elbow at El. 1,685; 6,400 cu. in. in the upper raise to the downstream elbow at El. 2,596; and 2,500 cu. in. from that point to the upstream end of the steel liner. Normally the welding crews at a joint consisted of four men and weld deposition averaged 29 cu. in. per man shift.

Plate was preheated to about 400°F. and held at that temperature while welding. Heating was accomplished by a ring of resistance elements jacked against the inside of the pipe on each side of the joint to be welded. Underground field joints were radiographed by centering a cobalt 60 bomb of 1,000 milligram radium equivalent in the pipe cross-section with film tied around the entire outside surface of the joint. The overall average of weld repair in about 5,200 feet of radiographed manual weld was 2.4 per cent and the 2,940 feet of above ground automatic welds required only 0.2 per cent of repair. It is of interest to note that the percentage of weld repair decreased with increase of plate thickness and amounted to only 0.4 per cent for the 913 feet of welds in the heavy plate of the manifold.

The final operation on the underground welded joints was stress relieving by the low heat process, utilizing oxy-acetylene gas in two 6-in. wide heads at 10-in. centers, followed by a water quench.

### Backfill

Backfill concrete for all of the sloping portions and part of the horizontal portions of the 11-foot diameter penstock was produced by the intrusion-prepakt method in which the mortar fraction of the mix is pumped into previously placed coarse aggregate. For this purpose it was necessary to produce an aggregate in sizes between ½ and 3 in. and containing less than 5 per cent of sizes smaller than ½ in. Despite the special screening and washing at the main Kemano River aggregate plant, it was found necessary to rescreen and rewash at the portals, because of the production of fines in the several transport and handling operations and to exercise great care in placing around the pipe to avoid further breakage of particles. Screen analyses of aggregate as placed gave less than 1 per cent sizes smaller than ½ in.

Placing of coarse aggregate in the horizontal runs by combinations of belt conveyers and specially constructed blowers without attrition of the aggregate was particularly difficult, so that the contractor elected to place all concrete backfill at El. 2,600 and portions at El. 1,685 and downstream from Wye No. 1 at El. 210 with pumpcrete equipment. For placing of aggregate on the sloping runs of the penstock a 10-in. pipe was supported on the top centreline of the liner and filled with aggregate from hopper cars at the head of the shaft. With the pipe maintained full of aggregate, gates were burned in the sides of this slickline as filling of the annular space progressed upwards. Aggregate placing averaged 3 feet of penstock length per hour.

The first backfill concrete placed on the slope was in the lower 400 feet of the upper raise. With experience gained there, the upper raise was completed in one lift of 800 feet, then the lower raise backfilled in a single lift of 1,940 feet. The mortar which was pumped into the voids of the coarse aggregate consisted of approximately 7.15 parts by weight of sand screened to a fineness modulus between 1.6 and 2.0; 5.0 parts type II portland cement; 2.16 parts alfasil, plus 0.07 parts intrusion aid and 3.15 parts water. A laboratory investigation, using strain gages on a number of 10 x 20-in. cylinders, obtained approximate values of 0.17 for Poisson's ratio and established the secant modulus of elasticity as $(2.75 + 0.06t)\ 10^6$ psi. where $t$ is age in weeks.

Pumping equipment was located at El. 210 for the lower raise and at El. 1,685 for the upper raise, with booster pumps as necessary intermediate between the grouting skips and the bottom of the raise. Grout was injected into four holes at a time and in a sequence which advanced the grout surface on a slight slope downwards toward the invert of the shaft. 4,700 cu. yd. of grout to make 11,090 cu. yd. of completed backfill concrete was placed in the lower raise in 20 days, making an average progress of 4.0 feet per hour.

Numerous laboratory tests were run to determine a minimum age at which the concrete could safely be loaded. The following age-strength characteristics were obtained:

| *Age days* | *Ultimate strength, psi.* |
|---|---|
| 16 | 2,047 |
| 28 | 2,458 |
| 37 | 2,552 |
| 49 | 3,303 |
| 63 | 3,388 |
| 103 | 3,650 |

Measured temperature rise in the prototype concrete was from 48°F. to 75°F. and back to 50°F. in 14 days.

In order to make certain that the grout had in fact filled the voids and produced a relatively uniform quality and strength of encasement, numerous cores were taken through grout holes to the rock contact, particularly in the lower raise, where the rock must take larger loads. No check hole showed any unfilled voids in the aggregate or other conditions considered detrimental and very little grout was taken by these drill holes when attempting to consolidate the rock or to tighten up the concrete at pressures up to 300 psi.

Since the pH factor, temperature and other qualities of the reservoir water are considered generally favorable as respects corrosion, the penstock was put into service without interior paint, except for short test sections of five coatings in turbine branches No. 1 and No. 2.

Fig. 49. Wye No. 2 looking downstream through 7 ft. 9 in. inlet.

# Design and Construction

## of the

# Transmission Line

*by*

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**Not the least interesting and spectacular part of the Kemano-Kitimat development was the design and construction of the 51-mile transmission line. The design was required to be unusually heavy to withstand the severe climatic conditions and construction handicaps were as difficult as they could be. All these details are entertainingly discussed in this paper.**

Power for the Aluminum Company of Canada's smelter at Kitimat is transmitted across 51 miles of mountainous topography from the underground powerhouse at Kemano. Characteristics of both route and electrical load make the lines unique in many respects.

### Preliminary Investigations

Initial studies disclosed that a standard approach to transmission line design and construction would be unsuitable. In September, 1949, a helicopter reconnaissance of possible routes disclosed that access and the number of tower lines would be restricted by narrow valleys, steep ridges and alpine passes. Subsequent surveys confirmed that flash flooding and new channel formation by glacier-fed streams, snow movement, ice accumulation and high winds would be significant in structure design and location. The smelter would require an extremely reliable transmission system to maintain the continuous power demand of the aluminum reduction cells, which could be damaged by power outages. These severe mechanical and electrical conditions called for lines of robust design.

The shortest possible route between Kemano and Kitimat crosses an intervening mountain range via Kildala Pass, the only pass which affords suitable tower sites and reasonable access. It could be entered from the Kemano end by a ridge wide enough for two tower lines and crossed at 5,300 feet elevation, with descent on the Kildala side by spans between rock buttes.

As part of the early investigations, costs of the direct overland route were compared with costs of a route down the Kemano River and along tidewater to Kitimat. Because of the generally milder climate near sea level, it was reasoned that a longer 78-mile coastal alternative could be of lighter construction and that the saving in material, plus the longer working seasons, might compensate for increases in other construction costs, as well as for increased power losses. Once in operation, either scheme would need special maintenance equipment, such as helicopters, or work barges and aerial cableways, to repair any major break. There was no reason to assume that one route would be more vulnerable than the other to snow and lanslides, since protected tower sites could be found on both the mountains and on the coastal side-hills. Estimated construction cost of the coastal route exceeded estimates for the overland route, and annual charges against this difference in capital cost were considered more than enough to offset any possible difference in frequency and duration of outages.

Since no weather records were available, meteorological observa-

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Editor's Note: A photograph of Bruce Cooper was not available.

tions were begun at the end of 1949 for use in planning and subsequent operation of the transmission system. First data were obtained at three stations in the period from Autumn, 1949, to the Spring, 1951. The only observation station for the first winter was the base camp at tidewater at the mouth of Kildala River, on the west side of Kildala Pass. For the winter of 1950-51, additional stations were established at El. 3,000 in the upper Kildala River valley and at El. 5,300 on the summit of the pass. At both these points, twenty-foot spans of 795,000 cm. A.C.S.R. conductor were erected for studies of rime and ice formation. The first two years' weather record, though all too brief, helped to establish design criteria and indicated the living, working and flying conditions to be considered in construction and maintenance programs. Spring to fall weather is mild, but snow-melt and heavy rains keep the streams at high stage and both valleys and peaks are often under cloud. The frequency of electrical storms, however, is only about one in two years. To date, the periods from late December to early March have provided the worst weather. Snow depths have varied from 15 feet at the pass to three feet at tidewater, with extensive and rapid shifting of snow by high winds at upper levels. Although snow slides occur on the steep valley walls during winter and spring, there are enough isolated ridges and protected points which will be unaffected by snow movements and which are, therefore, suitable as tower sites.

Ice formation was frequent on the test span at the pass, where a maximum rime load of 2.4 lb. per foot of conductor was measured in February, 1951. Clear ice, which would have produced a conductor load of about 3.5 lb. per foot, formed on ground objects at Kildala Arm once during the two years. Although measured ice loads were light, it was recognized that heavier deposits could occur with a combination of observed wind, temperature and precipitation.

Winter temperatures seldom rose above freezing and dropped to extremes of −24°F. at the pass, and −17°F. on the upper Kildala River. During one storm, wind velocities reached 100 mph. at the pass and 70 mph. on the upper Kildala, but winds generally were gusty as a result of topography. Visibility for flying varied from an estimated 20 days per month in the late fall to five days per month in December and January.

#### Electrical Design

The electrical system was investigated on a network analyzer to determine the most satisfactory voltage and circuit combinations for the proposed generation, transformation, line length and number of lines. The resulting transmission system with very large conductors at high voltage is flexible and efficient.

The analysis brought out that a nominal voltage of 287 kv., phase-to-phase, was by a small margin the best voltage at which to transmit the ultimate load of 1,250,000 kw. In practice, the voltage at the Kitimat end of the line is held at about 275 kv. The voltage at the Kemano end will vary under different conditions, up to a maximum of 301 kv. Any savings in structures, insulation and transformers possible by transmission at the more common 230 kv. would be offset by a large increase in synchronous condenser capacity at Kitimat. Still higher voltages were precluded, primarily, by the limitations of available electrical equipment. 287 kv. was at or above the upper limit of voltage proven in service for oil-filled cable as required between powerhouse and transmission line, and line hardware for voltages above that voltage is special. Some additional assurance was afforded by the fact that transmission of 287 kv. had operated successfully for many years.

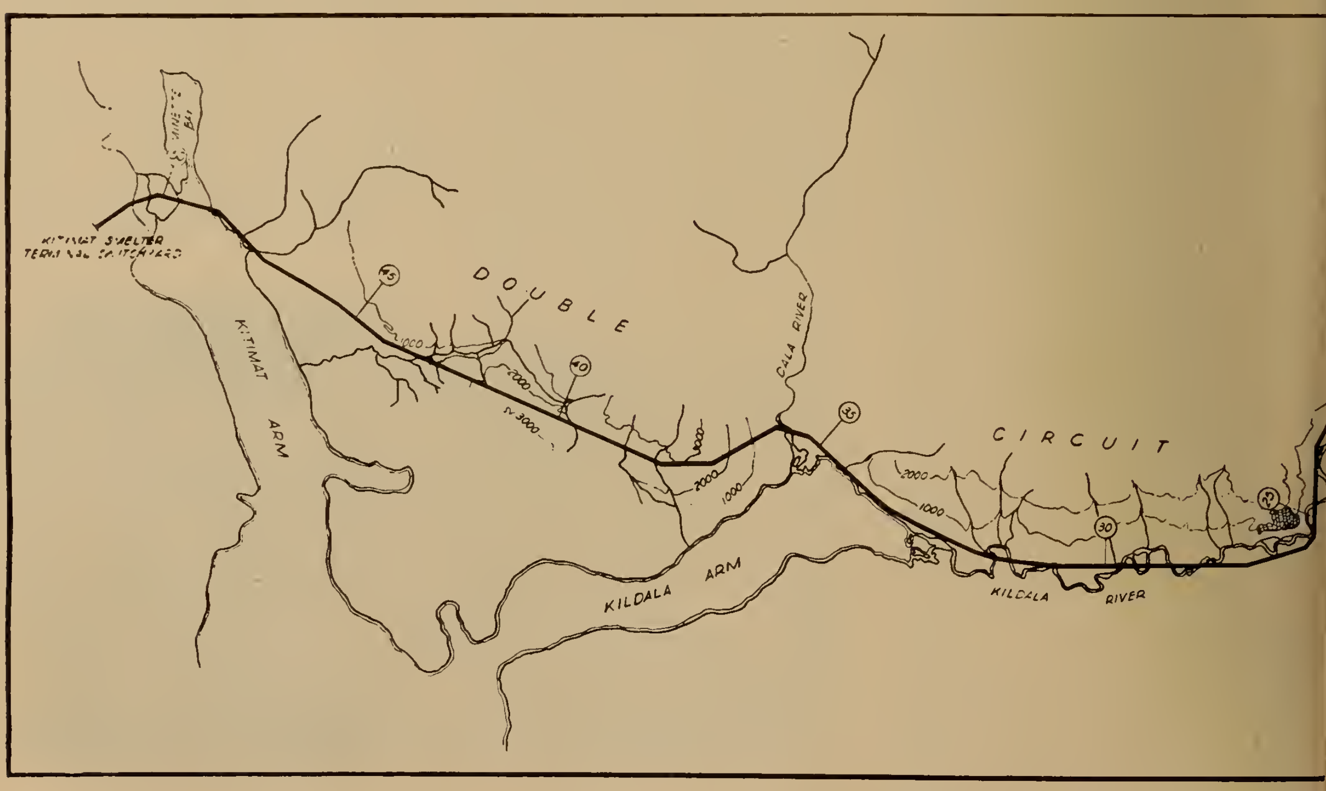


Fig. 50. Route of Kemano-

Circuit types were chosen for maximum of flexibility consistent with mechanical reliability. For the ultimate development, two double circuits with intermediate switching stations would give the best arrangement for isolating faulted sections and would require the least amount of synchronous condenser capacity. Double circuit construction was considered feasible over all sections of the route except through Kildala Pass, where vertical configuration of conductors, with steep spans and heavy loads, could not satisfy the specifications for reliability. Security could be obtained by using two single circuits over the entire route, but this arrangement lacked flexibility and needed the largest amount of reactive correction. The adopted scheme combines both circuit types into one line. Double circuits are used for the relatively accessible, lighter loaded, more regular profile and span sections in the valleys, while single circuits serve for the heavier loaded, irregular profile and span section over Kildala Pass. Switches between the double and single circuits, at both ends of the pass, permit several operating combinations.

Since the initial electrical load can be carried readily by half the transmission system, only one line on both double circuit sections was erected. However, the ultimate development of two single circuits was built to avoid reopening Kildala Pass in future for a second line. Disconnect switches are not installed at the switching stations between the double and single circuit sections; therefore, Kemano and Kitimat are joined by two independent circuits. Switching facilities and the additional double circuit lines will be built in the future.

Large conductors are required for the exceptional electrical and mechanical loads. Under emergency conditions, almost the entire ultimate load of 1,200,000 kv. may have to be carried on half the transmission system. A current of 2,600 amperes per phase on the single circuit calls for a conductor area of 3,300,000 cm., which is about twice the capacity of Falcon, the largest standard A.C.S.R. conductor. Falcon, with an area of 1,590,000 cm., was suitable for the double circuits. Accordingly, conductors were selected with the characteristics given in Table 1.

Insulators for all suspension and strain assemblies are standard 10 by 5¾ in. units. Double circuit suspension assemblies consist of 16 25,000-lb. clevis-type insulators in single or double strings, depending upon span length. Strings in triple or quadruple suspension assemblies, for the single circuit, are increased to 18 units to compensate for the lower insulation provided by each unit at the higher altitudes of Kildala Pass. Strain points on both single and double circuits are reinforced with two extra insulators per string, as future additions at these positions would be difficult. Dead-

**Table 1: Conductor Characteristics**

| | *Double Circuit* | *Single Circuit* |
|---|---|---|
| A.C.S.R. Code word | Falcon | Emu |
| Size Circular Mils | 1,590,000 | 3,364,000 |
| Stranding: Aluminum | 54 x 0.1716 in. | 108 x 0.1765 in. |
| Steel | 19 x 0.1030 in. | 37 x 0.1261 in. |
| Diameter, Steel Core, in. | 0.5150 | 0.8827 |
| " Complete Cable, in. | 1.5450 | 2.2947 |
| Weight, lb. per foot | 2.032 | 4.760 |
| Ultimate Strength, lb. | 55,400 | 135,400 |


Kitimat transmission line.

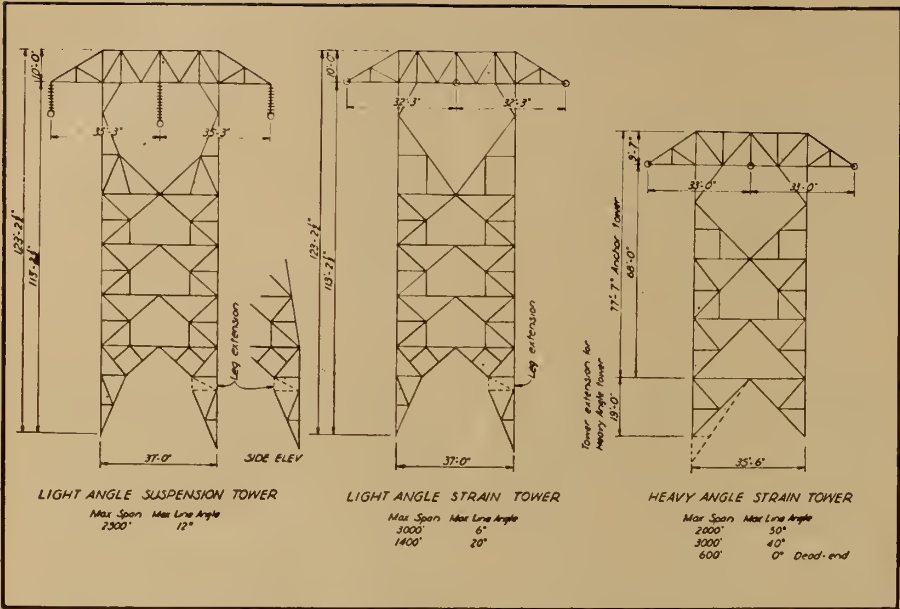


Fig. 51. Single circuit towers.

end assemblies, therefore, consist of three 18-unit strings of 25,000-lb. clevis-type insulators on double circuit, and six 20-unit strings on single circuit. Jumpers at strain positions are supported by 10 by 5¾ in. 15,000-lb. ball-and-socket-type insulators, assembled into 16-unit strings for double circuit and 18-unit strings for single circuit. In case of flashover at strain towers, this insulation unbalance between strain and jumper assemblies could protect the dead-ends from damage that might cause a major outage. Although use of standard insulators led to multiple string assemblies with somewhat complex hardware, this was an overall economy since stronger units were not commercially available.

Conductor clearances to tower members are based upon the impulse flashover characteristics of the suspension insulator strings. A 1,567-kv. design impulse level, for the 16-unit double circuit suspension assembly, fixed clearances at 8 ft. 4 in. for unloaded conductors and 6 feet for a 15-lb. per sq. ft. wind load on the bare conductors. Single circuit design impulse voltage across 18-unit strings was 1,743 kv., which required conductor-tower clearance of 9 ft. 2 in. for unloaded conductors, and 6 ft. 9 in. for conductors loaded only with wind at 15 lb. per sq. ft. Generally, tower framing and hardware provided these clearances, but on steep single circuit spans, it was necessary to check clearances from the center conductors to the members around the throat of the tower.

Ground wires are installed only at the transmitting and the receiving ends of the system. In order to protect switchyard equipment from possible lightning damage, two ¾-in. steel ground wires are placed over the double circuit sections for about one mile from both terminals. Elsewhere, ground-wire protection was considered unwarranted, since lightning storms are infrequent.

A deficiency of overburden along the route ruled against extensive grounding of the lines and counterpoise wire, to lower ground impedance for protection in line surges, would be damaged by water and snow movements. The only feasible grounding method was the removal of static charges by copper-weld ground rods at towers with concrete footings.

Conductors are transposed at the Kemano switching station between double and single circuits and again at the Kildala switching station. Transpositions were accomplished by making only slight modifications of the standard double circuit towers.

Corona was considered in the electrical design of both conductors and hardware. Power dissipated by corona discharge on the line will be negligible, since the diameter of Falcon conductor is greater than necessary for minimum corona loss for 287 kv. at sea level. Even at the pass, (El. 5,300), Emu conductor diameter is larger than required. All conductor-support hardware was designed to keep corona discharge to a minimum, but provision was made for the addition of anti-corona rings if required. Radio interference from corona is important only at the terminals and can be checked during operation.

Conductor de-icing by load transfers among sections of the line was regarded as impractical, because assumptions as to weather would be unreliable and also because there would be periods during construction and early operation when the lines would be carrying no load or too little load for effective ice prevention or removal. Consequently, the lines had to be designed for maximum reliability under full ice-loading.

### Mechanical Design

The selection of basic design loads was made from a study of records on other lines, from weather observed along the route, and from the service requirements of the system. Experiences with heavily loaded transmission lines elsewhere, though not directly applicable, were given close study. In the mountains of south-central France, conductor ice loads were reported at 13 to 27 lb. per foot, while utility companies in the United States Pacific northwest, with 230 kv. lines at 5,000-foot elevation, experience heavy icing, but not of the order of the above. It is their experience that conductor-failure from over-tension occurs only rarely, but unloading of ice accumulations causes structural and hardware damage, as well as short circuits. Their greatest trouble is distortion of members in the lower panels of towers by snow creep loads, or by heavy masses of snow and ice accumulated in the structure during rapid thaws. Vulnerability of structures to snow action in the mountains is confirmed by investigations made in Switzerland by the Avalanche Bureau. All these reports, in combination with the known and suspected weather conditions in the Kemano-Kitimat area and the exceptional degree of reliability demanded of the line, dictated exceptional design loads for all structures.

Accordingly, the following loadings were specified for the conductors:

*Single Circuit*

A: Ice-load of 40 lb. per foot of length at 0°F. to produce yield point stresses in tower members and to stress the conductor to its ultimate strength.

B: Radial ice of 2½ in. at 57 lb. per cu. ft. to produce design stresses in tower members.

C: Radial rime of 2 in. at 19 lb. per cu. ft., combined with wind at 8 lb. per sq. ft. of conductor projection, to produce design stresses in tower members.

D: Radial ice of ¾ in. at 57 lb. per cu. ft., combined with wind at 11 lb. per sq. ft. of conductor projection, to produce design stresses in tower members.

***Double Circuit***

A: Ice-load of 24 lb. per foot of length at 0°F. to produce yield point stresses in tower members and ultimate stresses in the conductors.

B: Radial ice of 2 in. at 57 lb. per cu. ft. to produce design stresses in tower members.

C and D: Same as C and D loads for Single Circuit.

The single circuit towers were all designed to resist the stress induced by the pressure and movement of deep snow, using the following loadings:

For all tower members from ground line to a height of 19 feet:

(a) Load of (3000-100$h$) lb. per lineal ft. of horizontal projection of member length, where $h$ is height in feet above ground line.

(b) Load of 300 lb. per lineal ft. of vertical projection of member length.

Towers for the specified loads and route topography have some special features. Double circuit towers and those of one single circuit line are conventional, four-legged, steel-lattice structures, but many details differ from those of towers designed to standards such as the National Electrical Safety Code. Besides exceptional strength and weight throughout to carry the heavy conductor loads, the single circuit towers have lower panels reinforced by channels and double angles to withstand the above snow-creep loads. Torsional forces transverse to the box crossarms became a factor of importance at strain towers on steep spans and first-panel legs of single circuit towers are vertical to reduce space requirements and simplify footing layout at the restricted sites in the mountains.

It was advantageous to adopt only a few tower types in each general classification. Variations in tower framing to suit the unorthodox loadings were minimized by using one tower type for several applications, leading to economies in fabrication and erection, which more than balanced the value of any excess material. Tower types and their capacities are detailed in Figs. 51 and 52. Tests on prototype single and double circuit towers established their adequacy for field erection and the specified loads.

The second line of the single circuit uses tubular aluminum towers of a unique design developed by Aluminum Laboratories Limited and described in an article which appears elsewhere in this issue of the *Journal.*

Supports on both double and single circuit towers are special to suit the extra-size conductors. Proof tests of suspension clamps designed for the job gave the above average strengths.

Curvature in the suspension clamps for both Falcon and Emu conductors is designed for a maximum vertical angle of 34°.

Tapered armour rods are used at all suspension points, except those of jumpers at strain towers. Armouring reinforces the conductor for vibration loads and protects the conductor from flashover damage. Corona loss at the ends of the armour-rodding is reduced by anti-corona ferrules. At jumper suspension points only flashover-protection, which is afforded by grading rings, is required. Standard design compression assemblies are used for the termination of conductors at strain towers. Special sleeves and compressors were necessary for the large conductors.

A wide variety of footing conditions were encountered along the line. In the valleys, double circuit towers are erected on footings suitable for gravel, talus, rock, muskeg or silt. Double circuit light suspension towers are built on steel grillage footings for sand and gravel, but concrete pad-and-pedestal-type

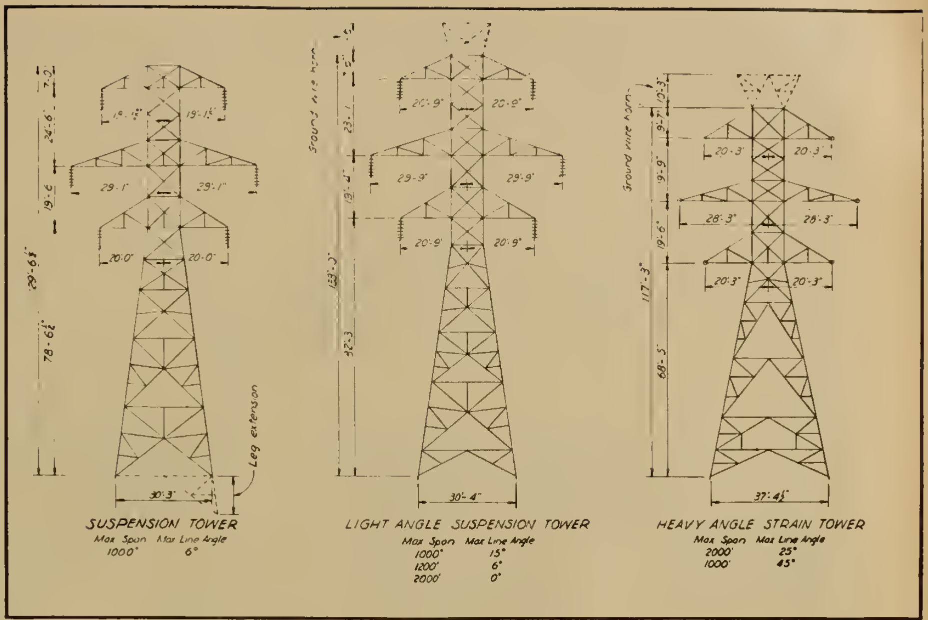


Fig. 52. Double circuit towers.

**Table 2: Average Strengths of Suspension Clamps**

| *Clamp for* | *Maximum vertical load, lb.* | *Maximum horizontal load-slip strength lb.* |
|---|---|---|
| Double Circuit, Falcon A.C.S.R. | 30,000 | 10,000 |
| Single Circuit, Emu A.C.S.R. | 75,000 | 30,000 |

Fig. 53. Double circuit towers.

Fig. 54. Helicopter landing platform.

footings are needed for the heavier towers. Some structures had to be located in detritus at the bases of valley walls and for these towers, talus-type footings were formed by consolidating a sufficient mass of rock with concrete. Towers based on bedrock use conventional footings of concrete pads and anchor bolts grouted into holes drilled in the rock. Pile-clusters, capped with concrete, hold structures in muskeg in the flat, low-lying, valley bottoms and in the silt of the tidal flats at the entrance to Kitimat. Footings for towers near glacial streams, which are prone to flash-flooding and course-changing, are specially designed to support towers with complete washout of backfill and to protect tower members from floating logs.

Most single circuit towers are founded on the typical granite or diorite of the Coast range mountains. Bases for light angle towers on rock are made up of stub legs set between two 12-in. I-beams, which are keyed by shear lugs to 6-in. concrete pads and held down by two 2¼-in. anchor bolts grouted into the rock. Foundations for towers in one talus area are tied, mass-concrete footings resting just below the surface of the rock rubble, extensive excavation of which might have precipitated slides as the slope recovered stability. Other footing types are special designs for glacial till and soft, biotite-rich diorite and concrete pad-and-pedestal footings in earth for a few towers.

The standard A.C.S.R. graphic method of conductor sag-tension calculations was suitable for design of double circuit spans, but a new method was developed for conductors on irregular single circuit spans. Sags and tensions for double circuit Falcon A.C.S.R. are based on a conductor tension at maximum design load of 27,700 lb. which is 50 per cent of ultimate conductor strength. Maximum accuracy with the graphic method is reached when the spans for ruling-span calculations are flat and of reasonably uniform length. Since sags of some inclined spans, the steepest of which rises 60 feet in 100 feet, deviated too widely from the parabolic assumptions of the graphic method, they were reconciled to equivalent spans for ruling-span computations by increments which were functions of the horizontal spans and the differences in elevation of the supports. The equivalent spans were effectually uniform for design since the length of the longest span in a series between anchors was not more than three times that of the shortest.

The graphic method for conductor sag-tension design was inadequate for the unique situation on the single circuit where towers are restricted to sites on the ridges, rock islands and ledges in the mountains. As a result, spans in a series are irregular and it was discovered that, even with adjustments for slope, the common approach to sagging would result in sag errors as high as 15 per cent. Also, standard A.C.S.R. sag-tension design could not be extended to deal efficiently with variations of required maximum design tensions from one series of spans to the next. A procedure was devised to overcome these difficulties and to enable stringing sags and tensions to be computed for any temperature and from any value of final design conductor tension, which in this case could reach a maximum of 68,000 lb. for Emu conductor.

Other features were considered in the sag and tension design of the conductors for the unorthodox spans. It was appreciated that the conductor, when in the stringing sheaves, would run downhill on the inclined spans, making sags correct only in those spans which were used for sag control. The suspension clamps, when clipped-in, were offset a specified distance from plumb lines at conductor support points to remove or to replace in each span sufficient slack to equalize horizontal tensions and to leave the suspension insulator assemblies hanging vertically. The behaviour of other lines indicates that both double and single circuit conductors should be free from damaging aeolian vibrations, since supports are reinforced with armour-rods and conductor tensions under average unloaded conditions never rise above 14 per cent of the ultimate tensile strengths of the conductors.

Fig. 55. Road from Kemano valley to Kildala Pass.

### Surveys

Ground survey parties pioneered lines in the valleys, along the ridges and over the mountains to obtain topographic data for tower locations and construction access. The surveyors were transported by helicopters and conventional aircraft and assisted by aerial mapping in the areas above tree-line, but in spite of these aids, it was a laborious and often hazardous task obtaining plans and profiles in a region previously traversed by only a few trappers and prospecters. The final surveys established that the nine miles of double circuit lines would leave the powerhouse switchyard at El. 250, follow the Kemano River and terminate at the Kemano switching station at El. 700. The single circuit lines would then rise to the summit of Kildala Pass at El. 5,300 in 3.6 miles and descend to Kildala switching station at El. 500, a total section length of 9.5 miles. The remaining 32.5 miles of double circuits would follow the Kildala River, cross Green mountain at El. 2,900 and traverse Minette Bay and tidal flats to the switchyard at Kitimat.

### Construction

Construction of the transmission lines was a planning and logistics problem of the first magnitude, involving working seasons of uncertain and short duration, particularly on the high ground. Work commenced in the fall of 1951 and was completed in September, 1954.

The first task was to move men and materials to the site of the line. Construction of a road up the Kemano valley from the base camp and supply centre at Kemano powerhouse site to the line switching station was relatively easy. This served the one section of double circuit, while part of the westerly, or Kildala, section was supplied through a dock at Kildala Arm and roads in both directions. This dock is about 70 miles by water from Kemano Bay. In similar fashion, supplies for the double circuit section from Green mountain to Kitimat were landed at Minette Bay and transported along construction roads. Access and supply for single circuit construction were maintained by continuations of the double circuit roads from both Kemano and Kildala switching stations. These roads met at the summit of Kildala Pass, but snows in the upper levels restricted straight-through passage for most of the working period. Roads to the summit of Kildala Pass, negotiable only by four-wheel-drive and track equipment, snaked their way along cliffs and over glaciers in a series of hair-pin curves with grades up to 30 per cent. All roads needed frequent repairs, as heavy rains and snow-melt sluiced the surfacing and created washouts.

Construction could not have proceeded as well without aircraft, which provided almost the only transportation in pioneering stages and were much used for moving men and materials quickly during construction. Single-engine, six-passenger Norseman and Beaver seaplanes supplemented water transportation by hauling personnel and light freight between Kemano Bay, Kildala Arm and Minette Bay. Bell helicopters, with a capacity of one passenger, or 300 pounds, and Sikorsky S-55 helicopters, with a capacity of 10 passengers, or 1,500 pounds, flew many ton-miles, particularly to Kildala Pass for single circuit construction. The Bells were

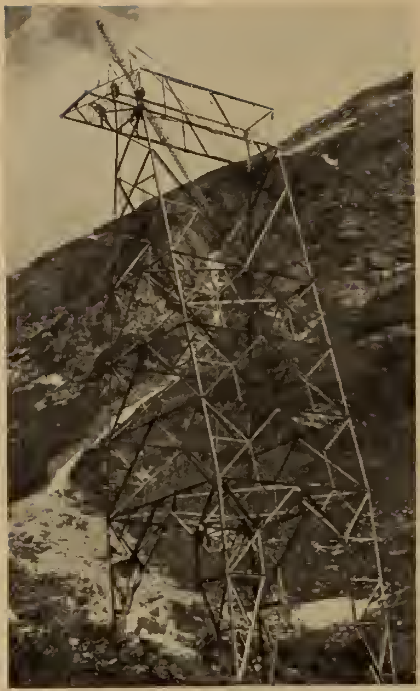

Fig. 57. Top: Compressing joint in "Emu" conductor.

Fig. 56. Left: Erecting single circuit tower with aluminum gin pole.

invaluable for moving men and light loads to any one of the six landing platforms near tower sites inaccessible by road, while the Sikorksy's biggest job was lifting fuel, prefabricated camp buildings and other supplies by cargo slings and dropping the loads where required.

Wherever feasible, roads were built to tower sites, but where the construction cost of a road was prohibitive, highline cableways, powered by gas-driven logging donkeys, moved material from stockpiles beside the main access road. Portable highlines served individual tower sites, but semi-permanent installations were needed for groups of towers.

Steel, cement, lumber and camp supplies were hauled up the steep grades by power wagons, six-by-six army trucks, and special body, short-wheelbase, multiple drive trucks powered by 200-hp. diesels. Four-wheel, dual-transmission drive jeeps were used almost exclusively for transporting personnel. Athey wagons, pulled by tractors, moved much heavy material before roads were built.

A wide variety of construction equipment was required to suit the differing conditions at tower footings. Draglines or backhoes were used for excavations in sand and gravel where ground water proved troublesome, despite heavy pumping with 4- or 6-in. gas-driven pumps. Concrete for double circuit tower footings was trucked to the sites from central mix-plants located at intervals along the right-of-way, while concrete for the small pads of most single circuit tower rock footings was hand-mixed at the sites. For the framed reinforced-concrete, single circuit tower foundations resting on talus, it was necessary to set up crushers, batchers and mixers for the total 2,600 cu. yd. of concrete. Most anchor bolt holes for rock footings were drilled by air hammers, supplied by portable compressors and by air lines up to 1,200

Fig. 58. Stringing operations on single circuit strain tower. Kemano valley in background.

feet long from larger compressors, but at some more inaccessible tower sites holes had to be drilled with portable gasoline-hammers. Special drill supports and tungsten-carbide-tipped bits were utilized to drill 3 in. x 9 ft. holes for double circuit footings and 4 in. x 9 ft. holes for single circuit footings. The anchor bolts were fixed in the holes with grout containing an admixture to prevent shrinkage and to give high early strength. Piles for footings in muskeg in the Kildala valley and in alluvium at Kitimat were driven by a double-acting hammer in leads hung from a dragline or crane and powered by two 500-cfm. portable, diesel air compressors.

Tower erection was carried out by crews in a production-line sequence. After delivery of steel to a tower site, groundmen assembled panels for an erection crew, which raised them into place with 25-ton motor cranes with 105-foot booms and 25-foot jibs. The tower was topped-out beyond reach of the crane by another crew working with a floating aluminum or wood gin pole and 25-hp. hoist. At sites inaccessible to the truck crane, towers were erected entirely with gin poles and member-by-member erection was resorted to at single circuit tower sites where there was no room for ground assembly. After all members were placed, still another crew tightened all bolts and inspected tower details.

Stringing the extra large conductors on both double and single circuits was surprisingly straightforward, although some unconventional procedures and equipment had to be developed. First, insulators and conductor sheaves were hung from the towers. Then stringing sheaves, with one large diameter wheel, or three smaller diameter wheels in line to reduce bending in the large conductors, were suspended by pendants adjacent to insulator strings and threaded with ⅞-in. pulling cables from a tractor-mounted winch to the conductor reels. All six conductors on double circuit towers were pulled at once from the reel carts. Only one single circuit conductor at a time could be strung, as it had to pass through a tension machine to keep the conductor above the rough ground and safe from damage. The stringing length of double circuit conductor between strain towers was from one to two miles. Single circuit strain towers are much closer together, therefore stringing lengths were much shorter. Sizes of reels for transport and handling limited the maximum conductor lengths to 2,360 feet per reel for Falcon and 2,200 feet per reel for Emu, which increased the number of compression joints in the line. A gasoline-powered hydraulic compressor, instead of the conventional manually-operated type, was necessary for the large compression-joint and dead-end assemblies. Required sags were set in one or two spans of the series, being strung by sighting with a transit and controlling the winch operation by radio. Fog, clouds and rough terrain often reduced visibility and blanked out radio signals. The final stringing operation was the application of armour rods and the clipping-in of conductors to suspension insulator assemblies.

The lines have performed satisfactorily since the beginning of plant operations early in July, 1954, but unusual provisions have been made for inspection and maintenance. Since it will not be feasible to keep the access roads in good condition, permanent timber shelters for equipment and personnel have been built along the route. Repair crews, when required, will be flown by helicopter to these shelters, where some supplies and replacement parts will be stored. Observations of weather, snow movement and icing are being continued for a few more years by men housed in the shelter nearest Kildala Pass. √

**Fig. 59. Kildala Pass in winter, before completion of stringing operations on left line.**

# Aluminum Towers on the Transmission Line

*by*

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**One of the single-circuit transmission lines from Kemano to Kitimat uses aluminum towers, the other uses the conventional steel towers. These aluminum towers are of novel design and construction, both of which are described in considerable detail in this paper. In their short operating life of less than a year they have completely lived up to expectations. It may well be that such towers will find wide use where their light weight simplifies transportation and their streamlined contour will reduce snow, ice, rime, and wind loads.**

### Introduction

This paper deals with a major innovation in supporting structures for high-voltage transmission lines, as applied to the single-circuit aluminum towers used on the Kildala Pass section of the 300 kv. Kemano-Kitimat system of the Aluminum Company of Canada, Limited, (Alcan) in British Columbia.

After discussing general considerations, the paper deals with investigations made on a tower designed and fabricated for test purposes. After consideration of the findings from this test tower, various aspects of the final design are presented. The paper then discusses fabrication and erection of the towers as finally designed.

The relative economy of aluminum towers as compared with conventional steel towers is dealt with, field investigations and observations on the aluminum towers are discussed and certain findings presented.

### Principal Features of Transmission Line

The left hand line, in the direction of power flow, in the Kildala Pass section utilizes a unique type of transmission tower, fabricated essentially from aluminum, as shown by Fig. 60. The right-hand line uses conventional lattice-type galvanized steel towers. Both lines carry the same 3,364,000 cm. ACSR conductors.

The power line carried by the aluminum towers starts at Tower No. 103L, at El. 1,000 above sea level in the Kemano River Valley, and climbs over a distance of approximately 7,000 feet in a slightly S-shaped route to El. 3,600, at Tower No. 109L, on Twin Peaks. From this point the line descends and attains its longest span of 2,592 feet between Towers Nos. 110L and 111L. Climbing again to the maximum altitude in Kildala Pass, at El. 5,300, at Tower No. 116L, the line is mostly in a narrow gully known as "Glacier Creek draw." Descending, it spans 2,184 feet over the snout of a glacier between Towers Nos. 117L and 118L, and thence drops into the Hanging Valley at the Kildala end of the pass.

Due to the irregular terrain, the line is far from straight. There are only a few towers on the line with tangent spans. The maximum angles in the line are 41°-01′ and 32°-00′. Towers Nos. 132L and 135L are subjected to the heaviest loads due to line deflection. Tower No. 137L, at El. 720, is the last aluminum tower at the Kildala end of the single-circuit transmission line.

Through Kildala Pass both single-circuit lines run side by side, but, due to the rugged topography, they are not parallel. Limited latitude for location of the towers existed in some sections because of the rocky hummocks and the risk of snowslides. As a result, the left-hand and right-hand lines occasionally approach each other, so that only the minimum acceptable centre-to-centre separation exists.

In a total length of 45,320 feet, the transmission circuit with aluminum towers involves 34 spans, distributed as follows:

5 spans of between 2,000 and 2,592 feet.
7 spans of between 1,500 and 2,000 feet.
13 spans of between 1,000 and 1,500 feet.
9 spans of between 634 and 1,000 feet.

There are a total of 19 suspension and 16 strain towers, the height varying from tower to tower.

Heights of these 35 towers are as follows:

8 towers from 128 feet to 139.5 feet high.
13 towers from 113 feet to 125 feet high.
9 towers from 91 feet to 111 feet high.
5 towers from 74 feet to 89 feet high.

The height of tower given here is the average vertical height of all legs from the concrete footing to the bottom of the cross-arm.

**General Considerations**

At the time the decision to build the second of the two single circuits was taken, the Korean war interfered with securing the necessary tonnage of galvanized steel, so those responsible for the design turned to aluminum.

Aluminum as a material for transmission-line towers has many merits. Among these may be noted:

> Its light weight, approximately one-third that of steel.
> Its ease of fabrication.
> Its freedom from corrosion.

Light weight was an important factor in the case of the Kemano-Kitimat transmission line. In the first place, the tower material had to be transported from the fabrication plant which was located in Victoria, B.C., to the end of water transportation at Kemano Bay, Kildala Bay and Kitimat Arm. There it had to be unloaded from barges and reloaded on trucks and hauled and distributed to the tower sites along the transmission-line route. Because of the rugged terrain, actual transporation to the various tower sites involved truck delivery in a few cases, highline (construction cableway)delivery in many cases and anticipated helicopter delivery in others.

It was this helicopter transportation which established limitations on length, size and weight of members. Even in the case of highline delivery, much the same conditions existed. The lower weight of the aluminum towers as contrasted with steel was thus an essential factor.

An additional advantage of aluminum, embodied in its light weight, is ease of erection which carried with it an inherently lower labour requirement for erection.

Another advantage of light weight was the possibility of erecting the towers by means of simple, lightweight, manually-operated equipment, especially applicable in the case of the aluminum towers.

The light weight of aluminum also made for greater ease of fabrication.

Galvanized steel is particularly subject to attack by corrosion during transportation by barge over salt water, even in pure atmospheres such as that of British Columbia. Development of corrosion in such atmospheres is normally slow, but where the galvanizing is damaged, corrosion may develop fairly rapidly. Aluminum tower members are free from such corrosion.

An important factor of the aluminum towers dealt with in this paper is safety of workmen, both during erection and during maintenance. A steel tower, when covered with ice, snow and rime, provides treacherous footing at best and workmen are exposed to the elements. On the other hand, the tubular legs of the aluminum tower, with permanently installed ladders inside, permit safe and sheltered access to its top and through the cross-arm to the conductors.

**Loading Specifications**

Design of the towers is based on an unusually heavy loading. Three factors exercised major influences:

> Climatic conditions, due to the influence of the orographic features on the warm moisture-laden air masses moving inland from the Pacific ocean.
>
> The high capacity conductors necessary with the heavy electrical loading dictated by the limitation in the number of circuits arising from topographic restrictions.
>
> The large deflection angles in the line, the long spans and the sharp breaks in the general slope of the terrain, arising from topographic conditions.

At the time design had to be undertaken, available information as to climatic conditions, was extremely sparse. There were no inhabitants along the route of the line, except for a few Indians near Kitimat. Consequently, in the fall of 1950, an experimental span of 795,000 circular-mil ACSR was erected between two 26-foot high aluminum towers, at El. 5,300 on the summit of Kildala Pass, some 2,000 feet above the timber line. Observers were stationed along the transmission route and the site of the test span was provided with recording instruments. The maximum ice loading observed during the winter of 1950-51 was 2.4 pounds per foot. However, conditions occurring during the one winter are not necessarily the most severe which can arise.

The aluminum towers were designed to the same loading specifications as the steel single-circuit towers*, which are repeated here for convenience:

A: Ice load at 40 pounds per foot of conductor at 0°F. Horizontal component of the conductor tension = 120,000 pounds maximum. This may be described as a yield-point load.

B: 2.5 in. radial ice deposit on the conductor. Horizontal component of the conductor tension = 65,000 pounds. Horizontal pull normal to the cross-arm, $P = 10{,}000$ pounds, at each point of conductor support.

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*The reference is to the loads given for single circuit towers, under the heading "Mechanical Design" on page 1424 of the paper "Design and Construction of the Transmission Line."

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**Fig. 60. Erection of aluminum tower.**

$B^1$: 60 percent of B loads, except $P = 45{,}000$ pounds, at each point of conductor support.

C: 2.0 in. radial deposit of rime on the conductor combined with wind of 8 pounds per square foot. Horizontal component of the conductor tension = 35,000 pounds. $P =$ 10,000 pounds, at each point of conductor support.

D: ¾ in. radial deposit of ice combined with wind at 11 pounds per square foot and broken conductor. Horizontal component of conductor tension = 31,000 pounds. At the suspension towers, $P =$ 22,500 pounds at any one point of conductor support. At the strain towers, $P = 25{,}000$ pounds at any one point of conductor support.

The following secondary loads are also used:

Dead weight of tower legs and cross-arm.

Wind load at 20 lb./sq. ft. on circular surfaces and 40 lb./sq. ft. on flat surfaces. Wind loads are supposed to act in the direction of $P$ or $T$ (transverse) loads.

Snow load corresponding to 6 inches of ice on all surfaces, including the legs, and snow-creep pressures on the legs under three categories, varying with the depth of snow and with the slope and roughness of the ground:

Normal load 33,000 pounds in 20-foot depth of snow, with a ground slope of 20°.

Light over-load of 49,500 pounds in 20-foot depth of snow, with a ground slope of 40°.

Heavy over-load of 66,000 pounds in 20-foot depth of snow, with a ground slope over 40°.

The 6 inches of ice is assumed to act simultaneously with snow-creep pressures.

#### General Type of Structure

The aluminum transmission-line towers are braced H-frame structures, which utilize, in general, five thin-walled tubular aluminum legs of 38-inch overall diameter. The legs carry a box-girder aluminum cross-arm, as illustrated by Figs. 60 and 61. The tower legs are arranged as an A-frame and a tripod. The cross-arm rests freely on caps, guided by pins. The caps are bolted to the heads in which the legs of the A-frame and the tripod terminate. There are, however, two towers on the line, where two tripods are used, the A-frame being replaced by another tripod, because of large deflection angles there.

The tubular legs are composed of sections bolted together inside. They are anchored to the rock foundations, or to the concrete foundations by means of four or more 2-inch bolts, grouted into holes drilled to a sufficient depth to transfer the tensile loads in the tower legs to the foundations.

The tubular leg section provides excellent strength and stability under unusually heavy axial loads and the severe moments arising from the snow, rime, ice and wind loading. Heavy icing on the conductors, on insulators and on the tower itself results in loads not usually encountered in power-line design. Snow on sloping terrain, to a depth of 20 feet and more, can occasion heavy creep pressures. The moments on the tower legs from snow-creep pressures must be taken into account. These factors led to developing the tower described, which would perform satisfactorily under the severe climatic conditions to which it would be subjected, without incurring the hazard of being turned into a more or less solid mass of snow, rime and ice, with a large area exposed to wind pressure.

Although the towers are mostly aluminum, welded mild-steel plate was used for the shoes, leg tops and caps, all galvanized after fabrication, largely because time available did not permit the necessary experimentation with these relatively complex members. Galvanized high-tensile steel bolts were also used for the clamp-type inside joints of the legs, shoes and leg tops.

The overall result is a line structure with relatively smooth exterior surfaces and with a minimum tendency to snow and rime accumulation.

#### Design Considerations

The aluminum towers must carry a mechanical loading derived from the principal loads as stipulated, combined with secondary loads, consisting of vertical, longitudinal and transverse components acting on the cross-arm at the three points of conductor attachment I, II, and III, with the cross-arm, a simply-supported beam, resting on the top of the A-frame and the tripod, as in Fig. 62. The geometry of the tower was based on design requirements as follows:—

Minimum distance between conductors, 30 feet.

Maximum insulator swing for strain towers, 30°.

Maximum insulator swing for suspension towers, 36°.

Clearance between conductor and tower at the point of maximum swing, 7.75 feet.

Length of the insulator string:

For strain towers, 11 feet at line angles up to 22°,

For strain towers, 12 feet at line angles up to 45°,

For suspension towers, 13.625 feet.

Angles adopted at the intersection of tower members:

For legs Nos. 1 and 2, 23°
" " " 3 and 4, 23°
" " " 5 and 1, 2, 25°

The angle of intersection is a design consideration, because it involves a relationship between the strength and stability of the legs under severe loading conditions and puts general limitations on the length of the tower legs.

The loads at the points of conductor support were calculated for every individual tower from the loading conditions described, based on the limits of tower application as to span, slope of span and line angle. Individual load components at points of conductor support were figured from the loading specification, in the following manner:

Vertical load, $V$ = dead weight of conductor + ice load on conductor + weight of insulator assembly.

Horizontal load in the direction of the axis of the cross-arm, $T$ = $2 \sin \frac{\phi}{2} \times$ horizontal component of conductor tension where $\phi$ is the line angle.

Controlling cases of the above loading were figured and the $V$, $T$, and $P$ component loads in the cases of $A$ and $B^1$ loads were increased by 5 per cent and for $B$, $C$, and $D$ loads by 50 per cent, in order to obtain loads consistent with the permissible stress in the structure at yield point.

Dead weight, wind loads and snow loads acting on the tower legs produce both bending and normal forces. Bending moments were calculated at three sections—at the top, at the middle and at the bottom of the legs. For design purposes the actual moments were increased by 5 per cent for $A$ and $B^1$ loads, and by 50 per cent for $B$, $C$, and $D$ loads.

The eccentric application of the $P$ load components through the insulator yokes onto the cross-arm results in torque in the cross-arm and bending in the tower legs.

An additional contribution to the moments in the tower legs from

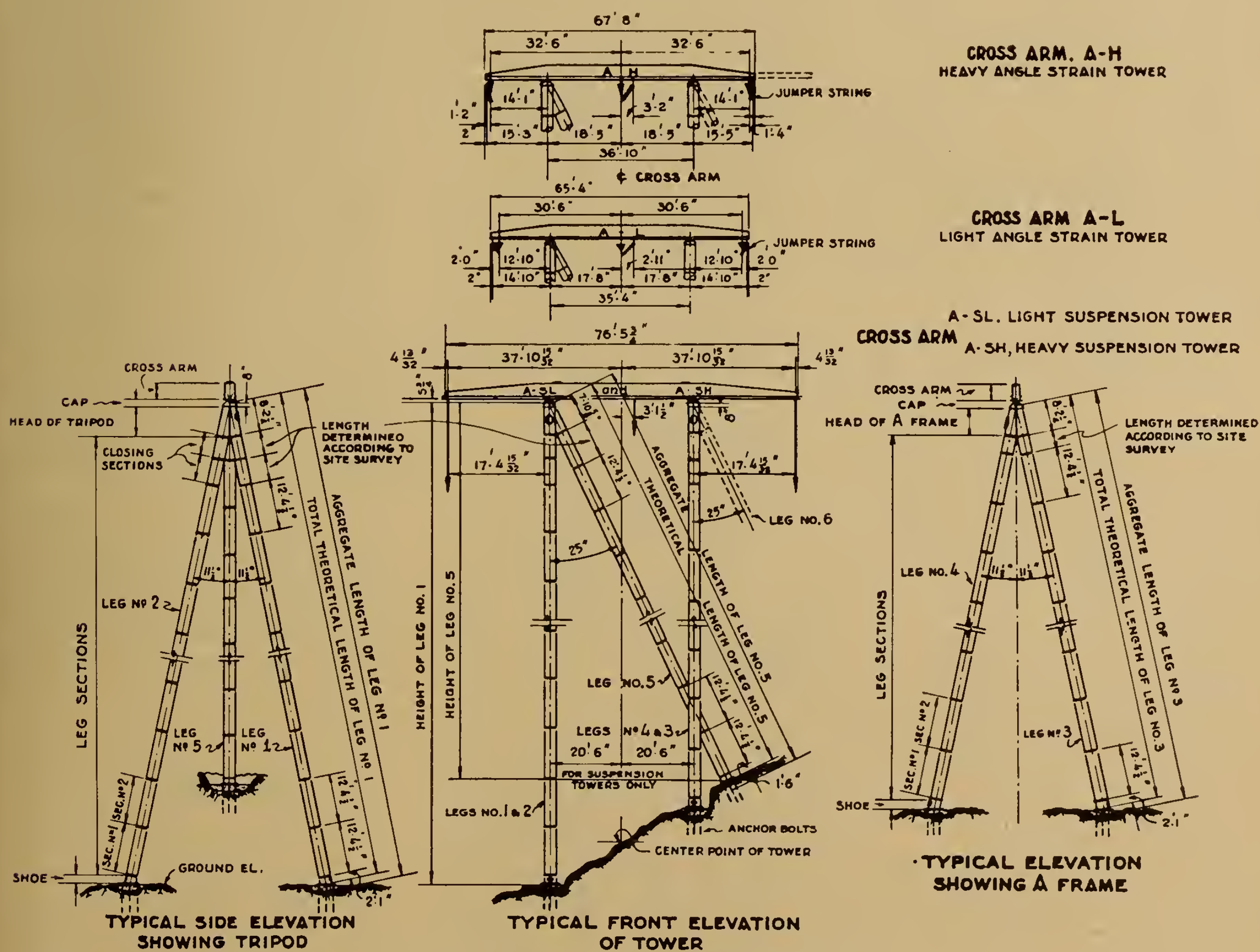



Fig. 61. Typical elevations of aluminum towers.

**Table 1: Maximum Principal Loads on the Cross-arm in Kips**

| Load components | $A$ | $B^1$ | $B$ | $C$ | $D$ |
|---|---|---|---|---|---|
| (1) Light-type cross-arm for the strain towers: | | | | | |
| Vertical load, $V$ | 82.5 | 40.0 | 37.9 | | 17.0 |
| Horizontal load in direction of the cross-arm, $T$ | 29.2 | 41.7 | 15.8 | | 14.9 |
| Horizontal load in direction 90° to the cross-arm, $P$ | 0 | 45.0 | 10.0 | | 25.0 |
| (2) Heavy-type cross-arm for strain towers: | | | | Not significant | |
| $V$ | 100.5 | 39.2 | 45.7 | | 20.0 |
| $T$ | 85.9 | 39.8 | 46.5 | | 29.8 |
| $P$ | 0 | 45.1 | 10.0 | | 25.0 |
| (3) Light-type cross-arm for suspension towers: | | | | | |
| $V$ | 78.7 | Not applicable | 34.7 | | 15.3 |
| $T$ | 25.2 | | 13.6 | | 13.5 |
| $P$ | 0 | | 10.0 | | 22.5 |
| (4) Heavy-type cross-arm for suspension towers: | | | | | |
| $V$ | 115.1 | | 50.5 | | 20.3 |
| $T$ | 20.8 | | 11.3 | | 9.8 |
| $P$ | 0 | | 10.0 | | 22.5 |

temperature gradient was considered, as a result of the difference in temperature on opposite sides of the shell of the leg. One side of the leg, when exposed to the heat of the sun, will expand to a greater degree than the other side, so the leg tends to assume a slight bow. Obersvations made on the test tower indicated that adoption of a temperature difference of 15°F. would be justified for design purposes.

Finally, the compression and extension of long tower legs under the influence of large primary loads is the source of displacements at their tops. The secondary moments due to this tendency to displacement of the top were taken into account.

The load combinations studied were:

1. $A$, $B^1$, $C$, and $D$ loads, combined with dead weight + snow loads.

2. $C$ and $D$ loads, combined with dead weight + wind loads.

In general, the maximum snow loads were not combined with maximum wind loads. From the load combination the limiting conditions were selected.

The following types of towers were designed:—

1. Light-angle strain towers, for line angles up to 23°-49′.
2. Heavy-angle strain towers, for line angles up to 41°-01′.
3. Light suspension towers, for line angles up to 13°-08′.
4. Heavy suspension towers, for line angles up to 8°-28′.

Types 1 and 2 were governed by the line angle, while Types 3 and 4 were governed by the magnitude of the principal loads.

Four different cross-arms were designed, applicable with tower legs designed for the specific loading due to the supported spans and site conditions, loadings being as given in Table 1.

The legs of each tower were designed for the individual principal loads and checked for secondary stresses from the action of principal and secondary loads on the tower.

In order to provide the necessary adjustment in the height of the individual towers, i.e., in the length of the individual tower legs, the following provisions were made:

The height of the tower, the average vertical height of the cross-arm above the ground, could be increased up to 14 feet.

The individual length of each leg could be increased by 5 to 14 feet, with some few exceptions for legs close to 150 feet in length, e.g., the length of the legs for the purpose of stress calculations was rounded out as follows:

Theoretical leg length 86 to 95 feet, taken as 100 feet.

Theoretical leg length 96 to 105 feet, taken as 110 feet.

In addition to these design margins, not expressed in the usual safety factors, the following design assumptions tend to increase the actual safety factors:

1. No deductions for the length of the rigid leg top and the depth of the caps were made; on the other hand, no increase in the length on account of the foundation below the leg shoe was allowed. The effect is that the assumed buckling length of the legs is not 0.7 of the theoretical length (as valid for the fixed footing and articulated top), but the coefficient varies from 0.84 for 50-foot legs to 0.74 for 150-foot legs.

2. No allowance was made for the fact that, in some of the legs, the bottom section and, in some cases, also the second section, were made of aluminum plate with a greater thickness than the rest of the sections. This increase in stiffness of the leg, which would increase still more the above coefficient, was not taken into account.

While there was no special problem in including Items 1 and 2 in the stress calculations, it was felt that the time required to deal with them was out of proportion to possible gains in economy.

For practical reasons, the number of thicknesses of leg sections was kept to a minimum. Design was based on the assumption that the steps in value of sections would be approximately as follows:

Section area ........... 10 per cent
Section modulus ....... 15 "
Moment of inertia ...... 20 "

An overall diameter of 38 inches was selected for all tower legs to achieve minimum weight and requisite strength, and this diameter gave a circumference close to twice the maximum five foot available width of Alcan 65 S-T aluminum plate, which permitted fabricating the leg sections with two longitudinal seams. This diameter also permitted easy access to all parts of the legs; the adoption of leg heads and shoes of corresponding diameter and of identical overall dimensions for all tower legs was convenient.

Limitation of the minimum plate thickness to 3/16 inch and of the maximum to ⅜ inch, with variation of thickness in steps of 1/32 inch, reduced the number of different leg sections to seven.

The procedure employed for stress calculation embodied three general rules:

The principal loads were determined as exactly as possible, based on weight- and wind-spans between towers. The weight-span is the horizontal distance between the apexes of the catenaries of adjacent spans, while the wind-span is the average length of adjacent spans.

The secondary loads, as well as their various combinations, were determined somewhat less exactly, but the error is on the safe side.

The secondary stresses were calculated as exactly as possible, neglecting influences and combinations of influences, which do not contribute in any appreciable extent to the total stress.

Finally, it should be noted that the process of stress calculation for the legs was identical for all towers.

*Normal forces in tower legs*

The load components $V$, $T$, and $P$ produce normal forces in the legs of the tower, which were calculated from the formulas below, with the notation shown by Fig. 62.

For $V$ components, acting at points I, II and III, force in legs is

Legs Nos. 1 and 2,

$$-\frac{1}{2}\left(1+\frac{a_1}{a}\right)\times\frac{V}{\sin 78\frac{1}{2}^\circ}$$

Legs Nos. 3 and 4,

$$-\frac{1}{2}\left(1+\frac{a_2}{a}\right)\times\frac{V}{\sin 78\frac{1}{2}^\circ}$$

Leg No. 5, *0*

For $T$ components, acting at points I, II and III, force in legs is

Legs Nos. 1 and 2,

$$\pm\frac{3}{2}\times\frac{T}{\tan 25^\circ\times\sin 78\frac{1}{2}^\circ}$$

Legs Nos. 3 and 4, *0*

Leg No. 5,

$$\mp\frac{3}{2}\times\frac{T}{\sin 25^\circ}$$

For $P$ components assumed acting at points I and II, or II and III, force in legs is

Nos. 1 and 2,

$$\pm\frac{1}{2}\times\frac{P\,(a+b+a_1)}{a\sin 11\frac{1}{2}^\circ}$$

Nos. 3 and 4,

$$\pm\frac{1}{2}\times\frac{P\,(a+b+a_2)}{a\sin 11\frac{1}{2}^\circ}$$

No. 5, *0*

In the formulas above (−) denotes compression and (+) tension.

*Dimensioning the legs for the normal forces*

The legs were checked first for the centric tensile forces. The stress on the net sectional area of the leg shell was based on the yield point of the aluminum sheet, 35,000 psi.

The subsequent checking of the legs for compression involved both a study of the general buckling strength of the legs and the determination of the maximum stress in bending due to the bending moments and normal forces in the tower legs.

The critical stress in general buckling on the gross sectional area of the sheet was based on the formulas:

$$46{,}000-384\,\frac{l_k}{i},\ \text{when}\ \frac{l_k}{i}<81$$

(elastic range)

$$\text{or}\ \frac{102{,}000{,}000}{\left(\frac{l_k}{i}\right)^2},\ \text{when}\ \frac{l_k}{i}>81$$

(semi-elastic range)

Where $l_k$ = buckling length, $i$ = radius of gyration.

Tests on the test tower proved the applicability of these formulas to the design of the large diameter leg sections.

The deflection at the centre of the leg was computed from the direct acting secondary loads, from the eccentric application of the $P$ loads, from the temperature gradient (15°F.), and from the secondary influence of primary loads.

Graphs for the reduction factors were used for the determination of the permissible buckling stress under eccentric loadings of the legs for the fictitious slenderness ratios $\frac{l_k}{i}$ and eccentricity ratios $m=\frac{er}{i^2}$.

Where $e$ = eccentricity in inches.
$r$ = radius of circular shell section in inches.
$i$ = radius of gyration in inches.

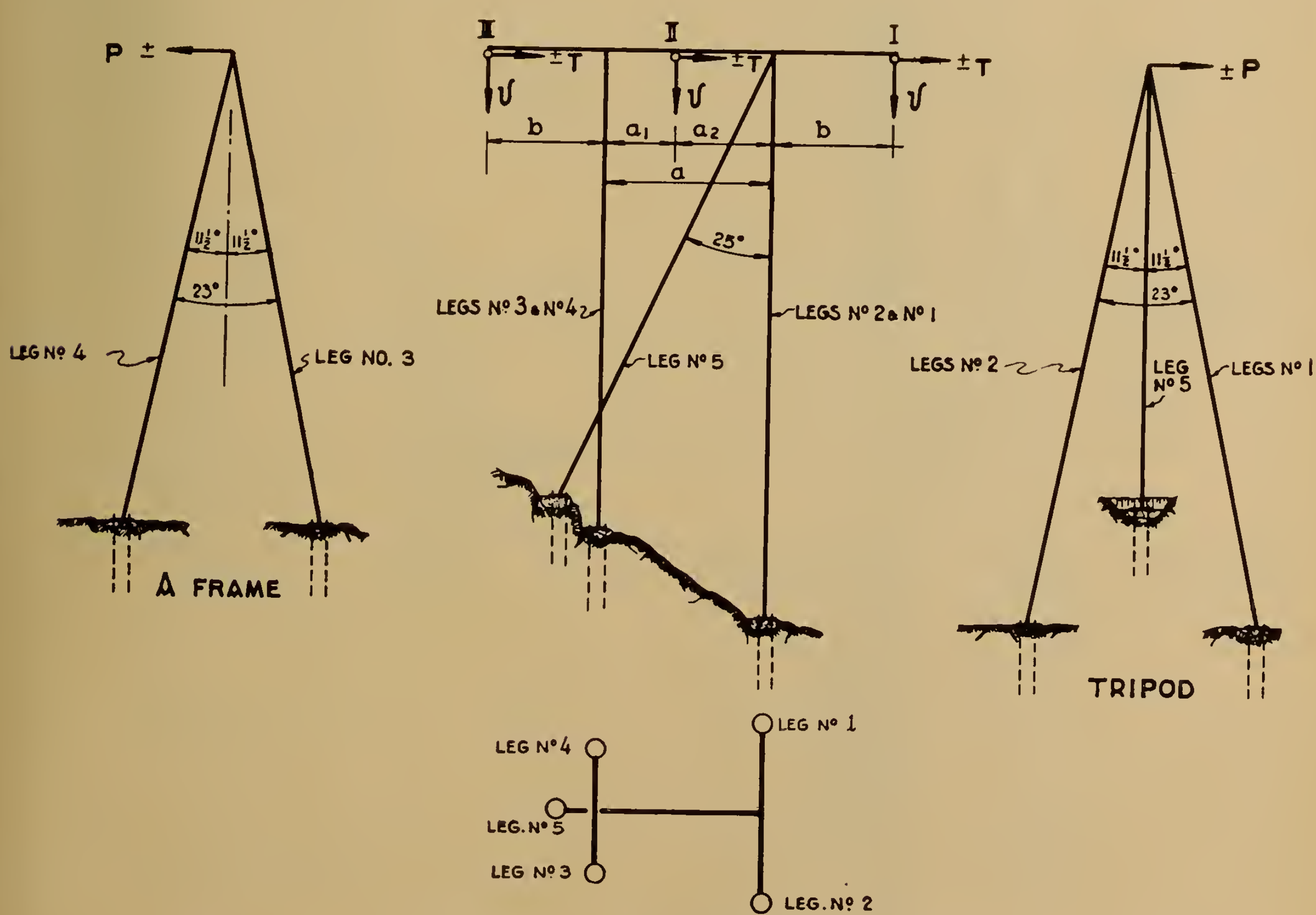



Fig. 62. Basic diagrams for aluminum towers.

**Table 2: Loads in Kips at All Three Points of Conductor Support**

| Type of Load | $A_1$ | $A_2$ | $B_1$ | $B_2$ | $D_2$ |
|---|---|---|---|---|---|
| Vertical load, $V$ | 138.0 | 66.0 | 62.5 | 31.0 | 14.0 |
| Horizontal load in direction of the cross-arm, $T$ | 11.0 | 41.5 | 5.0 | 20.0 | 13.0 |
| Horizontal load in direction 90° to the cross-arm, $P$ | 0 | 0 | 10.0 | 10.0 | 25.0* |

*at any point.

The multiplication of the critical centric buckling stress by the reduction factor gives the critical stress for eccentric buckling. This stress is lower than the yield strength of the material, i.e., less than 35,000 psi on the net area of the leg shell.

***Dimensioning the legs for bending moments***

Dimensioning the legs for bending moments and normal forces involved a stress analysis of the shell of the leg against both the tensile stress and the critical local buckling stress in compression.

Bending moments from secondary loads, i.e., from wind and snow loads on the legs, from the 15°F. temperature difference in the leg shell and from the rigid A-frame top under the action of the normal forces in the legs, were calculated at the top, at the middle and at the bottom sections of the legs. The permissible tensile stress was fixed at less than 35,000 psi, on the net area in these sections of the leg.

Maximum compressive stress was computed at the middle and at the bottom of the leg. The permissible value had to be smaller than the critical local buckling stress and below 30,000 psi.

The critical local buckling stress was figured for the leg sections manufactured from various thicknesses of sheet, based on the formula:

$$46{,}000 - 384\frac{l_k}{i}$$

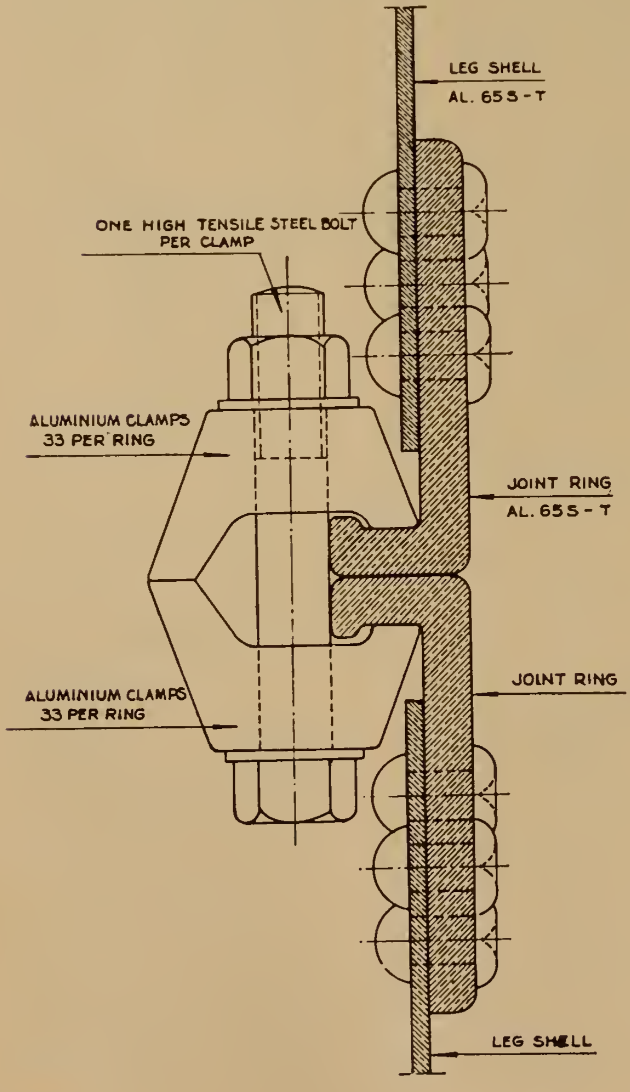
Where

$$\frac{l_k}{i} = 5.7\sqrt{\frac{d}{2t}}$$

$d$ = diameter of leg in inches.
$t$ = thickness of sheet in inches.

Tests on the legs of the test tower indicated that this formula could be used for the fictitious slenderness ratio $\frac{l_k}{i}$ and for the particular size of tubular section, with two longitudinal seams, adopted for the legs, for which information was non-existent.

For a few cases where the maximum compressive stress was in excess of the limit, mainly due to snow-creep pressures, the thickness of the first leg section was increased. All other sections in the leg, up to the top, have the same sheet thickness as adopted on the basis of



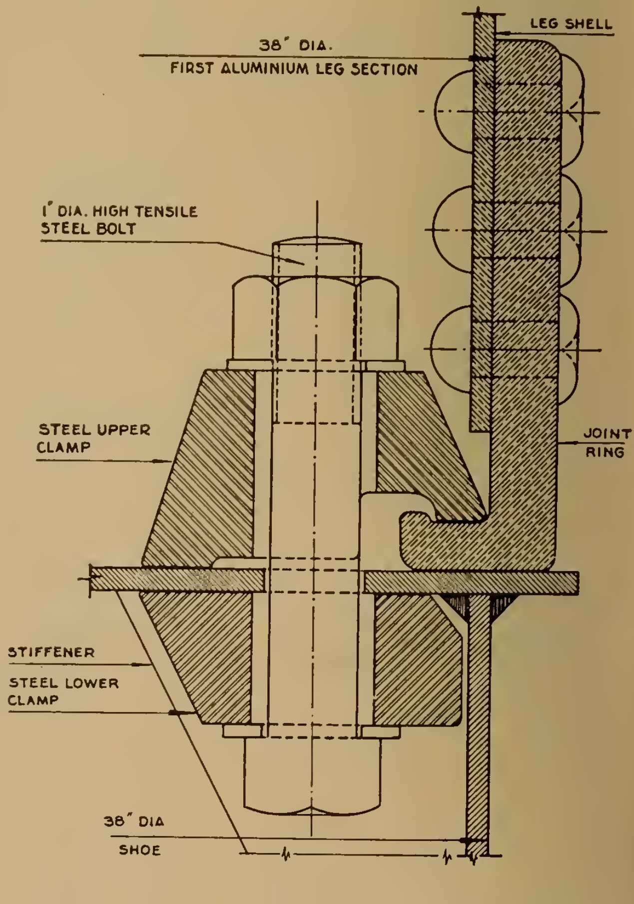




Fig. 64. Above: Detail of leg joint at shoe.

Fig. 63. Left: Detail of leg joint.

stresses computed for the middle section.

### Investigations on Test Tower

Early in 1952 a 100-foot high test tower was fabricated and erected in the Yarrows shipyard in Victoria, B.C., in order to establish the feasibility of the type of transmission tower discussed herein and to investigate both manufacturing and erection problems. It satisfied expectations and contributed valuable data needful in determination of the overall strength of the structure. It also proved the correctness of the formula adopted for general buckling of the compression members of the length and the diameter used for the tower legs.

The geometry of the test tower was similar to that adopted in the final design. However, some of its details were modified in the final designs to cope with conditions brought about by both heavier loads and higher towers on the actual line, as well as to reduce the manufacturing costs.

The legs of the test tower were assembled from 25-foot tubular sections with the following dimensions:

Leg Nos. 1 and 2, Overall diameter, 34 inches, sheet thickness, ⅛ inch.

Leg Nos. 3 and 4, Overall diameter, 30 inches, sheet thickness, ⅛ inch.

Leg No. 5, Overall diameter, 38 inches, sheet thickness, 9/64 inch.

The leg sections and the 65⅓-foot long cross-arms were fabricated from Alcan 65 S-T aluminum sheet. The heads and shoes were made of ¼-inch mild-steel plate.

The design of the test tower provided for rigid bolted connections between the legs and the cross-arm. This arrangement possessed the advantage of permitting a direct passage through the legs to the cross-arm. However, under the loading on the cross-arm due to a broken conductor, the rigid connection distributed sizable moments from the cross-arm into the legs, one result of which was an increased deflection in the middle of the legs, reducing their general buckling strength. Also, from the point of view of the critical local buckling stress, an increase in the moment in the head of the legs produced undesirable effects.

The observations on the test tower and considerations relative to general stability, resulted in the adoption of special supports for the cross-arm caps, which release the legs from moments arising from the cross-arm.

Load specification for the test tower called for the loads, in kips, at all three points of conductor supports, as given in Table 2.

In the cases of the $A_1$ and $A_2$ loads, the maximum permissible stresses were taken 5 per cent lower than the ultimate strength. In the cases of $B_1$, $B_2$, and $D_2$ loads, the maximum permissible stress was taken 50 per cent lower than the yield strength of the materials.

Under certain conditions during the test a slight bowing of the legs in the line direction was noticed. When the A-frames were assembled and were still on the ground, the legs assumed a slight general bend towards the sunny side. It was obvious that the bend was due to the difference in temperature between the sunny and the shady sides of the thin leg shell of relatively large circumference.

Considerable thought was given in testing the tower to the possible occurrence of resonant vibration of the tower legs when exposed to a steady wind strong enough to cause small deflections in a plane at 90° to the wind direction. This vibra-

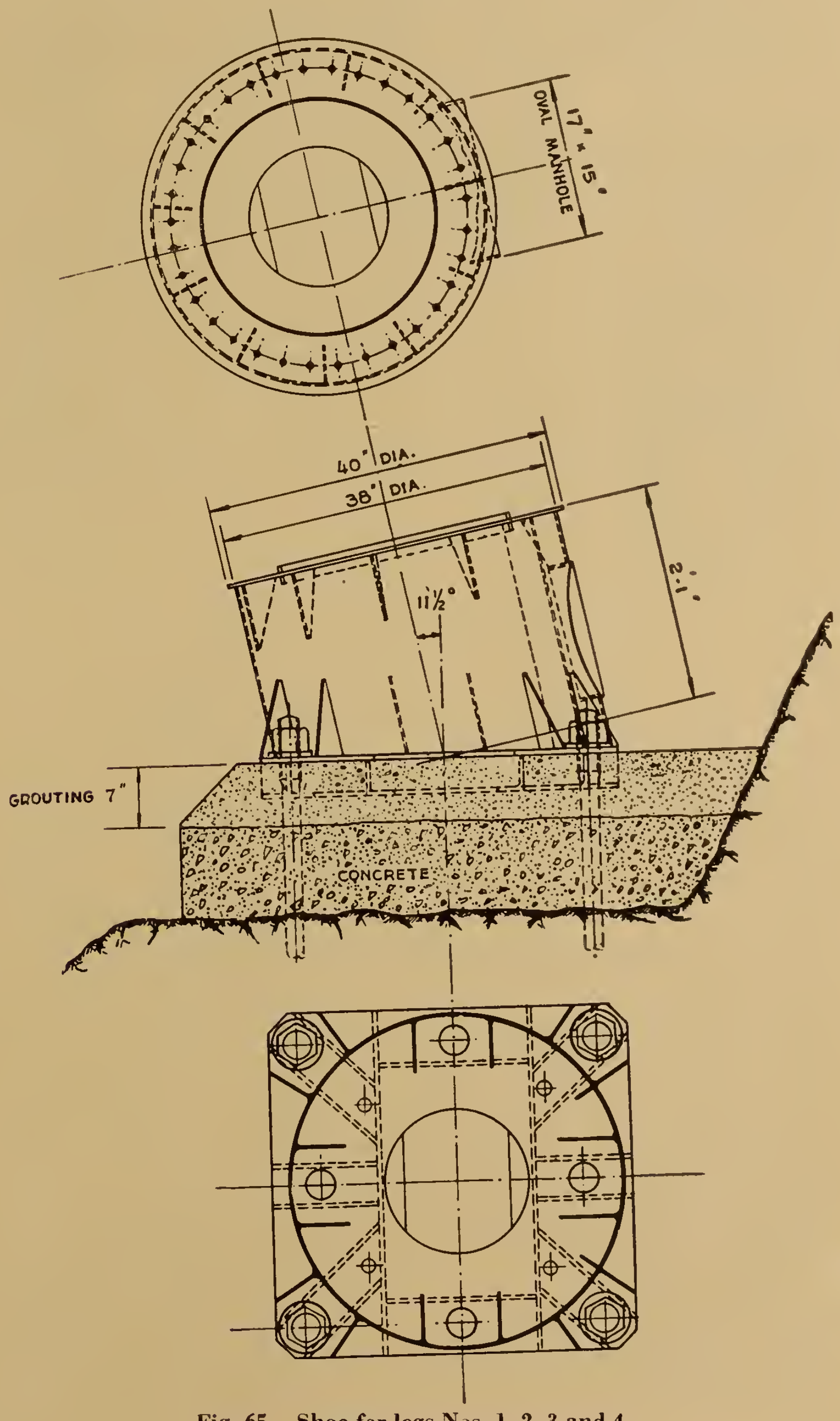



Fig. 65. Shoe for legs Nos. 1, 2, 3 and 4.

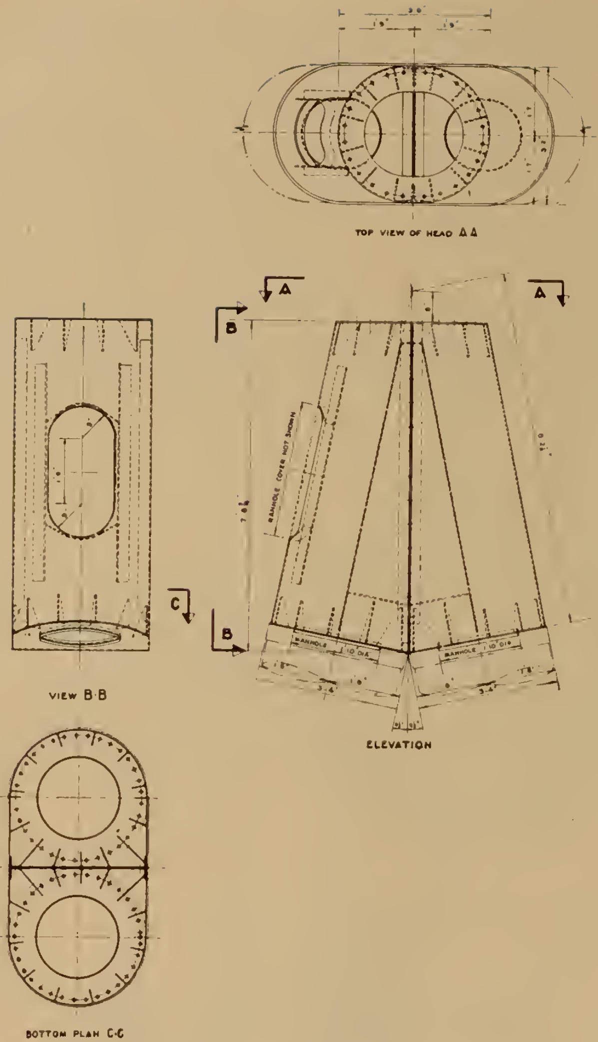



Fig. 66. A-frame head.

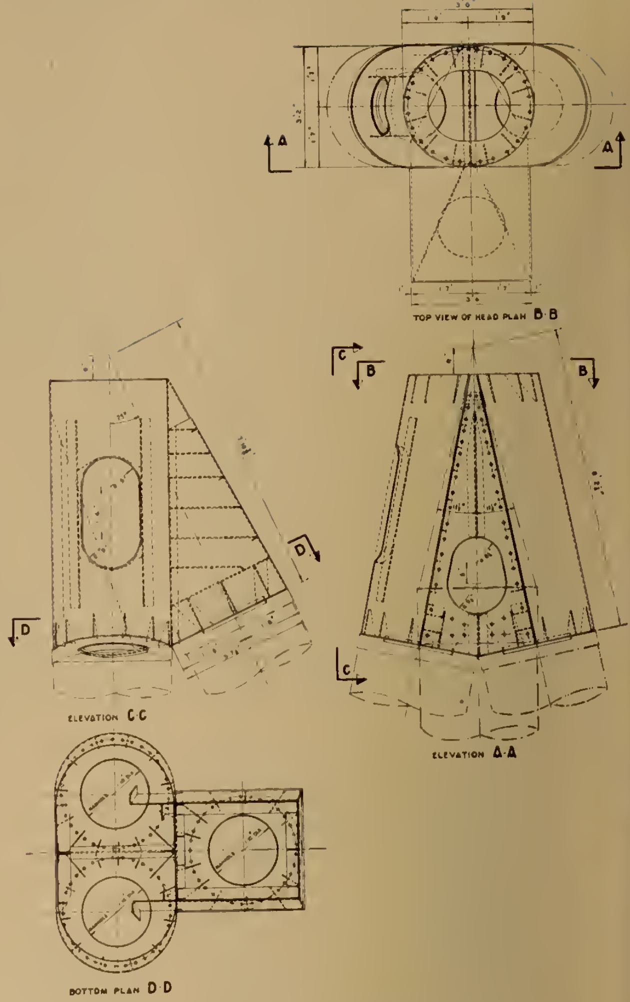



Fig. 67. Tripod head.

tion is due to trains of air vortices, known as "von Karman" vortices, acting on the legs. No such vibration was observed on the test tower under wind conditions.

However, a laboratory test was arranged with a 75-foot tubular section of 30-inch diameter. The section, arranged in a horizontal position between the pin-points of the strong backs of a compression-test arrangement, was forced to vibrate under a small axial load, the impulses of energy being transferred to it through a helical spring attached at its middle. For dampening the vibration, a Stockbridge-type damper was found to be successful and indicated an acceptable method of dampening the vibration in the legs of the actual towers, should it be necessary.

The test tower displayed, in general, the strength expected under the specified loads and demonstrated the feasibility of this type of structure for the transmission towers.

## Final Design

### *Legs*

The tubular tower legs are composed of a number of sections, their strength corresponding to the requirements based on tower height, conductor pull, span and local snow-on-ground conditions. The adopted standard length for sections was 12 feet 4½ inches, and for standard half-sections 6 feet 4½ inches. Half-sections and odd-length top closure sections were used because generally the footings of the tower legs are at different elevations. Half-sections were occasionally utilized to permit using a reasonable length for the top closure sections.

Manholes in the shoes at foundation level provide ingress into the legs, where aluminum ladders afford access to the head of the tower. Access under deep snow conditions is furnished by a manhole in the second section of Leg No. 5. The manhole, 24 x 17½ inches, is reinforced and fitted with a hinged cover.

The thicknesses of aluminum sheet used for fabrication of sections were 3/16, 7/32, ¼, 9/32, 5/16, 11/32 and 3/8 inches. All sections were composed of two semi-circular halves, rolled from 5-foot wide sheet. The halves were joined by shielded argon-arc welding, with a backing strip at each longitudinal seam.

Both ends of the leg section are reinforced with joint rings, aluminum extrusions of Alcan 65 S-T alloy of special shape as shown in Fig. 63. The joint rings are riveted to the leg shell and their flanges serve for joining the leg sections by means of 33 sets of aluminum clamps and high-tensile steel bolts per joint.

Three types of joint rings and clamps were employed; light, medium and heavy. Their strengths correspond to those of the various thicknesses of aluminum sheet:

Light type, for sheet thicknesses of 3/16 and 7/32 inch.

Medium type, for sheet thicknesses of ¼, 9/32 and 5/16 inch.

Heavy type, for sheet thicknesses of 11/32 and 3/8 inch.

Rivets were made of Alcan 16 S-T aluminum, with a typical ultimate shearing strength of 33,000 psi. Rivets of ½-, 5/8- and ¾-inch diameter are used for the light, medium and heavy joint rings, respectively. These rivets have conventional button-type heads for riveting the light and medium joint rings; countersunk heads were used for the heavy joint rings. The set heads are internal.

Bolts used with the clamps are ¾ and 1 inch, high-tensile steel bolts with a yield strength of 106,500 psi. Due to the difference in the thermal expansion coefficients of the aluminum clamps and joint rings as compared with the steel bolts, the bolts tend to slacken at low temperature. Prestress of the order of 30,000 p.s.i. on the net area of the bolts was specified to maintain tightness at an extreme low temperature of −30°F.

***Shoes***

The tower legs are fixed to the foundations with anchor-bolts by means of galvanized steel shoes, illustrated in Fig. 65. These are all-welded tubular elements fabricated from mild-steel plate. These shoes transfer the compressive and tensile forces, as well as the moments from the secondary loads, into the foundations. Each shoe is bolted to its foundation by at least four high-tensile steel anchor bolts, with a net diameter of 2 inches. Provision was made for a total of eight anchor bolts, four in the outer corners of the base plate and four inside the shoe, to secure rational distribution of anchor bolts for different conditions, depending on the magnitude of stresses and on the direction of the snow-creep thrust.

The shoes were fabricated from ¼- and 3/8-inch plate, according to strength requirements, and for leg angles of 11½° from the vertical for Legs Nos. 1, 2, 3 and 4, and 25° from the vertical for Leg No. 5, and for Leg No. 6 where used.

The thickness of the base plates for both types is 9/16 inch; these plates were reinforced by 4- x 3- x ½-inch steel angles. The upper ring of the shoe, joining with the first aluminum section, is stiffened by 11 triangular stiffeners. Interior and exterior triangular stiffeners at the base plate are provided to strengthen the shell against load concentrations at the anchor bolts. The joint between the first leg section and the shoe consists of 11 sets of high-tensile steel clamps, each taking three bolts. Lower and upper steel clamps in sets, with galvanized high-tensile steel bolts, constitute the joint, as shown in Fig. 64. Two types of high-tensile steel clamps sets, light and heavy, were used with the high-tensile steel bolts, with a yield strength 106,500 psi.

***Heads***

Each leg has a top piece, as shown by Figs. 66 and 67, fabricated from mild-steel plate by welding. Plate thicknesses of either 3/16 or ¼ inch were used, depending on circumstances. The top pieces, when bolted together, form rigid heads for the A-frame and for the tripod.

Side plates of the heads are given a contour affording a smooth extension of the leg sections. An exception is the top piece of Leg No. 5, which has flat side plates reinforced with welded stiffeners. This provides a simple plane bolting face for the tops of Legs Nos. 1 and 2. The curved side plates of the heads for the A-frames need minimum reinforcement against general and local buckling. The head of the tripod has been stiffened by two internal bulkheads opposite the side plates of the head of Leg No. 5. Bottom and top rings in the head provide necessary stiffness and the base for bolting adjacent leg sections and cap.

The loads on the head are the reactions of the caps supporting the cross-arm. The compressive and tensile loads in the legs combined with the bending moments require a rigid top.

Bolting of the individual leg tops was done from inside the head. For joining the head to the leg section, standard aluminum clamps were used in the leg, with steel multi-hole washers, between the triangular bottom stiffeners of the top-piece.

***Caps***

Two caps, as illustrated by Fig. 68, support the cross-arm. They are bolted to the heads of the tower by means of eight high-tensile steel bolts, supplemented by a number of subsidiary steel bolts on the perimeter of the bottom. The two caps, both that at the top of the A-frame and that at the top of the tripod, are identical for a given type of tower. These are fabricated from welded 3/8-inch mild-steel plate. The pin in the

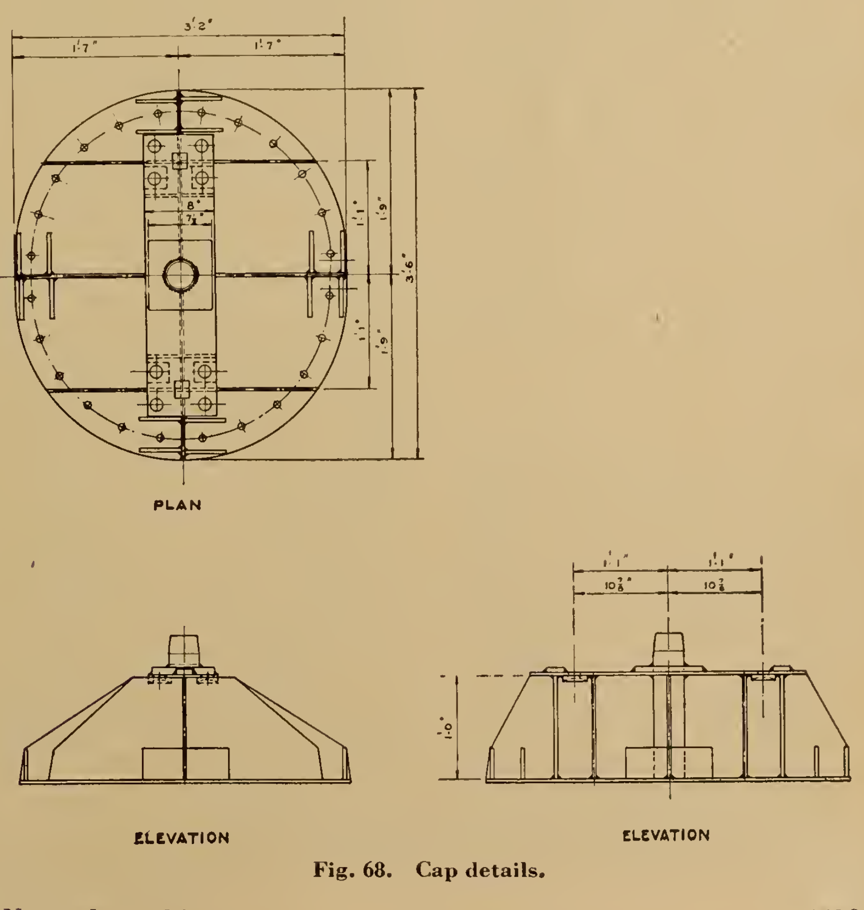



**Fig. 68. Cap details.**

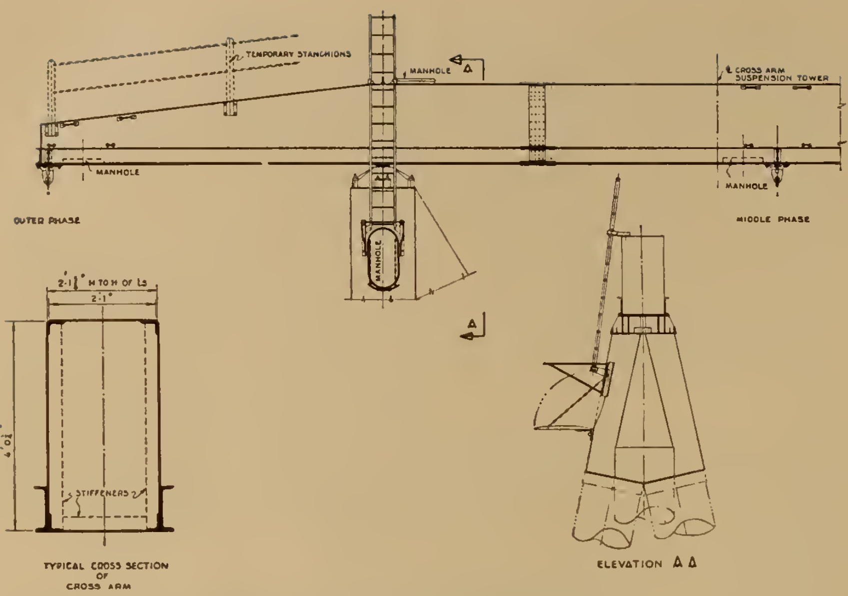



Fig. 69. Cross-arm and accessories.

centre of the cap is a solid steel bar, 3½ or 4½ inches in diameter, for light or heavy caps respectively.

The box-girder cross-arm is supported at two points just below the web plates by the caps. This type of vertical support permits relatively free movement of the cross-arm in any direction and avoids transferring bending moments to the legs. The pins on the centre line of the cross-arm resist the thrust of the unbalanced conductor pull in any horizontal direction. The holes for the pins in the bottom plate of the cross-arm are reinforced by cast aluminum bushings.

There are four silicon steel bolts per cap, with spherical-bearing surfaces fitting in spherical sockets in the cap, which are provided to limit the movement of the cross-arm on the cap, with free centering of the cross-arm on the pins. These bolts are important in view of possible load combinations on the cross-arm resulting in negative reactions.

### *Cross-arms*

Four cross-arms of different lengths and strengths were designed for the aluminum towers, as illustrated by Figs. 61 and 69. These cross-arms provide the requisite clearance between conductors and between conductors and structure under maximum line-angle conditions. Two types of angle-strain tower cross-arms were designed, one for small angles and another longer one for large angles.

The difference in the suspension tower cross-arms is mainly in their structural strength and not in their length. Light suspension tower cross-arms were designed for less severe duty than those for heavy suspension towers, in order to economise on material.

The several types of cross-arms have lengths as follows:

| | |
|---|---|
| Suspension towers.... | 76 ft. 5¾ in. |
| Small-angle strain towers............ | 65 ft. 4 in. |
| Large-angle strain towers............ | 67 ft. 8 in. |

The cross-arm of the tower is a simply-supported beam with the middle-phase conductor suspended at or near its centre line, the actual point of suspension being governed by the necessary clearance between the conductor and Leg No. 5. The cross-arm has cantilevered ends for supporting the outer phase conductors. The cross-arm has a constant width between web plates of approximately 26 inches. The portion between the caps is approximately 48 inches deep and the upper flange drops down from the caps towards the ends, where the depth is 24 inches. The cross-arms were designed to take care of a broken conductor on either the middle or outer phases.

Resistance against twisting in the cross-arms is important on account of the eccentric application of *P* loads. The eccentricity of *V* loads was eliminated by the adoption of special suspension yokes for the insulator assemblies.

The cross-arms were sectionalised for ease in transportation. The original requirement for transportation by helicopter limited the maximum length of the sections to 22 feet and the maximum weight of an individual piece to 1,700 pounds. These limits were maintained in the actual design for convenience in handling, despite elimination of the necessity for helicopter transportation, by construction of a road roughly paralleling the transmission line from Kemano to Kitimat. The angle-strain and suspension tower cross-arms were fabricated in either three and four sections, as governed by weight or length limitations. Splices are field bolted.

The cross-arms are rivetted aluminum structures, welding being used only for affixing stiffeners to the webs and bottom plates. The thickness of the cross-arm web plates is 3/16 inch, except for the heavy-type suspension cross-arms, where ¼ inch was used. Web plate and lower cover-plate stiffeners are 3 x 3/16 and 3 x ¼ inches, respectively. Noncontinuous fillet welds are used. The thickness of upper and lower cover plates varies for the different cross-arms, being 3/16, ¼, 5/16, and 3/8 inch, depending on the strength requirements.

Upper and lower flange angles in all cross-arms are 4- x 3- x 5/16-inch. Two 10- x 3-inch channels are used to secure necessary strength in the lower flange.

All cross-arms are strengthened at the points of support and of application of conductor loads. Three manholes are provided in the bottom of the cross-arm and two in the top. These manholes are oval, 24 x 16 inches, fitted with covers. All elements, such as plates, angles and channels, are Alcan 65 S-T. Rivets used are ½-inch except the rivets in heavy-type suspension cross-arms, which are 3/8-inch. Rivets are of Alcan 16-ST, with button set heads and annular driven heads. Aluminum welding was carried out with rod of 5 per cent silicon-aluminum alloy, with inert-gas shielded equipment.

### *Foundations*

Anchor bolts connecting the shoes of the tower legs to the foundations are deformed silicon-steel bolts 2 inches in net diameter, with upset threaded ends and a yield strength of 54,000 psi. Permissible tensile stress on the net area of the anchor bolts was fixed at 36,000 psi. A bond stress of 125 psi between the steel and the grout was adopted in the determination of the embedment depth of the anchor bolts in rock. The concrete at the base of the shoe was required to have a minimum compressive strength of 2,500 psi at 28 days.

Approximately 60 per cent of the towers are founded on sound rock.

Only minor excavation and concreting for levelling of the bases of the shoes was necessary in such cases. The other towers are founded on detritus deposits or on bad rock and are provided with reinforced concrete foundations. Where rock footings are used, weathered surface rock was generally stripped at each shoe to sound rock and 3½-inch holes were diamond drilled for the anchor bolts. Bolts were grouted in these holes. The shoes were placed on the concrete pads and the bolts tightened, with either steel wedges or shims under all four corners of the bottom plate reinforcement. Necessary small vertical adjustments were made either by means of these wedges or shims and by the adjustment of nuts on the anchor bolts. The anchor bolt holes in the base plate of the shoe were 3½ inches in diameter, permitting minor horizontal adjustments with the 2 inch bolts. Grouting of the shoe was carried out after the tower was assembled. The grout, to a thickness of about 7 inches, embeds the reinforcement of the bottom plate and the adjusting wedges or shims.

*Accessories*

Access into the interior of the tower legs is provided by the manholes in the shoes, 18 x 15 inches; they are fitted with covers.

Ladders inside the legs provide access to all leg joints and to the top of the legs. The sections of the ladders are supported by brackets fastened by the bolts in the joint ring.

The manhole covers in the tops of Legs Nos. 1 and 4, when opened, serve as platforms, as shown by Fig. 69. A guard rail affords safety to workmen. From these platforms a permanent ladder gives access to the cross-arm. The manholes on the top of the cross-arm afford access to the interior of the cross-arm. Access to the insulator assemblies is facilitated through three manholes in the bottom of the cross-arm.

Provision for a temporary guard rail on top of the cross-arm has been made by means of special sockets for stanchions or uprights. U-bolts and safety hand grips have been

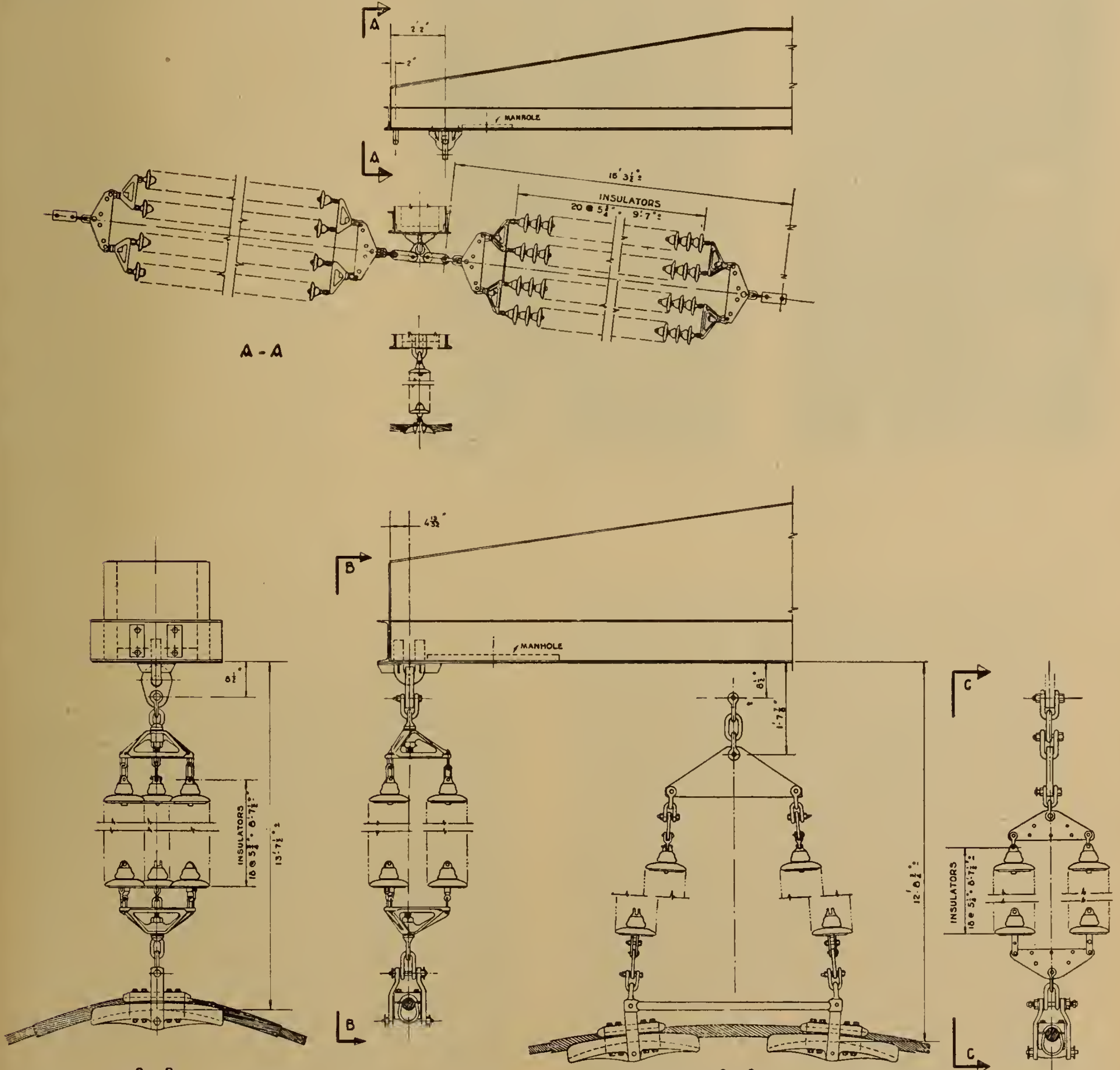



**Fig. 70. A-A Insulator assembly for angle-strain towers. B-B Triple-string insulator assembly for suspension tower. C-C Double-string insulator assembly for suspension tower.**

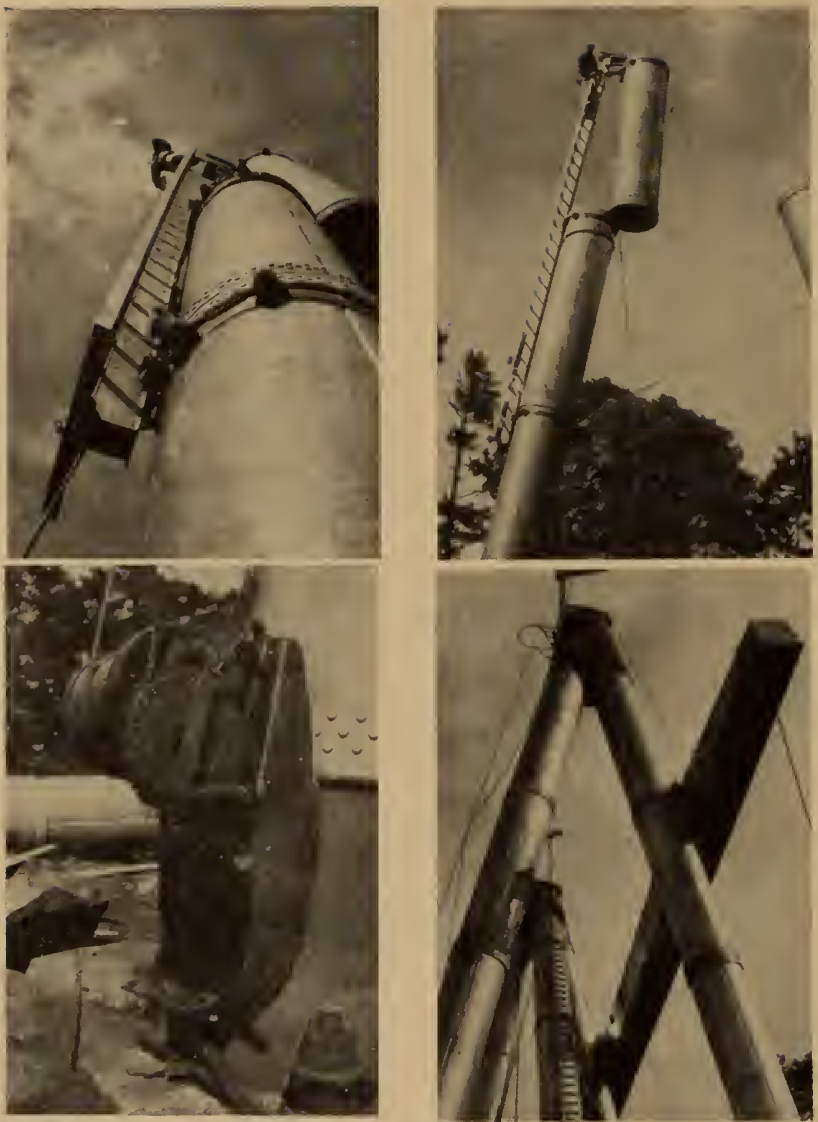


Fig. 71. Erection methods: upper views show "climbing ginpole". Lower left shows 5-ton hand winch; lower right shows cross-arm pulled up.

provided for use in stringing and servicing the line.

Two types of special insulator assembly suspension yoke were used, one for the angle-strain cross-arm (Fig. 70, upper), and the other for the suspension cross-arms (Fig. 70, lower left and right). These yokes are designed to yield essentially a torque-free application of conductor loads to the cross-arm at any line angle; they are bolted at the centre line of the cross-section of the cross-arm. The yokes are forged and welded steel members.

U-bolts for the suspension of the jumper insulator strings are fixed to the bottom of the cross-arm close to the suspension point of the yokes.

#### Fabrication of Towers

In describing the various components of the towers, attention has been drawn to certain components which were fabricated in steel plate by welding. The basic reason for this was that time available did not permit the experimentation which would have been necessary had aluminum been used. However, it is certain that all elements, with the exception of the high-tensile bolts, could have been fabricated from aluminum, possibly using castings for the shoes.

#### Erection Methods

The principal device used for tower erection was a winch-operated 28½-foot climbing ginpole furnished with a ladder, for operation by a crew of two men; see Fig. 71, upper left and right. The ginpole was an all-welded aluminum beam made from 3/16-inch sheet, a 4- x 6-inch box section providing necessary stiffness. An outrigger, approximately 3 feet long, was bolted to the upper end of the ginpole.

The first and second leg sections were assembled on the ground and the ginpole was fixed by two special steel hoop clamps to these sections, the upper end of the ginpole cantilevering. The first and second sections with the attached ginpole were erected and bolted to the shoe by means of another ginpole, supported on the ground and guyed to the anchor bolts of the leg shoes. The third and following leg sections were hoisted by means of the climbing ginpole.

For safety, the lifting wire rope ran over the sheaves of the outrigger down through the hollow ginpole to a hand winch of 5-ton capacity, fixed to the seat around the manhole in the shoe, as shown by the lower left view of Fig. 71. After the leg section had been lifted and secured by bolting, the ginpole could be freed from the grip of both hoop clamps. By removing two wedges, which secured the ginpole against lateral movement, and then a keeper, which supported it against the rim of the joint ring, the ginpole could be freed for climbing up to a new lifting position. It was pulled up by means of the same winch and wire rope. Lifted to the new position, it was fixed by the hoop clamps to the last leg section, and supported against the rim of the joint ring; it was then ready for lifting the next leg section.

Finally, the top piece was hoisted, together with a temporary davit bolted to it. When the A-frame and the tripod were assembled two temporary davits on the leg heads were used for lifting the cross-arm. The cross-arm was pulled up by two winches, the rope running over the sheaves on the davit down to the drums of the hand winches at the shoes of Legs Nos. 1 and 4. The assembled cross-arm, when pulled up, slid along Legs Nos. 2 and 3 on two rubber-wheeled dollies fixed to the cross-arm, as shown by Fig. 71, lower right view, and by Fig. 72. On the caps, the wheels of the dollies ran over a temporary clearance runner, which covered the caps. The clearance runners were removed after the cross-arm was pulled up and suspended from both davits. The cross-arm was then lowered onto the caps.

#### Relative Weight of Aluminum and Steel Towers

Although most of these aluminum transmission-line towers are high structures carrying unusually long and heavy spans, with extremely heavy loading, their average weight is only 25.8 tons. The lightest tower weighs 16.5 tons and the heaviest

33.5 tons. Weights of the tower components are:

Weight of leg section in standard length, including rivetted joint rings and joint clamps, but exclusive of high-tensile steel bolts:

| | | |
|---|---|---|
| Shell thickness | 3/6 inch | 425 pounds |
| " " | 7/32 " | 480 " |
| " " | ¼ " | 610 " |
| " " | 9/32 " | 665 " |
| " " | 5/16 " | 720 " |
| " " | 11/32 " | 870 " |
| " " | ⅜ " | 925 " |

Weight of rivetted cross-arms including splices and splice bolts:

| | |
|---|---|
| Small-angle strain cross-arm | 4,950 pounds |
| Large-angle " " | 5,390 " |
| Light-duty suspension cross-arm | 5,450 " |
| Heavy-duty suspension cross-arm | 7,130 " |

Weight of all-welded steel shoes exclusive of steel clamps and high-tensile steel bolts:

| | Legs Nos. 1, 2, 3 and 4 |
|---|---|
| Light-type shoe | 790 pounds |
| Heavy-type shoe | 950 " |
| | Leg No. 5, and No. 6 where used |
| Light-type shoe | 745 pounds |
| Heavy-type shoe | 860 " |

Weight of all-welded steel leg tops:

| | Leg. No. 1 | No. 2 | No. 3 |
|---|---|---|---|
| Light-type | 975 | 870 | 755 |
| Heavy-type | 1,145 | 1,035 | 895 |
| | No. 4 | Nos. 5 and 6 | |
| Light-type | 685 | 485 | |
| Heavy-type | 825 | 505 | |

Weight of all-welded steel caps:

| | |
|---|---|
| Light-duty cap, 3½-inch pin | 385 pounds |
| Heavy-duty cap, 4½-inch pin | 415 " |

The weights of the towers would have been moderately lower had aluminum shoes, leg tops and caps been used. The average weight of the single-circuit steel towers used on the right-hand circuit through Kildala Pass, designed to meet the same general conditions as the aluminum towers, was 42.6 tons, the lightest weighing 34.9 tons and the heaviest 48.1 tons. Thus, the weight of the aluminum towers was, on the average, only 60.5 per cent of that of the corresponding steel tower; for the lightest towers 47.2 per cent; and for the heaviest 69.6 per cent.

### Relative Economy of Aluminum Towers

What is the relative economy of the aluminum towers as developed for the Kemano-Kitimat transmission system? Many factors enter into the overall relative economy and these are dealt with in sequence, beginning with fabrication by the maker taken as complete and towers ready for shipment.

There are, in the case of a 114-foot tower, a total of 110 major components, as follows:

- 5 shoes.
- 41 leg sections.
- 5 closing leg sections, because of footings at different elevations.
- 5 top pieces (heads).
- 2 caps.
- 3 cross-arm sections.
- 45 lengths aluminum ladder inside legs.
- 2 lengths aluminum ladder for cross-arm.
- 2 guard rails at exit manholes in upper legs.
- 2,220 bolts, mostly with clamps, bagged or boxed.

For the equivalent steel tower of the same height, there are over 1,120 items of steel members in addition to some 4,740 bolts and washers. The likelihood of short- or over-shipment by the manufacturer is considerably greater with the multiplicity of parts in the steel towers.

The loading and unloading of the much smaller number of simple components for the aluminum tower requires substantially less labour, as mechanical equipment can be advantageously utilized. This is particularly important where unusual means of transportation, such as high-lines and helicopters, must be used, and is important even with trucks.

The substantially lower weight of the average aluminum tower, at 60.5 per cent of that of the steel tower, results in substantial economy in direct transportation costs of any kind.

The small number of components in the aluminum tower results in easier distribution to sites, with considerably smaller loss of pieces, which can so badly hamper erection. This is particularly true with snow on the ground. Much less labour is required for distribution; it is probably in almost direct proportion to the number of components.

The fabrication and erection costs of the aluminum towers for this line were considerably influenced by delays, due to changes in design details throughout the entire fabrication and erection period. This influence was anticipated, because the late decision to build the second pass circuit as part of the first stage of the power project required the fabrication, and even the erection, of parts of the line before the survey exactly locating the towers of the second circuit was completed. Further, the fabrication was of a new type and shop details, methods, jigs, etc., had to be worked out while the fabrication was in progress, and development was often held up waiting for engineering reports from the field, which first had to be trans-

Fig. 72. Views showing erection of aluminum towers.

lated into design drawings. It has proven impossible as yet to segregate the direct costs from the indirect costs on these accounts. However, certain principles regarding costs of the aluminum towers are self evident.

Savings in erection costs secured with the aluminum towers should be substantial. They arise partly from the simplicity of the design, with a minimum of joints; partly from the substantially smaller tonnage to be erected, labour costs varying with the weight; partly from the adaptability of the aluminum tower to erection with simple equipment of low weight; and finally, from the confidence of workmen when maximum safety of working conditions is built into the design.

At high altitudes men cannot accomplish the same output of work as at sea level. Hence, the substantially lower weight of the aluminum tower results in important savings in erection costs for transmission lines in mountainous country.

The average aluminum tower should require about 900 man-hours of labour for erection as contrasted with 2,100 man-hours for the equivalent steel tower, a saving of 57 per cent in labour requirements. There is considerable evidence indicating that the average aluminum tower should be erected with about 650 man-hours of labour using power tools, and possibly with as little as one half of this labour requirement with mobile cranes.

Maintenance costs are expected to be low for the aluminum towers, due to ease and safety of access and to optimum working safety during inspection and maintenance. Moreover, low maintenance costs over the life of the towers are anticipated, due to freedom from corrosion.

It was expected that the smooth, streamlined shapes of the aluminum tower will result in less accumulation of snow, rime and ice than would be the case with lattice tower construction; this was borne out by observations last winter. That is, the aluminum tower is inherently less severely loaded, with the probability that this condition will be reflected in lower maintenance costs.

Had the aluminum tower design not been governed by helicopter transport restrictions, the tower would have involved even fewer components, with the attendant savings in cost.

#### Field Investigations and Observations

Erection of the aluminum towers was completed in the fall of 1953 and the transmission-line conductors are being strung during the summer and fall of 1954. The towers were exposed to snow, rime and ice conditions during the winter of 1953-54, when a crew of engineering observers was maintained at the summit of the pass for recording weather conditions and for making observations on the structures.

A few minor members of the towers proved to be defective in one respect or another, but these instances were quite insignificant. Essentially, such faulty members were confined to welds in the guard rails around the manholes at the tops of the tower legs. A very few leg section joint rings proved defective to a degree. Careful examination traced the trouble to faulty fabrication. These have been replaced and no evidence has been found to indicate that all elements of the design are other than fully adequate.

As expected, some resonant vibration of aeolian origin has occurred in the leg members of certain towers. The amplitude of such vibration, as determined by manually-induced vibration, was found to range up to a maximum of 4.4 inches half amplitude, i.e., the maximum lateral movement from the position of rest. The frequency, of course, is the natural frequency of the structure and has been found to range from 1.76 to 3.55 cycles per second. Typical records for towers with legs of high slenderness ratio are shown in Fig. 73.

Wind-induced vibration has been observed on a few occasions, but at the time of writing no records have been secured. However, the half amplitude of vibration, as observed, was approximately 2.5 inches. In general, wind-induced vibration results in oscillation of a leg in the plane of its natural sag, so that all legs have a different type of vibration, related to the rigidity of the structure of the A-frame or of the tripod, respectively. The frequency of occurrence of wind-induced vibration, and the duration of the vibration when it does occur, are conservatively estimated at approximately 20 hours per year and 0.23 per cent of the time, respectively.

Stress measurements have been made on a tower subjected to manually-induced vibration. These measurements were carried out with SR4 resistance strain gauges used in combination with an oscillograph. Tests were made at several critical locations. They showed, at the most critical point of the leg shell, that the variation in stress was ±3,500 p.s.i. with a maximum half amplitude of 3.9 inches. The significance of such vibration, both as to secondary stresses induced in the tower members and as to tendency to fatigue, indicates that probably no vibration dampers will need to be installed. However, investigations have been carried out to determine suitable types of vibration dampers.

Observations on the aluminum and steel towers during the winter of 1953-54 indicate that the smooth outlines of the aluminum towers result in the accumulation of considerably less snow and rime than on the steel towers. In the case of some single-circuit steel towers, as much as 48 inches of icy snow, with a density of about 22 pounds per cubic foot, accumulated on the secondary bracing members in the top plane of the cross-arm and resulted in bending these members. The accumulation of snow and rime on the aluminum towers was much less.

The aluminum tower legs were relatively free of snow, rime and ice; as expected, this condition contrasts sharply with that of the steel towers, where snow and rime accumulated on the leg members to substantial thicknesses. Under severe winter conditions at high altitudes, maintenance workmen can gain access to the cross-arm of the aluminum towers with greater safety than in the case of the steel towers, a substantial advantage.

Devices recording snow-creep pressures were installed during the fall of 1953 and records secured, indicating that design assumptions were sound in that the maximum pressures recorded were lower than those assumed.

#### Conclusions

The work done on design and proof testing and on fabrication and erection of the towers, together with observations during the winter of 1953-54, when the towers were exposed to service conditions, except for the absence of conductors, which were strung only during the summer and fall of 1954, warrants the following conclusions:—

The aluminum towers on the Kemano-Kitimat transmission system adequately meet the loading specifications under which they were designed.

The aluminum tower represents substantial economies over the conventional steel tower. These arise from the 60.5 per cent average weight as contrasted with steel towers, substantially lower number of components, easier fabrication, easier transportation by all methods, easier transshipment and easier distribution. It offers substantial economies in erection labour requirements.

Aluminum towers are adaptable to the use of simple erection equipment.

Observations during the winter of 1953-54 indicate that aluminum towers are inherently better suited than steel towers where heavy snow, rime and ice deposits occur.

Aluminum towers provide maximum safety during erection, inspection and maintenance.

Experience gained with aluminum towers used on the Kemano-Kitimat transmission system indicates that, for loading specifications approximating more nearly the usual requirements, the design could be substantially simplified, with lower costs for fabrication and erection.

Experience gained with the aluminum towers on the Kemano-Kitimat transmission system indicates that such a simplified design will result in the recommendation of aluminum transmission towers for many high-voltage lines, where mountainous terrain and difficult transportation impose severe limitations.

Such a simplified design of aluminum tower affords a solution to the problem of high maintenance costs incurred in polluted atmospheres which cause high corrosion of galvanized steel structures.

The basic design of the aluminum towers was developed by Dr. K. Sutter of Aluminium Laboratories, Limited, Geneva, Switzerland. Actual execution of the design was carried out by a team of engineers in Montreal under A. Soosaar, engineer with the power department, Aluminium Laboratories, Limited. Many individuals contributed to the work of this team. In particular, acknowledgment is due to R. F. D. Collin for his contribution as liaison between Alcan and the design group. Acknowledgment is also due J. C. Millson and A. G. Pue-Gilchrist, of Aluminium Laboratories, Limited, Kingston, for their contribution in respect of strain measurements on the test tower, strength tests on tower components and for other services.

F. L. Lawton, M.E.I.C., is chief engineer, power department, Aluminium Laboratories, Limited, a development, investigation and research organization, which is a subsidiary of Aluminium Limited. He was closely associated with the initial investigations in connection with the power development and acted in a consulting capacity on a number of major engineering problems of the Kemano-Kitimat project.

The aluminum towers were fabricated at the Victoria, B.C., shipyard of Yarrows, Limited; thanks is due to them for the enthusiasm and co-operation with which they proceeded with the work of fabricating an entirely new product. √

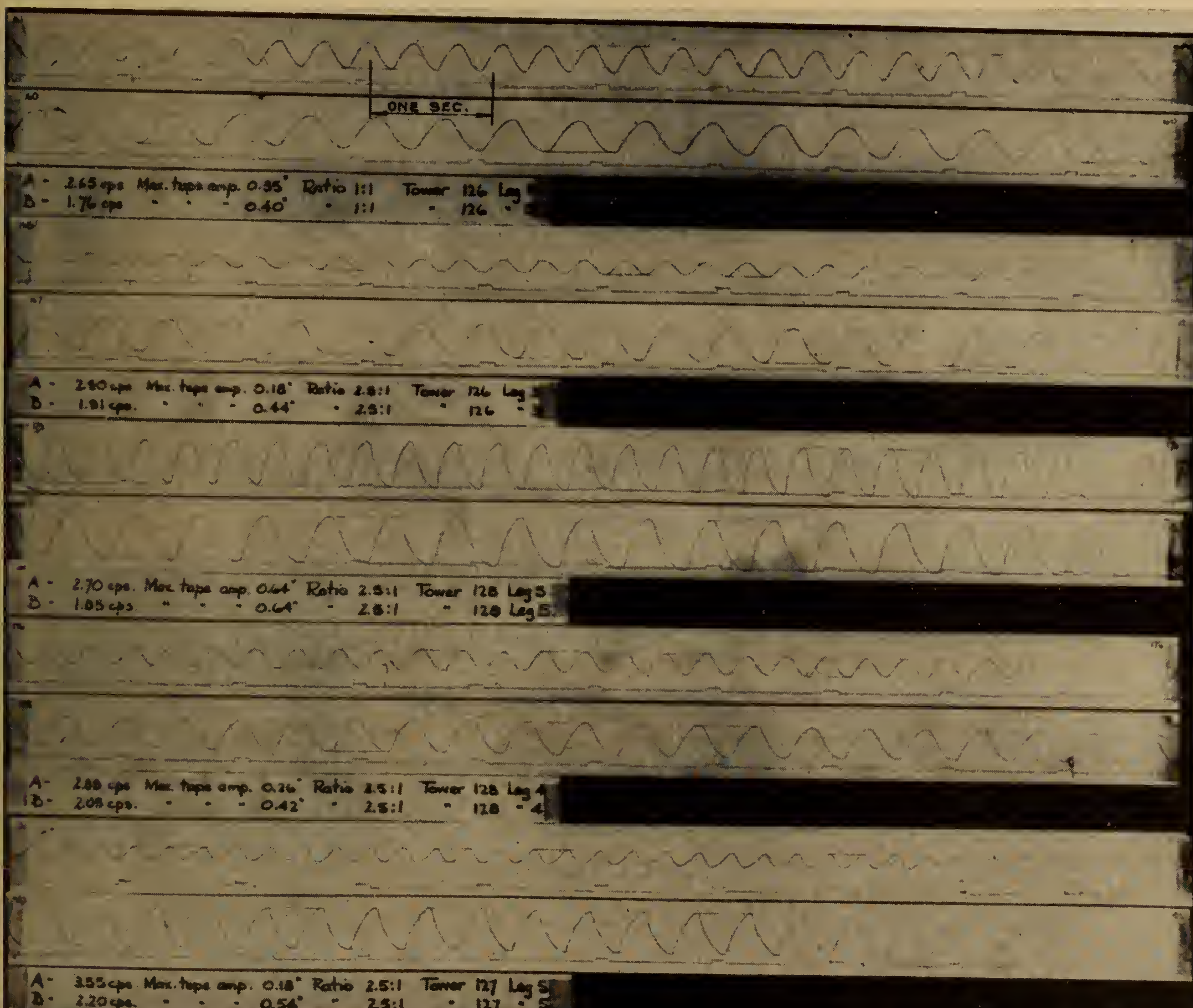



Fig. 73. Vibration records of high and low frequency manually-induced vibration in aluminum tower legs.

# Investigations of the Effect of the Power Development on Fisheries

*by*
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This paper shows how the engineer's work is often closely bound up with problems in non-engineering fields. For a time it was feared that the power development at Kemano might seriously affect the salmon runs on the rivers of the watershed. A few years of observation have indicated that these fears were on the whole, groundless; nevertheless some $400,000 have been spent on remedial works. The investigations and the steps taken to overcome any likely difficulty are the author's subjects.

In 1953 the output of the British Columbia fishing and fish-canning industry was valued at $65 million, equivalent to about 5 per cent of the province's industrial production. Salmon accounts for roughly two-thirds of the fisheries output.

There are five species of Pacific salmon: sockeye, spring, coho, pink and chum. All hatch from eggs deposited in fresh water and descend in due course to the sea, where they spend one or more years. At maturity the salmon ascend the coastal rivers and streams to appropriate spawning grounds, there to deposit their eggs and die.

The sockeye catch is of substantially greater value than that of any of the other salmon species and it is probably the most profitable. Apart from the spring salmon, the sockeye is the only salmon which as a rule spawns at any great distance from the sea, frequently 500 miles and more. Thus the sockeye is more likely to encounter man-made changes in its habitat.

### Sockeye Habits and Power Developments

For these reasons, the habits of the sockeye are reviewed in detail. The adult sockeye spawn and deposit their eggs in the gravel of streams having a favourable combination of bed material, water depth, velocity, temperature and possibly other factors as well. Generally such spawning areas are either upstream or downstream from a lake. Spawning occurs at various times in the months of August to November, depending on the particular area. After spawning the adult sockeye die.

The salmon eggs hatch the following spring and the sockeye fry emerge from the gravel. Where there is a lake on the spawning stream, the fry migrate to the lake. In cases where there is no lake, the fry descend directly to the sea. After a year or two in the lake, the young sockeye descend to the Pacific Ocean, where they spend the next several years. At maturity the sockeye return to seek out their customary spawning grounds, usually in the fourth or fifth year from egg deposition.

Obviously a power or storage dam on a river frequented by sockeye may affect directly one or more phases of the sockeye's life in fresh water. In some cases, the anticipated effect may be minor, or ameliorable in various ways. In others, the fisheries interests may conclude that the power development is completely incompatible with sockeye.

R. W. Kraft, M.E.I.C.

#### Early Phases of Alcan Studies in British Columbia

In 1948, Alcan initiated field studies of various potential water-powers in British Columbia. Ultimately the Nechako-Kemano project, was selected for development. One of its major advantages was that its development should affect fish only slightly, if at all. Another project studied would have required a dam directly in the path of migrating sockeye.

In 1949 the Canadian Department of Fisheries and the International Pacific Salmon Fisheries Commission indicated that they foresaw no basic conflict between the Nechako-Kemano project and fish. The main source of possible difficulty was thought to be lack of sufficient water after diversion of the Nechako River, for easy migration of salmon using the lower parts of the Nechako River. It was felt that such problems could be solved, but would require detailed study.

These two organizations have the main responsibility for conservation of the fish concerned. The Salmon Commission is composed of three appointees of each of the governments of Canada and the United States. Under treaty, it is responsible for making recommendations for the protection of the Fraser River sockeye salmon, which are caught by both Canadian and American fishermen.

#### Description of the Nechako-Kemano Project

Water for this development is supplied by a drainage area of 5,475 square miles, whose centre lies about 140 miles west, and slightly south, of Prince George. Until the Kenney dam was built, this area drained eastward, through two chains of lakes 2,600 to 2,800 feet above sea level. These gave rise to the Nechako River, which then flowed northerly and easterly to empty into the Fraser River at Prince George.

#### Fish in Waters Affected by Nechako-Kemano Project

Of the fish frequenting the various waters involved in the project, space permits dealing only with the salmon using the Nechako River. These have been studied the most intensively, because of their economic importance and of the immediate possibility of being affected. In addition, however, Alcan investigated and discussed with the appropriate fisheries-regulating bodies possible effects on salmon using the Nanika River; game fish using the lakes and tributaries above the Kenney dam; salmon using the Kemano River, which is now being augmented by the diversion from the Nechako reservoir; and fish in streams in the Kitimat area, in relation to the smelter's water intakes and sewage outfalls.

The average flow of the Nechako River at the Kenney dam site was 6,500 cfs. The first major downstream tributary is the Nautley River, draining Fraser and Francois Lakes and their tributaries. It enters the Nechako River 56 miles below the dam, with an average annual flow of about 500 cfs. The second major tributary, the Stuart River, drains the Stuart Lake system and discharges into the Nechako River a further 58 miles downstream, contributing an average annual flow of about 5,000 cfs. Finally, 55 miles below the Stuart River, the Nechako empties into the Fraser River at Prince George. Taking all the minor tributaries into account as well, the Kenney dam eliminated 80 to 90 per cent of the natural flow of the Nechako between the Nautley and Stuart Rivers, and about 50 to 60 per cent below the Stuart.

Three groups of salmon use the Nechako River. One run of sockeye salmon ascends the Nechako River for 55 miles, to spawn in the tributaries of the Stuart River system. A second run of sockeye continues a further 58 miles up the Nechako, to the Nautley River, to spawn in tributaries of the Fraser-Francois system. Finally, a certain number of spring salmon spawn in the Nechako River above the Nautley.

#### Study of the Project's Effect on Salmon

Preliminary study indicated that the hydroelectric development should have practically no effect on the Nechako salmon. The rapids and falls of the Grand Canyon were in the past an effective barrier, making the Nechako River above that point inaccessible to salmon. Diversion of the river at the canyon, therefore, would not obstruct any salmon runs.

In numbers and value, the sockeye are the most important of the Nechako salmon, though only a minor item in the provincial picture. The Canadian share of the Nechako sockeye is estimated to contribute about 5 per cent of the total British Columbia sockeye pack, or somewhat less than 2 per cent of the landed value of all salmon.

While the sockeye using the Nechako river would have much less water after the Nechako diversion, there would still remain in the extreme case of the sockeye going up the Nautley River, a flow somewhat larger than that of the Nautley itself and its principal tributary. Since the latter streams had ample water to convey the Fraser-Francois run, it was considered highly probable that this same amount of water still flowing in the Nechako River would suffice to get the run up to the Nautley.

The spring salmon spawning in the upper Nechako River would find only 100 to 200 cfs. after diversion, and it was thought possible they might no longer be attracted to that area. However, it was understood that the spring salmon were much less attached to specific spawning grounds than the sockeye, and that they would be inclined to spawn elsewhere—downstream in the residual Nechako River, or in its major tributaries.

#### Specific Problems Foreseen by Fisheries Bodies

Following detailed studies, the technical staffs of the Canadian Department of Fisheries and the Salmon Commission jointly issued in 1951 a "Report on the Fisheries Problems Created by the Development of Power in the Nechako-Kemano-Nanika River Systems". For the Nechako salmon, the following sources of trouble were feared:

(a) Obstacles to salmon migration in the Nechako River from the Stuart River up to the Nautley;

(b) Water temperatures in the Nechako River below Nautley high enough to be lethal to migrating sockeye (over 68° Fahrenheit); it was calculated that the reduced volume of water would heat up excessively in summer;

(c) Insufficient water for migration, spawning and egg protection of the spring salmon spawning in the Nechako between the Nautley River and the Kenney dam;

(d) Lowering of the level of Fraser Lake, which is drained by the 3,000-foot-long Nautley River into the Nechako; with the increased gradient in the Nautley caused by lowering of the Nechako after diversion, increased erosion of the former was feared, leading to a drop of six or eight feet in the lake level; Fraser Lake is an important sockeye rearing lake and since its average depth is only 44 feet, such a drop might be upsetting to biological conditions.

#### Solutions Proposed by Fisheries Bodies

The chief remedial proposal was that outlet works be installed at the Kenney dam about 200 feet below the surface, to release water from the main reservoir. This was calculated to provide cold water to solve the anticipated temperature problem, and partially solve the transportation problem and to protect the spring salmon eggs in winter. In addition, certain reaches of the Nechako River might have to be channelized in order to concentrate the reduced volume of water and provide a deep enough passage for salmon. If the Nautley River eroded, bed protection would be required.

Alternatively, the requirements of transportation and winter-cover water could perhaps be met by a storage dam on the Cheslatta River, a small tributary to the Nechako River about five miles below the Kenney dam. However, this alternative would not solve the temperature problem.

These proposals were studied thoroughly by Alcan, and discussed in detail with the fisheries organizations. It was agreed that a temporary storage dam should be constructed on the Cheslatta River, to provide water if needed to aid salmon transportation. A timber crib dam for this purpose was built and closed in April, 1952. Alcan was to make plans to provide additional water after the reservoir was filled by releasing 100 cfs. continuously into the Cheslatta system from the reservoir at a point about 45 miles from the Kenney dam. Plans would also be made to replace the temporary dam with a permanent control and storage dam. The last two measures would be dropped if further investigation showed no need for them. Possible necessity of channelization would be studied, as it might be a big factor in eliminating the need for the 100 cfs. release from the main reservoir.

These agreements covered all the questions raised, except the possible occurrence of lethally high temperatures in the lower reaches of the Nechako River. Here, Alcan felt that it could not take the responsibility for a low-level outlet in the vicinity of the Kenney dam. The 300-foot high dam would store permanently an enormous quantity of water—five years' flow of the Nechako River. This amount of water, if released abruptly, would have catastrophic consequences down stream, and every precaution was being taken to design and construct the Kenney dam so as to preclude any possibility of failure. On the other hand, a low-level outlet mechanism would be almost certain to fail eventually, even though it might last a long time as ordinary industrial structures go. In contrast to other dams having low-level outlets, it would be a practical impossibility to dewater the Kenney dam, hence the discharge mechanism could never be satisfactorily inspected and maintained. In the event of failure, only very hazardous and uncertain remedial measures would be available. Alcan could therefore not agree to take the risk of the proposed outlet.

At the same time, Alcan's assessment of the available information was that the small and problematic value of releasing cold water would not warrant doing so by any very hazardous or expensive means. The evidence was by no means conclusive that the calculated water temperature rises would occur, would be lethal to fish and could be overcome by comparatively small releases of cold water 60 to 110 miles upstream. Moreover, even in the worst case, no more than 5 to 10 per cent of the Fraser-Francois sockeye would be in the Nechako River above the Stuart during the times when it was feared water temperatures might be above 68° Fahrenheit.

#### Alcan's Field Studies of Salmon in 1952

To obtain further data on the water temperature and other questions, Alcan put parties into the field in the summer of 1952, to complement the studies of the fisheries organizations. Observers were stationed at the Nautley River to observe the times at which sockeye reached it from the Nechako River. Previously, the time of sockeye migration up the Nechako had been known only roughly by inference from the time of their arrival on the various spawning grounds. Water and air temperatures were recorded at a number of stations, for comparison with the timing of the salmon migration. The Nechako River was thoroughly reconnoitred to get further information on possible obstacles at low flows.

In this work, much assistance was provided by the Department of Fisheries and the Salmon Commission in acquainting Alcan's field people with their activities in the area, and the habits of the salmon.

The Kenney dam was closed on October 8th, 1952, following advice from the fisheries bodies that this date would be agreeable to them. Field parties were then able to inspect the Nechako River at very low flows. With one or two possible exceptions, each of the locations previously feared as potential obstacles to migrating salmon had a channel which would provide sufficient depth of water at low flows. The lower depth of water permitted counting the spring salmon nests in the upper Nechako River, hence a more accurate estimate of the number of springs in 1952. It was very close to 4,000, about half the number estimated in previous years.

#### Further Development of Cheslatta Dam

By the fall of 1952, the timber crib dam was storing some 60,000 acre-feet of water, amounting to about 5½ feet on Murray and Cheslatta Lakes, and practically no inflow was expected until the following spring. The dam still had about 9 feet of freeboard, equivalent to an estimated 110,000 acre-feet of additional storage, which was about the upper limit of annual runoff estimated for the Cheslatta.

After detailed study with the fisheries groups, it was agreed that the timber crib dam might be used for the time being as the control dam, in lieu of the permanent structure previously contemplated. Two openings were made by removing two of the cribs, and a double-acting steel gate 12 feet wide by 11 feet high was installed in each opening.

#### Alcan Field Studies in 1953

This was the first season that migrating salmon would be using the diminished Nechako River. Alcan crews patrolled the Nechako area during the summer, to watch for any signs of difficulty on the part of the salmon, to observe the timing of the sockeye passing up the Stuart and Nautley Rivers and the condition of these fish when they reached their spawning grounds, as well as to keep records of water flows and temperatures, and other pertinent factors.

The sockeye migration was found to encounter no difficulties resulting from the changed conditions. Large runs ascended both the Stuart and Nautley Rivers without untoward circumstances. Of the latter, about one-fifth constituted an early run numbering more than ever previously observed, which ascended the Nechako during the warmest part of the migration period.

Air temperatures at established stations in the area were close to, or above, normal monthly averages.

Mean daily water temperatures of 68½° to 69° Fahrenheit were recorded in the Nechako River for four consecutive days while salmon were migrating to the Nautley River; this run continued unabated during this time. The first season under the altered conditions thus indicated that, in normal summers at any rate, water temperatures would only slightly exceed the estimated lethal temperature, but that there would be no effect on the sockeye.

Conclusive and direct data were not available, but it appears probable that the flow of the Nautley River was somewhat above seasonal normals during the summer. Consequently, there was no real tryout of the residual river's passability by sockeye under average conditions. However, the inspections at low water the previous autumns had practically eliminated the possibility of this trouble.

As the time for migration of the spring salmon to the Nechako River above Nautley drew near, the flow of the former was down to 100 or 200 cfs. The fisheries engineers and biologists decided that 400 cfs. should be released from the Cheslatta reservoir. This addition of water proved sufficient to enable spring salmon to ascend to the spawning grounds without need of any channelization measures in the shallow reaches of the river. From 400 to 600 springs were found in the upper Nechako. Alcan parties found on investigation that spring salmon had spawned as well in the Nechako River below Nautley and in portions of the Stuart system, where few or none had been observed in previous years. Surveys of parts of these waters accounted for roughly 1,500 to 2,000 springs. Thus a reasonable nucleus of spring salmon was able to use the customary Nechako spawning grounds, and considerable numbers appear to have adapted themselves by using other areas.

#### Nautley River

After lowering of the Nechako River by the dam closure in October, 1952, minor erosion occurred at the mouth of the Nautley River for a time and then appeared to halt.

As the spring freshet of 1953 approached, the Nautley River was observed to be scouring and downgrading its bed severely. Measurements of the stream-bed elevation showed that the channel was being cut about six feet deeper. This erosion worked upstream, without seeming to slacken off after the flood peak was passed. The bed material consisted of four- to six-inch stones, mixed with glacial boulders. On investigation it proved to be only about one stone in thickness, and underlain by fine material which was easily washed out. Once the bed cutting was initiated by high water, it continued readily at lower flows.

By the end of July the erosion had proceeded about one-half mile upstream from the river's mouth, and was within 500 feet of a wooden pile highway bridge crossing the river, which was now threatened. From the bridge upstream the short distance to Fraser Lake the stream bed was of sand, which looked as if it would be rapidly eroded, and Fraser lake lowered, once the erosion reached the bridge.

Immediate remedial action was decided upon. With Professor Thomas Blench, M.E.I.C., of the University of Alberta as consultant, the following plans were made. The drop from Fraser Lake to the Nechako River would be concentrated in a 175-foot stretch of the Nautley River, with a 5.7 per cent gradient. The stream bed in this section would be paved with a three-foot thickness of 2,000-pound quarried rock, which was calculated from laboratory tests to be stable under the maximum floods expected. The banks of the paved section would be protected with heavy riprap. Velocities through the channel were thought to be negotiable by salmon, but if necessary, baffles of 5,000-pound rock would be placed across the paved section at 20-foot intervals. These rows of rock would create a series of riffles interspersed with relatively slow water.

These plans were then reviewed with the fisheries representatives. They agreed that work should start as proposed, but felt that some device such as the rock baffles was required in order to reduce water velocities sufficiently for the sockeye.

Construction work was started at the end of August and the remedial work, including rock baffles, was completed in November. So far the work has withstood an exceptionally heavy flood in 1954 —about 5,000 cfs. at its peak. Subsequently the sockeye have been ascending the stabilized section readily.

#### Alcan Field Studies in 1954

A program similar to that of 1953 is again being carried out. The tenour of preliminary reports from the field is one of uneventfulness. Stream flows in the area have been very much above seasonal normals. Temperatures appear to have been below normal. Much of the sockeye migration has taken place, with no noteworthy features.

#### Conclusion

One complete sockeye migrating period, and the more critical part of a second, have now been experienced since closure of the Kenney dam. During this time the company has been continually in touch with the fisheries regulating bodies. To ensure minimum interference with salmon $400,000 has been spent on remedial works and studies. To date there has been gratifyingly little effect from this major river-diversion: the sockeye runs seem to have been completely unaffected; a portion of the spring salmon have continued to use the upper Nechako spawning grounds; and others have spawned in quantity in previously unused areas. As more data are gathered, it becomes increasingly unlikely that the major temperature and transportation problems feared in the early days of the project will materialize. Should any further problems arise as the Alcan project develops, it is expected that by continued close co-operation with the fisheries organizations concerned, they will be solved equally satisfactorily. √

Fig. 74. Aerial photograph of plant and harbour site.

# The Kitimat

A large part of the raw materials required for making aluminum at the Kitimat smelter will always be received in ships from Jamaica and other far-away places. Hence, a harbour with suitable wharf facilities for berthing and unloading ocean-borne traffic is of prime importance. The wharf at Kitimat will be known as "Kitimat Terminal Wharf No. 1". This paper describes the design and method of construction of this wharf structure. Figure 74 is an aerial view of Kitimat area and of the delta of the Kitimat River. The many channels of the river as it discharges through its delta and also the long tidal flats can be seen.

The river valley stretches northward between high mountain ranges and the river winds back and forth across the valley floor. The site of the new aluminum plant is on the west side of the valley extending inland from these tidal flats on which the harbour is located. The flats fall off rapidly into deep water, and, in order to provide an economical wharf site with safe berthing for large ocean-going vessels, it was decided to dredge a channel inland to the selected wharf location, with a minimum width of about 400 feet. The dredged material from this channel was used for filling the flats behind the wharf area to provide building and storage areas.

In order to retain this dredged material, it was necessary to construct two large rock moles. One mole ran northward from the proposed wharf end to higher ground and the other mole ran westward to the shoreline. These moles were constructed by dumping quarried rock on the original ground surface. A graded sand and gravel filter was placed along the inside face of the mole to provide drainage and to

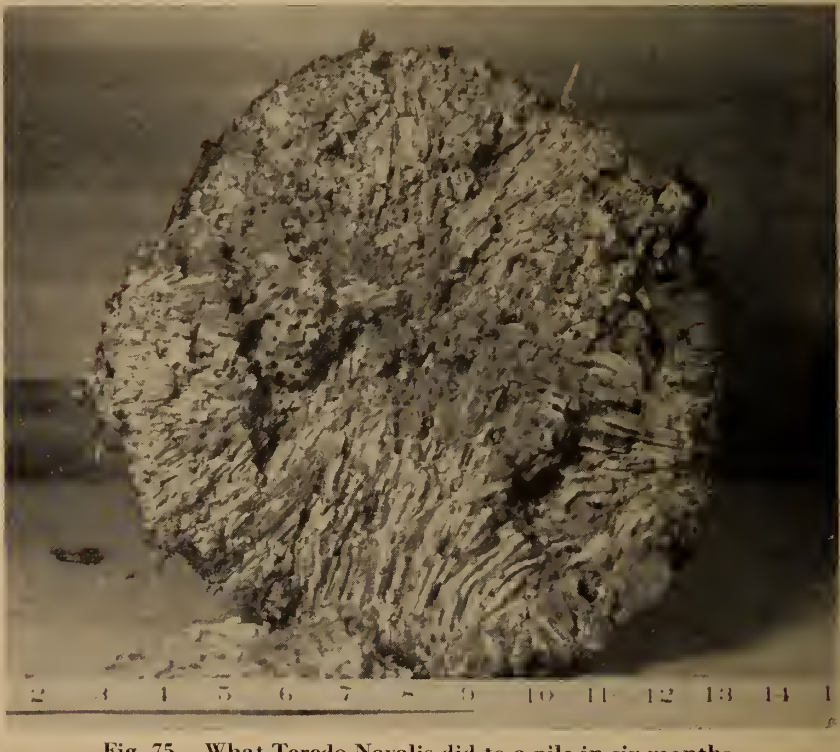

Fig. 75. What Teredo Navalis did to a pile in six months.

# Harbour

W. L. Pugh, M.E.I.C.

*by*

W. L. Pugh, M.E.I.C.

*Chief Engineer,*

*Aluminum Company of Canada, Limited*

**Alcan's development at Kitimat, B.C., required much work not generally associated with most industrial projects, for example, the design and construction of the wharf described in this paper, presented at the Quebec Annual Meeting on May 14, 1954. Read it and learn how to save time and money by building concrete caissons on their sides and then careening them upright.**

prevent tidal action from washing out the dredged fill.

The axis of the wharf was selected so that a vessel approaching it would be in line with the prevailing winds which are nearly due north or due south, depending on the season.

#### Selection of Wharf Type

Because of the large amounts and wide varieties of materials required for operating the aluminum plant, a wharf large enough to berth large ocean vessels had to be constructed and equipped with suitable unloading towers for handling bulk materials and also with facilities to ship out aluminum ingots.

Several wharf arrangements and types of construction were studied before the final design was adopted. Timber is plentiful in this area for a timber pile type wharf, but, because of the presence of marine borers, it would be necessary to creosote all such piling. Figure 75 shows the cross section of an untreated pile exposed in the harbour for a period of about six months, completely destroyed by Teredo Navalis. Steel H pile and pipe pile were also considered, but as steel was scarce at that time due to the Korean War, the idea of using them was abandoned. Concrete piles were also considered, but it was felt that their length would be so great that they would be too costly to cast, handle and install.

In any case, it was desired to have a fire-proof wharf structure because of its vital importance to the operation of the plant. Even a structure with a concrete deck supported on creosoted timber piles was regarded as a hazard. It was, therefore, decided to study the possibility of an all-concrete wharf. Consulting engineers were therefore retained to study and make recommendations for this type of wharf.

**Fig. 76. Platforms for soil borings, on stilts to take care of 22 ft. tides.**

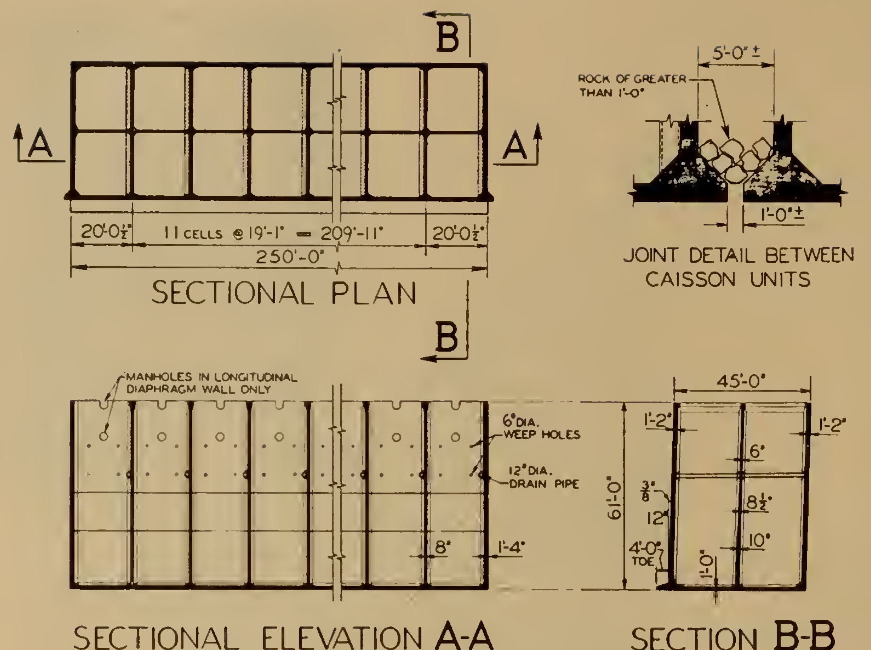


**Fig. 77. Typical details of the wharf caisson.**

At present, berthing a single large freighter requires a wharf length of 750 feet. The wharf had to be extensible to a length of about 2,200 feet to meet future requirements.

The extreme high tide at the wharf site is at about elevation +23.08 feet. The extreme low tidal elevation is +0.58 feet. A minimum depth of 32 feet was required for ship draft at low tide, and the wharf design had to be such that this could be increased to 34 feet in the future. The harbour is reasonably protected, but there is the possibility of wind-whipped, 7-feet waves occurring in the bay. Based on these data, the El. +30.0 was established for the wharf deck surface. El. −31.0 was established for the bottom of the dredged ship channel.

The consulting engineers suggested sinkable concrete boxes or caissons for the wharf structure. These caissons in place form a gravity retaining wall, with overturning resistance furnished by the weight of the internal fill. As such, they were designed to resist the external thrust of the backfill material and their concrete walls are designed to have sufficient strength to contain the fill material.

This type of wharf structure was finally adopted. Precast concrete units have previously been used for wharves, but this is one of the first applications where the units have been built on their sides, because of shallow water conditions, and then careened into final position.

### Soil Conditions

The soils encountered at Kitimat represent a complex history as indicated by borings. The general topography was formed by the eroding action of a glacier leaving high rugged peaks and deep valleys. The soils are a composite of alluvial and modified glacial deposits. The alluvial deposits are represented by the fine-grained soils and are stable and fairly dense, as indicated by the range of grain sizes. The coarser grained soils are of glacial outwash origin and are of lower density, as indicated by their range of grain sizes. It was thus anticipated that the stratification would be variable; however, each stratum should be fairly uniform.

To obtain first-hand knowledge of the subsoil conditions at the wharf site, a program was outlined for a series of drill holes to be sunk along the line of the wharf. Twelve borings were made, spaced about 120 feet apart for the first 1,100 feet, and then about 400 feet apart to provide information for the possible future wharf extension. Figure 76 shows the platforms used for the drill rigs because of the high tidal range. These platforms were moved as required.

Split-tube samples were taken in the coarse grained soils, Shelby-tube samples in the finer grained soils and wash samples when other samples were not recovered. These wash samples were not representative, as most of the fines had been washed out. However, they did indicate, in a general way, the granular characteristics of the soil; they were taken to complete the record. Six-inch, 4-inch and 3-inch casings were used. The 6-inch casing was driven through the upper gravel stratum and the 4-inch casing was telescoped inside it. This was necessary as the frictional resistance of the gravel would prevent salvaging the casing.

The depth of any boring was determined by the assumed wharf load and the necessity of terminating the boring in a relatively pervious stratum, so that no question would arise concerning the thickness of a loose, fine-grained stratum, if the boring terminated in such a layer. Drainage conditions would also be established by the coarse soil. All borings were carried to such a penetration, that the assumed stress intensity at that depth would not be of sufficient magnitude to cause appreciable settlement.

Samples were taken approximately every 10 feet, except immediately beneath the proposed bottom elevation of the wharf caisson; here they were taken at 5-foot intervals for a depth of approximately 25 feet. This closer spacing was required for verification of the stratification and test results, since the greatest load would be carried by the soils in this region. The soil samples obtained indicated the anticipated complex system of stratification and the existence of only granular non-cohesive soils. The soil immediately underlying the wharf area is fine silty sand, in a medium dense state.

The samples were shipped to Edmonton for testing. These results indicated that the average angle of internal friction was about 30°; that a compression index of 0.16 is representative of the soil under the wharf; and that the soil was granular with a suitable range of grain sizes and in a medium compact state.

### Design of Caissons

The wharf structure finally adopted is composed of three separate reinforced concrete caisson units. Each unit is 250 feet long, 45 feet wide and 61 feet high. The individual units contain a central longitudinal diaphragm wall of variable thickness and transverse 8-inch thick diaphragm walls spaced at about 19 feet centers, resembling an open-top egg crate. Figure 77 illustrates some of the typical details of one of these caissons.

The front and rear wall slabs are designed to resist the interior filling and backfill loading stresses, respectively. The interior diaphragm walls are designed for a maximum 5-foot differential in height of the interior filling. The main function of the bottom slab is to make the box watertight for floating into place. This slab extends four feet beyond the front wall to provide a toe to assist in distributing the foundation loads. The walls have a backward slope of ⅜ inches per foot of height in order to throw the center of gravity of the loading as far back as possible.

The reinforcing steel was proportioned on the basis of a unit stress of 20,000 psi, except during launching a stress of 24,000 psi, was allowed. Concrete was proportioned to secure 3,000 psi, compressive strength at 28 days.

### Design Loadings

The internal fill in the cells was assumed in design as of mixed gravel and rock with a unit weight of 110 pcf. The angle of internal friction was assumed as 40° and angle of wall friction as 25°. The pressures on the front wall were computed on the basis of soil at rest, including the effect of a 750 psf. surcharge at the deck level. Bin effect and the effect of wall friction were also included in the computations. Free drainage of the material above mean low water was also assumed. Backfill pressure against the cells was assumed as that from a combined gravel-rock fill with a dry weight of 110 pcf. and a submerged weight of 65 pcf. The angle of internal friction was assumed as 40°. The deck live loading assumed consists of the 750 psf, uniform load, combined with two standard railway track loadings, the loading of the unloading cranes and the impact or pull from ships.

### Caisson Drainage Provisions

Special drainage provisions were required to insure that water would not be trapped inside and behind the caissons, since the caissons were designed on this assumption for maximum economy. These special provisions consist of two rows of 6-inch weepholes through the three longitudinal walls and a 12-inch pipe drain cast into each transverse diaphragm wall, extending from the wharf face through to the backfill. This pipe will also aid in draining the back cells. The weepholes are spaced so that there will be two, together with the 12-inch pipe drain, in each cell. The weepholes should help to drain both the internal and external backfills, although some of them will probably become clogged. Then those in the front wall, the more important, can be cleared so that they will drain the front cells. It is improbable that all the weepholes in the back cells will become clogged, so some degree of drainage will always be provided in the back cells. The 12-inch pipe drains will not clog easily; if they do, it is possible to clean them by rodding and jetting from the front face of the wharf. Drainage of the backfill is thus permanently insured.

Drainage between the caisson units will be insured by the open type joint shown in Fig. 77. The front wall slab is extended two feet beyond the cell end wall to form this special joint between the caissons. This joint was designed to retain the fill between the units, provide free drainage of the fill, and allow adequate tolerance in placing of the units. It will also allow some differential movement of the caisson units in place.

### General Wharf Details

Figure 78 is a typical cross-section through the completed wharf structure.

The caissons were topped off with a 5-foot coping wall and reinforced concrete beams carry the travelling unloading crane loads directly into the caisson walls. Reinforcing bars were left projecting from the top of the caissons to anchor these beams.

The level of the wharf deck was established at El. 30.0. The deck surface was sloped upward from the wharf face to give proper drainage. The annual precipitation at Kitimat is about 90 inches. During the months of December, January and February the snowfall may amount to over 200 inches. Thus, surface drainage required serious consideration and study.

The unloading crane rails were spaced 32 feet center to center. The outer rail is 5 feet from the wharf face, providing space for bollards and a timber guard rail along the edge of the wharf. The unloading cranes span two standard railroad tracks extending the length of the wharf. A steel conveyor gallery mounted on temporary timber bents extends along the wharf, back of the unloading cranes, to convey unloaded bulk materials to storage buildings on shore. A future steel-framed transit shed is provided for; when it is built it will provide a permanent support for the conveyor gallery.

Oil pipes were located below the deck surface, with connections to discharge oil from tankers to shore tank farms. Water lines were provided for fire protection and ship supply. The surface of the wharf will

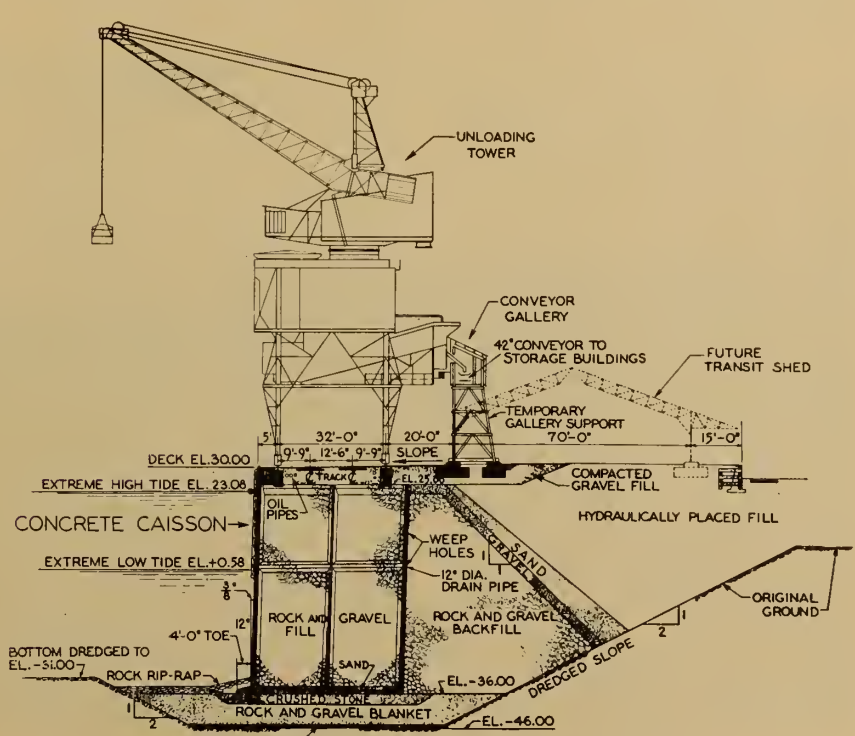


Fig. 78. Typical cross-section through wharf.

Fig. 79. The three caissons in the graving basin.

be paved with asphalt for the present, perhaps later to be replaced with concrete when all settlement of cells or compaction of cell fill materials has ceased.

Galvanized steel bolts were cast into the face of the caisson, to which a creosoted timber fender system is attached. This system is really a rubbing block arrangement for the protection of the wharf wall from the floating fender system. The floating fender was made up of untreated timber and will act as a cushion between ship and wharf.

#### Caisson Internal Fill

The internal caisson fill was selected to furnish sufficient mass for stability of the structure, to have high internal friction to reduce pressure on the caisson walls and to be free draining to reduce pressure from entrapped water. This material was specified to be composed of rock up to one cubic foot size with the largest dimension of any piece not greater than 18 inches. Gravel-sized particles could be included, but no more than 10 per cent in weight should pass a ¾ inch screen.

Before placing the fill in the caissons, the bottom was covered with a 1-foot sand cushion. The caisson fill was placed in lifts so that there was never more than a 5-foot difference in elevation between adjacent cells. The fill was placed by direct dumping, but care was taken to avoid heavy impact on the concrete.

Because of the difficulty of finding suitable and sufficient rock fill as specified, the specification was altered to permit the use of river boulders and gravel up to 1 cubic foot in size and screened to remove all fines smaller than 1 inch, but boulders and gravel only to the extent of 50 per cent of the total fill quantity. The filling operation was regulated so that rock, boulders and gravel were completely mixed. The combined fines of the quarry rock, river boulders and gravel that would pass a ¾-inch screen was not more than 10 per cent of the total volume.

#### Backfill Behind Caissons

The special gravel and rock backfill immediately behind the caisson was designed to reduce overturning and sliding forces. The material specified was similar to the caisson internal fill, except that larger rock was used when not in direct contact with the caisson concrete and at least five feet away from the sand and gravel filter. In general, the material was graded from coarse to fine towards the back of the fill, with the back two or three feet composed mostly of particles less than six inches in size to prevent the filter material from washing into the voids. The sand and gravel filter was to contain no more than 10 per cent by weight of material passing the No. 200 sieve and from 60 to 90 per cent passing the 1-inch sieve. This sand and gravel filter was carried over the top of the special rock backfill. The area behind this special fill was filled hydraulically.

#### Base Pressure and Blanket Fill

Base pressure distribution was carefully considered. It was known that the foundation would yield and that settlements would occur. The redistribution of the base pressure resulting from this yielding condition had, therefore, to be considered. The caisson is inherently a rigid structure. Therefore, the entire caisson should settle as a unit and settlement should tend to be uniform. However, only a flexible structure would be capable of withstanding large differential settlements, with resulting uniform bearing pressure. As a result of these studies, it was finally decided to design the toe slab for a maximum base pressure of 12,000 lb. per sq. ft.

The ultimate bearing capacity of the soil was determined from Terzaghi's formula for continuous footings (Article 29, *Soil Mechanics in Engineering Practice*, Terzaghi and Peck). As the relative density tests and blow counts of samples indicated a medium dense soil, an intermediate value between the loose and dense state was used in the Terzaghi formula. On this basis, the ultimate bearing capacity of the natural soil, for an angle of internal friction of 30°, was found to be 12,000 lb. per sq. ft. However, the bearing pressure at the toe of the caisson is also 12,000 lb. per sq. ft. Hence, it is apparent that the soil did not have sufficient bearing capacity to support the caisson wharf directly on the surface of the dredged cut.

Two means of supporting the

wharf were considered, namely, a pile foundation and dredging out some of the material and backfilling with soil of higher bearing capacity. A pile foundation would have been expensive and difficult to install because of the depth of water and was so ruled out, and the dredging and backfilling method was adopted.

This scheme improves conditions in two ways. First, the stress intensity at the elevation of the top of the natural soil is reduced, since the stresses are somewhat dissipated in the blanket layer. Second, the natural weaker soil is confined by the weight of the overlying blanket layer and will therefore have a higher ultimate bearing capacity. Assuming a 10-foot gravel-rock blanket, the underlying natural soil will have its ultimate bearing capacity increased to 22,000 lb. per sq. ft., as a result of confinement. This bearing capacity is ample and provides a factor of safety of two, since the bearing pressure on the natural soil beneath the blanket is reduced, due to the distribution of toe pressures by the blanket.

The possibility of a slide failure occurring beneath the caisson was investigated. It was found that the most critical slide surface is the one that passes closest to the base of the wharf. The high shearing resistance of the gravel and rock blanket lowers the slide surface and increases the safety factor to something over two, which is sufficient.

The function of the blanket is to distribute the load to the underlying soil and to help prevent sand boils and piping under the caisson when the tide is ebbing. The soil tests indicate that the underlying soil below the blanket is sufficiently dense and has sufficient bearing capacity to make further foundation provisions unnecessary.

The material for the main body of the blanket was specified to be composed of particles up to 4-inch size, with no more than 10 per cent passing the No. 30 sieve. Crushed stone would have been the ideal material for the blanket, because of the mechanical interlocking of the angular particles. As suitable rock was scarce and costly, this specification was revised and the blanket is composed chiefly of gravel with particles up to 6-inch maximum, for the lower three-foot thickness, but for the upper one-foot thickness not to exceed 4-inch maximum. The upper two to three feet of fill immediately under the caisson was composed of crushed stone.

The blanket material was placed by direct dumping and high spots leveled off by means of a drag with a variation of about ±3 inches.

#### Casting Basin Construction

Possible construction methods for the caissons were discussed for different launching schemes, such as inclined launching ways, rigid barges, graving basin and drydock.

A sectional timber drydock was available at Prince Rupert, 150 miles away. In addition to the towing hazard down the coast, there was the problem of preventing any movement of the drydock while the concrete was being placed, and until it attained substantial strength. Rigid barges could have been used as drydocks. Launching could have been done by grounding them at low tide, filling with water and utilizing the rising tide to float off the caisson. It was not practical to use this method for 250-foot long sections. Using inclined launching ways was not desirable, as this method would involve special stress and stability problems and would require extreme care to avoid difficulties. The cost of this method, because of the length of pile supported ways, would be greater than that of other methods. Launching the caissons in a graving dock was considered to be the safest and simplest of the methods and was finally adopted. This method is particularly adaptable to units of great length and width.

Adjacent to the wharf site was an area large enough to accommodate the three caissons in a basin as shown in Fig. 79. Existing ground was a little above low tide level. Natural soil was not impervious enough for a completely water-tight dike around the basins, but with the bottom a few feet below low tide, full head would be against it only part of the day. No serious damage could result from a try, so part of the necessary excavation was

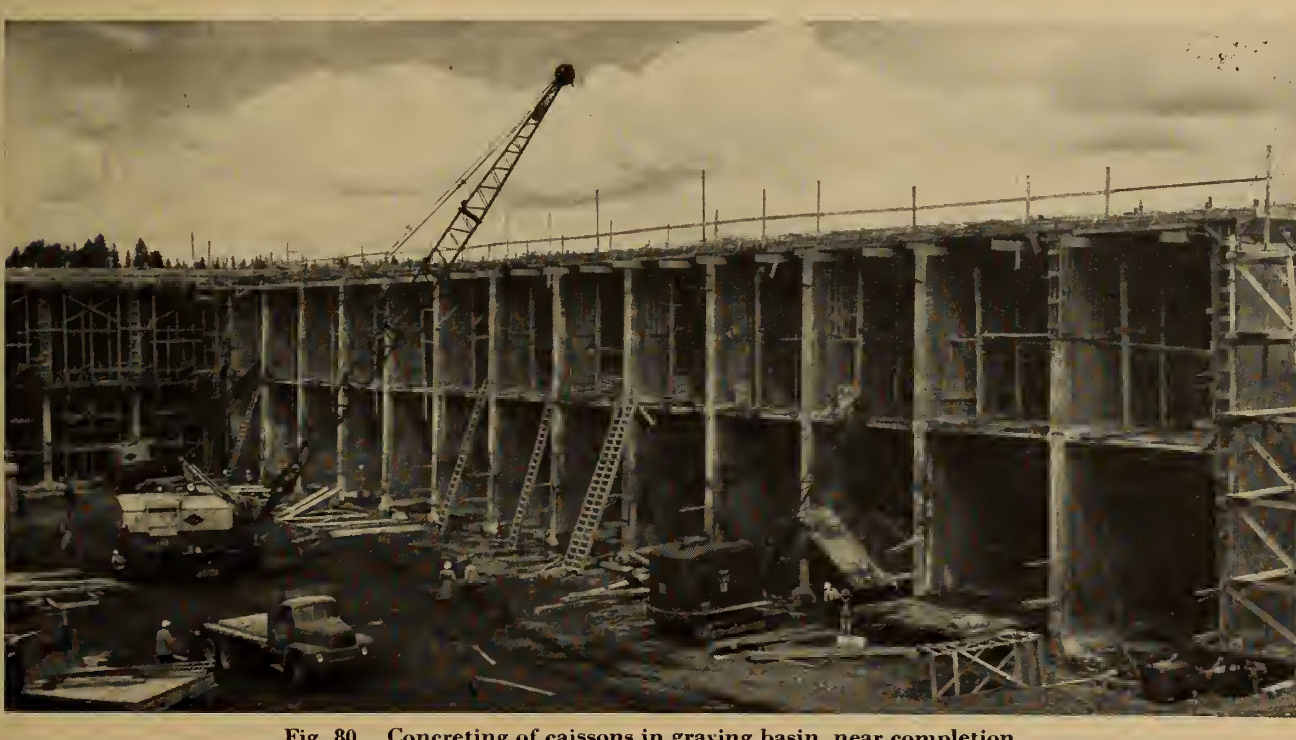

**Fig. 80. Concreting of caissons in graving basin, near completion.**

Fig. 81. Caissons ready for launching, bulkheads, ladders, lighting plants, etc., all in place.

removed by drag-lines and bulldozed into dikes to form the basin walls. These dikes were reasonably satisfactory after the outer slopes had been sanded to reduce leakage. Timber sheet piling was also considered to aid in reducing leakage, but it was impossible to drive it into the fill.

The consulting engineers had figured that if the caissons were cast in an upright position, a draft of 30 feet would be required to float them. This would have required a deep and costly casting basin. By casting the caissons on their sides, a draft of approximately 19 feet would be required, so this method was adopted. They also advised that an additional two feet of depth be provided as a safety margin. The casting basin floor had, therefore, to be at least 21 feet below mean high tide level during the period when the caissons were expected to be floated. Available information indicated that mean high tide level during a seven-day high-tide period would be at approximately El. +17. Thus, the top of the finished casting floor was established at El. —4.

The casting basin floor was approximately 260 feet wide by 330 feet long in the north-south direction. There was a berm about 20 feet wide at El. +8 around the basin, used as a roadway, with a ramp to the basin floor in the center of the south end. A ramp ran from the berm to the top of the dike at about El. +25 at each of the south corners. The basin was drained by a timber sheeted ditch around the edges connected with sumps. In addition, there was a well point system with headers at El. +8. Maximum seepage was estimated at about 4,000 gpm.

The caissons were arranged in the form of the letter U with one caisson at the north end of the basin, running east and west, to form the bottom of the letter, and one caisson along each of the east and west sides of the basin, running north and south, and forming the sides of the letter. The caisson edge was only five to six feet from the inside toe of the basin dike on all sides.

#### Construction of Caissons

The casting basin was completed, the floor leveled and the first formwork for the caissons was started on February 1, 1953. Forms had been prefabricated as far as possible while the casting basin was being completed. The first concrete was poured in the east caisson on February 20; in the west caisson on February 24, and in the north caisson on February 27.

The concreting of each cell was carried out in five different lifts. The back slabs of the cells rested directly on the floor of the casting basin. The lower sections of the diaphragm cross walls and ends were then poured; next, the longitudinal diaphragm; next, the upper sections of the diaphragm cross walls and ends, and then the top slab, which is the exterior wall of the caisson in its final position. This method of pouring was adopted so that full control of the pouring and finishing of the critical outside face wall could be done under ideal conditions.

It is known that an imperfection in the original concrete surface of a structure exposed to sea water action is the first point of attack or disintegration. It is expected that the pouring method adopted will minimize this possibility of failure.

Transit-mix trucks and dumpcretes were used to haul concrete from the central batching and mixing plant to hoppers on the bank of the casting basin. From these hoppers, power and hand buggies carried the concrete to the forms over a system of runways about five feet above the level of the slab being poured. Cranes and buckets were also used to handle some of

Fig. 82. The dikes breached and the caissons floating on their sides.

Fig. 83. The first caisson moored to its dolphins and partly careened.

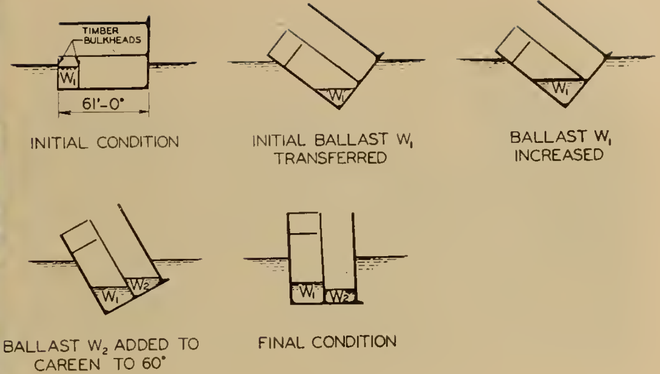


**Fig. 85. Careening a caisson.**

**Fig. 84. (Left)—The caissons in place and the third being careened into place.**

the concrete for the top pours. Each pour was a continuous operation. Figure 80 shows the caisson construction near completion with some of the forms removed.

Concrete was placed in the lower half of the cross walls and ends by means of elephant trunks and pockets in the sides of the forms. The remainder of the walls were filled by dumping into the top of the form. Particular attention was given to vibration and a plastic mix was used to avoid honeycombing, but some did occur in the first pours. These areas were repaired by first chipping out the defective concrete and then filling the voids with gunite.

The concrete for the east caisson was completed on April 11, 1953, for the west caisson on April 13, and for the north caisson on April 15. There was a total of 10,715 cu. yd. of concrete in the caissons.

The concreting was carried out in fairly cold weather, but all concrete was kept under specified curing conditions with the aid of oil salamanders and steam heating. The caissons were totally enclosed by tarpaulins. The temperature of the concrete delivered to the site varied from 63°F. to 72°F. with an average of about 65°F.

Type II cement was specified for this concrete because of its high sulphate resistance. The aggregates were natural sand and screened gravel graded to specified limits. The water-cement ratio was specified to be not greater than 0.50 by weight. An air entraining agent was used to achieve a final air content of 4 to 6 per cent in the fraction of the mix below 1½ inch size. A plasticizer was also used to aid in securing a very dense concrete.

The caissons were designed on the basis of 3,000-pound concrete. The mix was designed to give as high a grade of concrete as possible, because durability was superior to all other requirements. The ultimate strength of the concrete averaged about 2,200 to 2,400 lb. per sq. in. at three days; 3,600 to 4,000 lb. per sq. in. at seven days, and 5,100 to 5,900 lb. per sq. in. at twenty-eight days.

In order to float the caissons for launching, it was necessary to close the lower cell openings with temporary bulkheads. Figure 81 shows this work completed. These bulkheads were prefabricated and erected after the caisson forms had been removed. They were faced with canvas to improve their watertightness, and all gaps where the timber did not fit the concrete walls were caulked with grout.

#### Preparation for Launching

Figure 81 also shows the installation of ladders, gauges, catwalks, etc., completed on all three caissons. A lighting plant was installed in slings on each caisson. The discharge manifold, to be used when pumping water ballast into the cells, was installed on each caisson. Mooring and fendering facilities inside the graving dock were installed in accordance with recommendations of the consultants. The bottom of the graving dock was graded to El. —4 and all debris removed ready for launching.

On Friday, May 8, the drainage pumps were shut off and removed from the graving dock in final preparation for the trial launching scheduled for Saturday, May 9. On Saturday, May 9, flood gates in the south dike of the graving basin

**Fig. 86. Placing the sand filter blanket behind the caissons.**

Fig. 87. Looking south along wharf, backfill completed.

were opened and the water level in the basin was allowed to rise with the tide. Considerable leakage through the timber bulkheads became apparent and caulking was started immediately on the east and west caissons. Suitable 1½- and 2-inch pumps were brought in and one pump was placed in every cell of each caisson. It was found that one pump per cell was not sufficient to dry all three caissons quickly enough, so all valves in the north caisson were opened and it was allowed to rest on the bottom until the other two were ready for towing from the basin.

As soon as the flood gates were opened, work was commenced on cutting a channel through the south dike. Two carryalls, four bull-dozers and three 2½-yard draglines worked continuously from Saturday morning until Monday afternoon, May 11. The dike was breached at 11.00 a.m. on Monday, shortly after the carryalls stopped work. Figure 82 shows the dike breached and the caissons floating inside the casting basin. The three draglines continued widening and deepening the cut until just before the last two caissons were towed from the dock. The dredge was also used to remove high sections in the central portion of the breach, which the draglines could not reach.

The trial launching of the east and west caissons was carried out on Monday morning shortly after the dike had been breached. Both caissons floated with characteristics very close to those calculated. Both floated and grounded on each tide cycle thereafter until they were towed from the basin.

At 1:00 a.m., Wednesday, May 13, the west caisson was towed from the graving dock into the dredged harbour. Two 400 h.p. tugs were used for this work. The weather was clear, the sea was dead calm and this caisson was towed to the south end of the permanent wharf site and moored. The water in the ballast tanks was then transferred to the back cells to careen the caisson partially and to lift the timber bulkhead out of water. All but three pumps were then removed and set up aboard the north caisson.

Figure 83 is a general view of the wharf site looking west and showing the first caisson removed from the casting basin and anchored in a partially careened position, and the two remaining caissons still in the casting basin.

At 2:00 a.m., Thursday, May 14, an attempt was made to tow the east caisson out of the graving dock. It was first shifted straight west from the east side of the graving dock to the channel entrance. Then as the tug started moving the caisson southward, it grounded on the east side of the channel and had to be pulled back into the graving dock. By the time these operations had been completed, the peak of the tide was past, and it was necessary to moor the caisson in the graving dock until the next suitable tide. At 1:30 a.m., Friday, May 15, it was finally towed out of the graving dock.

While the east caisson was being towed into deep water, lines were run from the north caisson to tractors on the shore, which turned the caisson in the basin. The east caisson was left in deep water and at 3:00 a.m., the tugs came back for the north caisson and towed it through the channel into the dredged harbour. Driving the temporary mooring dolphins on the east side of the ship channel was completed on Sunday, May 17. All three caissons were moored to these dolphins and remained there until grading of the foundation blanket was completed. Placing and grading this blanket was completed on Thursday, May 28.

On Friday, May 29, Caisson No. 1 was moved from its temporary mooring on the east side of the ship channel to its final location and careened to its upright position. At approximately 7:00 a.m., Friday, the tugs started moving the caisson to its final location. This operation was completed without incident and at 9:12 a.m., pumping into the lower cells was started. This continued until 11:13 a.m., at which time pumping into the upper cells commenced. At 4:30 p.m., the caisson had reached the upright position and the pumps were temporarily shut off. Additional water was pumped into the caisson to increase its draft so that it would rest on the bottom at low tide Saturday morning at about 9:00 a.m. During the careening operation, the caisson was held in position by the two tugs and mooring lines to dolphins and to tractors on shore. The pumps used were mounted on a scow alongside the east side of the caisson.

Caisson No. 2 was moved from the east side of the ship channel to its final location on Saturday afternoon, was careened during the night and set on the bottom at approximately 7:00 a.m., Sunday, May 31.

Caisson No. 3 was moved to its final location on Sunday morning, May 31, and careened during the day. It was set on the bottom at 8:30 a.m., Monday morning, but failure of a winch on one of the holding tugs at a crucial moment allowed the caisson to settle off position. The caisson was refloated on a rising tide and placed on the bottom again at approximately 7:00 p.m. Figure 84 is a view looking south along the wharf showing Caissons Nos. 1 and 2 landed in their final position, and No. 3 just being careened.

The maximum deviations of the actual front faces of the caisson from the design location of the front face are 0.08 feet east and 0.48 feet west. Caisson No. 1 is located 2.17 feet north of the design location. The space between the exterior end walls of Caissons Nos. 1 and 2 is 4.06 feet, thus making Caisson No. 2, 3.11 feet north of the design location. The space between the exterior end walls of Caissons Nos. 2 and 3 is 5.93 feet, thus making Caisson No. 3, 2.18 feet north of the design location. These figures indicate that the entire wharf is 2.17 feet north of its design location.

Stripping of the bulkheads and removal of the equipment from the caissons commenced as soon as they had been placed.

#### Description of Careening Procedure

A brief description of the careening procedure should be of interest. This was worked out in detail by the consulting engineers, who have had extensive experience with floating drydock structures. Figure 85 is a sketch showing the various stages of the careening operation.

In the first view of the sketch the initial condition of the caisson in its floating position is shown. By putting two temporary timber bulkheads at and near the open end of the caisson, it could be properly ballasted with water to float level for removal from the casting basin. This ballast was necessary to counterbalance the weight of the bottom slab or the closed end of the caisson. After the caisson had been towed to deep water, the water ballast was transferred as shown in the second view of the sketch.

A six-inch pump lifted water to the top of the caisson where a full length pipe header with 1-inch valves in each compartment made control of ballast water for sinking easy. Filling by gravity through valves in the bottom of the caissons could have been used, but it gives less positive control of the operation.

With the caisson partly careened by permitting the original ballast water to flow to the bottom, the pumps were used to add water in the same compartment to sink the low edge to about 36-foot draft as shown in the third view of the sketch. This was necessary to insure stability in the final upright position. Water levels in adjacent compartments were kept within a foot of each other and trim of the caisson was held within a foot for its full length. Next, water was pumped into the upper compartments to bring the caisson vertical at 33 feet draft as shown in the fourth view of the sketch.

About an hour before low tide, the caisson was accurately positioned and evenly ballasted. Ballast was then added to increase the draft to about one foot greater than the depth of water predicted at low tide. As the tide ebbed the caisson settled on the bottom; plugs in weepholes below water level were knocked out and water pumped in from the top to fill the caissons ahcad of the rising tide. If final positioning was not accurate, as was the case with Caisson No. 3, the water was pumped out and the caisson allowed to be lifted by the tide and positioned again.

The filling of the caissons was started as soon as possible after their being finally positioned. The type of fill material has already been described. Mine side dump cars were used at first until the fill was brought up to an elevation where motor trucks could be used.

Figurc 86 shows the placing of the sand filter blanket over the rock backfill behind the caissons. The remaining area behind the caissons was then completely filled by material placed hydraulically from the dredge.

Figure 87 is a view looking south along the wharf showing the cell filling and backfill nearly completed. The projecting reinforcing bars for anchoring the coping wall and unloading tower track beams to the cells can also be seen.

Figure 88 is an aerial view looking over the completed wharf. The casting basin where the caissons were constructed can be seen to the right. Looking closely, a shadow in the water shows the dredged approach channel leading to the wharf site through the tidal flats from deep water. The mountains surrounding the plant site can also be seen in the background.

#### Acknowledgments

The general arrangement and preliminary design of the wharf caissons, as well as full launching and careening details was carried out by the consulting engineers, Frederic R. Harris, Inc., of New York and Toronto, for whom C. J. Murphy and L. G. VanHouten were the project engineers.

The final design and detail construction drawings were prepared under the author's general direction by the General Engineering Department staff of the Aluminum Company of Canada, Limited. J. F. Braun, M.E.I.C., assistant chief engineer, R. F. Ogilvy, M.E.I.C., project engineer, and Viggo Andersen, M.E.I.C., senior concrete design engineer, directed this work in detail.

The contractor for this work was Kitimat Constructors, a joint venture of several British Columbia contractors, for whom H. M. Whiting was project manager. √

Fig. 88. Aerial view showing completed wharf at right center with line of dolphins beyond.

# Foundation Investigation

## for the

# Kitimat Smelter

*by*

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This paper, which was presented at the Annual Meeting in Quebec in May, 1954, describes the soil tests and studies required to foretell the settlement behaviour of the 44-acre fill, up to 30 feet deep, on which the great aluminum plant at Kitimat is founded. It also outlines the methods adopted to compensate for the inevitable settlement which took place during construction and which will continue for an unpredictable period.

The smelter site at Kitimat is underlaid by sedimentary deposits varying in depth to a maximum of 350 feet. They are of a complex nature including sand, gravel, silt and marine clays. The necessity of using a fill varying in depth to a maximum of 30 feet and covering an area 1200 feet by 1600 feet in order to raise the site to a working level presented major problems in the forecasting of the amount and rate of settlement below the fill in the irregular natural soil deposits. Based on preliminary soil investigations it was estimated that the maximum settlement would be about 18 inches and that the major portion of the settlement would be complete within a period of a few months after placing of the fill.

However, in view of the wide variation in subsoil conditions a series of settlement gauges was installed over the area of the site to permit irregularities in the amount and rate of settlement as compared to the forecasted values to be determined. The data from these showed the rate of settlement to be proceeding at a somewhat lower rate than anticipated and that the maximum estimated settlement would be exceeded in certain areas.

The settlement data were used to adjust the elevations of the building elements so that future settlements should not result in certain critical tolerances set by plant operation requirements being exceeded.

The discussion of the problems and their solution is given in chronological order. It is hoped that it will permit a clearer understanding of the reasons for the procedures which were followed.

### Geology

The geological conditions of Kitimat are typical of the coastline of British Columbia at the heads of

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the many inlets or fjord channels. Kitimat Arm is about 2 miles wide at the mouth of the Kitimat River. The mountain slopes rise steeply from the shore line providing practically no space for habitation. It is thought that the upper end of the fjord now occupied by the Kitimat River was filled with sediments during glacial and interglacial periods of the Pleistocene age. The Kitimat River is entrenched in these sediments and flows southward, emptying into Douglas Channel at Kitimat. A high ridge across the valley about three miles upstream from the smelter site appears to mark the terminus of the sediments of one glacial period. From the ridge northward the general land area is from 300 to 500 feet above present sea level. Southward of the ridge the land surface drops off rapidly to the tidal flats of the Kitimat River delta on which the plant is located. Beneath the smelter site the thickness of sediments above bedrock varies to a maximum of 350 feet. The geology of the sediments is complex because they include alluvial fan deposits of sand and gravel laid down by Moore and Anderson Creeks and by the Kitimat River, deltaic sand silt deposits brought in by the Kitimat River, and marine clays, all interlaid in an irregular manner. Thus, the subsoil profile varies considerably from point to point below the delta area.

#### Foundation Investigations

Foundation investigations were commenced at the site immediately after the establishment of a beach head construction camp. At this time, however, the exact locations of the dock and smelter sites had not been chosen. The initial boring, sampling and laboratory testing program was therefore planned to assess the general nature of the subsoil conditions over an extensive area around the head of the channel.

At that time access to and around the site with drilling equipment was difficult except on the water, because of the heavy forest growth and the large number of drainage channels. The first series of test holes of the initial program included 12 churn drill holes and nine wash bore holes made with a portable diamond drill rig. These were put down on the tidal flat near the shore line. Access to these test holes was by water. A second series of test holes of the initial program was undertaken farther inland as access facilities improved. This consisted of a grid on a spacing of about 500 feet each way, extending northward from Moore Creek. Holes varied in depth to a maximum of 200 feet. Only those close to the west shore line reached bedrock. About 80 holes were drilled in these programs.

During the following two years, subsequent drilling programs were undertaken at the dock and plant site areas for the purpose of obtaining more detailed subsoil information at specific locations after the general plant layout had been determined. The location of all test holes are shown in Figure 89. The log of one of the test holes, typical of the later ones, is shown in Figure 90.

In the initial program, most of the samples obtained were of the disturbed type and were primarily for the purpose of identifying the general nature of the subsoil. In addition, however, some 35 undisturbed samples were recovered for the purpose of obtaining quantitative data on the physical properties of the subsoil strata. Penetration resistance data were recorded and a few pile loading tests were made in the Bay area.

#### Subsoil Conditions

The preliminary investigation indicated a wide range of soil types, from gravels through sands and silts to silty clays. Silt is predominant in the profiles. The sands and gravels are of low to medium density as determined by the results of the penetration resistance data. Over the tidal flat and in the forested area highly organic material occurred to depths ranging from about two feet to as much as 20 feet, with the material frequently being interlaid in pockets with gravel and silt. Many logs and stumps were found at shallow depths. Generalized subsoil profiles are shown in Figure 91.

Soil tests on samples from the preliminary borings showed natural moisture contents of the silts and clays ranging from 15 to 36 per cent. The liquid limits of the clays and silty clays ranged from 32 to 27 and the plastic limits from 22 to 19. In general, the silts were nonplastic, but contained some organic matter. The compressive indices of the fine grained soils ranged from 0.06 to 0.20.

#### Plant Foundation Type

The final locations of the dock and plant sites were made late in 1951. The finished grade of the smelter area was chosen to prevent flooding by tides and by mountain freshets from Moore and Anderson Creeks. This required the placement of a fill over the smelter site area, ranging in thickness from zero to 30 feet. The only alternative was to move the site to higher ground away from the shore line. This would have resulted in increased costs in handling all materials entering and leaving the plant from the dock. Moreover, the deep fill presented some advantages in eliminating irregular settlement in the organic material underlying the area at shallow depths.

The dimensions of the area to be filled were 1,600 by 1,200 feet, with a total volume of 1.8 million cu. yd. and a total weight of over 3 million tons. The intensity of net loading ranged from 0.2 to 2.0 tons per sq. foot. The distribution of the total loading, including building and fill, is shown in Figure 92. The average building load applied over the area of the buildings is of the order of 0.25 ton per sq. ft, which constitutes only a small fraction of the total loading of the fill itself.


**Fig. 89. The smelter site showing location of test holes.**

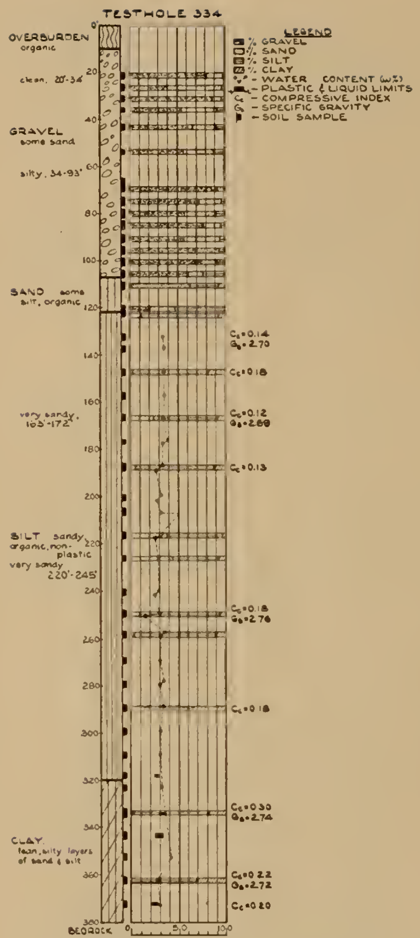


Fig. 90. Log of a typical test hole.

The calculation of the amount and rate of consolidation involved the computation of the stress distribution in the soil below the applied load and a knowledge of the compressibility of the underlying soil strata and of the position of porous strata in the profile. The Boussinesq equations[1] were used to estimate the stresses in the soil. Laboratory consolidation tests[1] on undisturbed soil samples from which pressure-voids ratio and time curves are obtained, were used to determine the compressibility characteristics of the soil.

The calculation of settlements by this procedure has proved to be reasonably accurate where a single layer of fairly uniform, highly compressible soil occurs, so that most of the settlement takes place in this one layer. As the soil profile over a site becomes less uniform and the number of soil strata in which appreciable consolidation will occur increases, the mathematical analysis becomes more difficult and the accuracy of the predictions decreases, particularly with respect to the rate of settlement.

The laboratory tests on soil samples from the preliminary investigation indicated comparatively low compressibility characteristics for the subsoil strata. A measure of the compressibility of a soil is the "compressive index." This is a coefficient obtained from a laboratory consolidation test. Ordinary building loads would not produce appreciable consolidation in materials with compressive indices of the order of magnitude obtained from the Kitimat samples.

However, to appreciate the settlement problem at the Kitimat site an understanding of the nature of the stress distribution below a loaded area is necessary. An area 1,200 by 1,600 feet is loaded and the depth to bedrock beneath the site is as much as 350 feet. At this depth the principal compressive stress below the center of the loaded area would be about 95 per cent, and below a corner 25 per cent, of the intensity of the surface loading. This signifies that appreciable settlements are induced throughout the entire thickness of compressible sediments above bedrock by the applied fill load. By comparison for a loaded area of say 100 by 150 feet, significant settlements would be induced within the upper 150 feet of compressible soil only. Thus the effect of the comparatively large

[1]Taylor; Fundamentals of Soil Mechanics, Chap. 10, p. 208 and Chap. 11, p. 250; Wiley; 1948.

A compacted granular fill was selected for the site of Potlines 1 and 2 because of the availability of excellent material and because of its good drainage characteristics under the wet climatic conditions at Kitimat. This compacted gravel fill was considered to be a suitable pad on which to carry the plant buildings on spread footings.

### Process of Consolidation

The hazard in the use of the fill was the magnitude and rate of settlement which would occur in the underlying soil during the process of consolidation under the weight of the fill. This process involves slow settlement, which may extend over months or years in saturated silt or clay soil types as the water is slowly squeezed out of the soil by superimposed loads on the soil mass. During this process the water in the soil is under a gradually decreasing excess hydrostatic pressure. The rate of consolidation is a function of the permeability of the soil and of the distance that the water must move through the consolidating soil to reach a more permeable layer, such as a sand or gravel stratum.

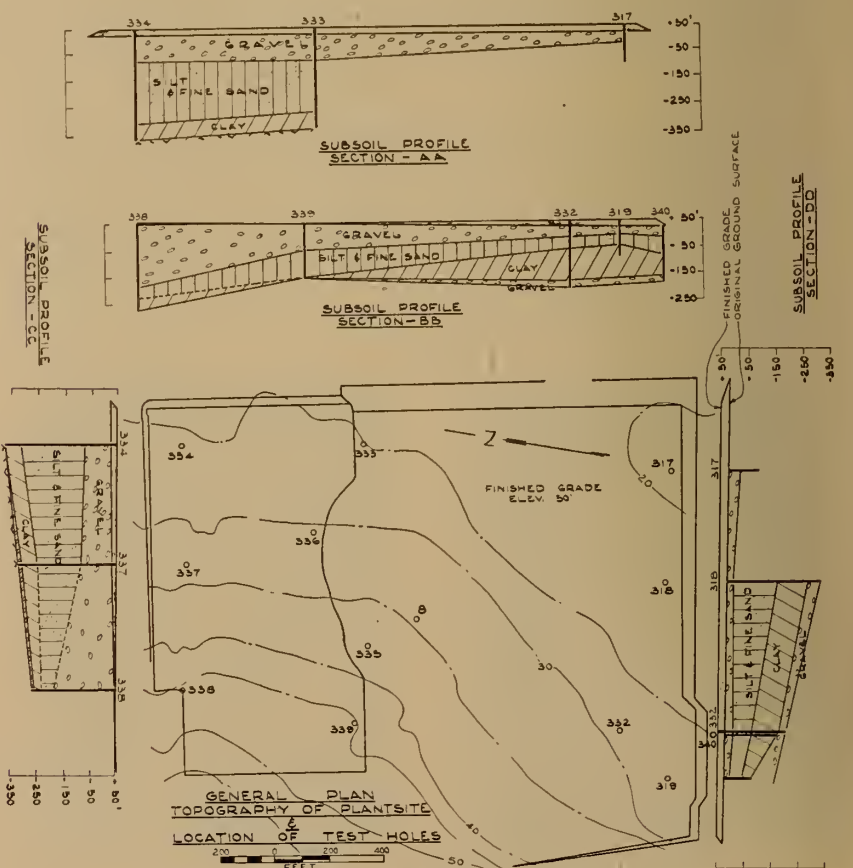



Fig. 91. Generalized soil profiles.

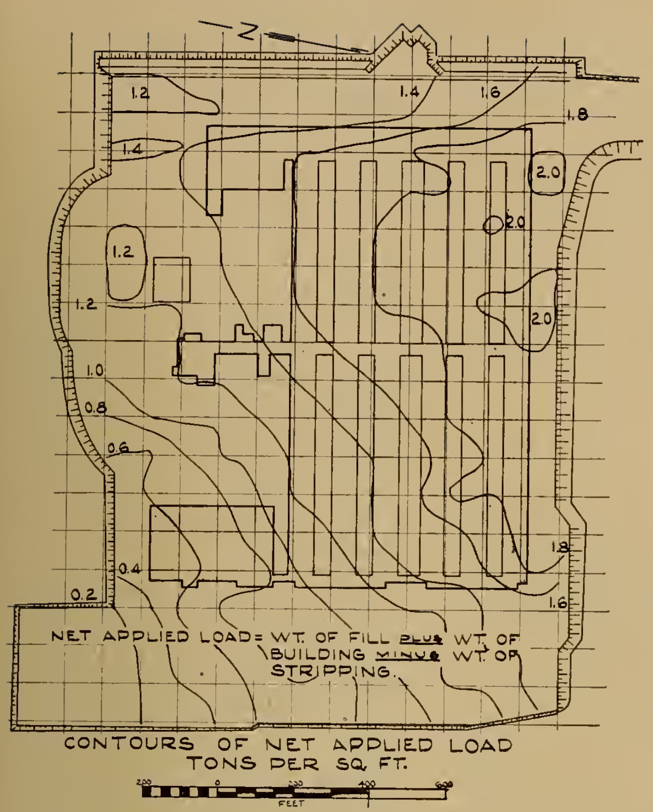



**Fig. 92. Distribution of loads over plant site area for Potlines 1 and 2**

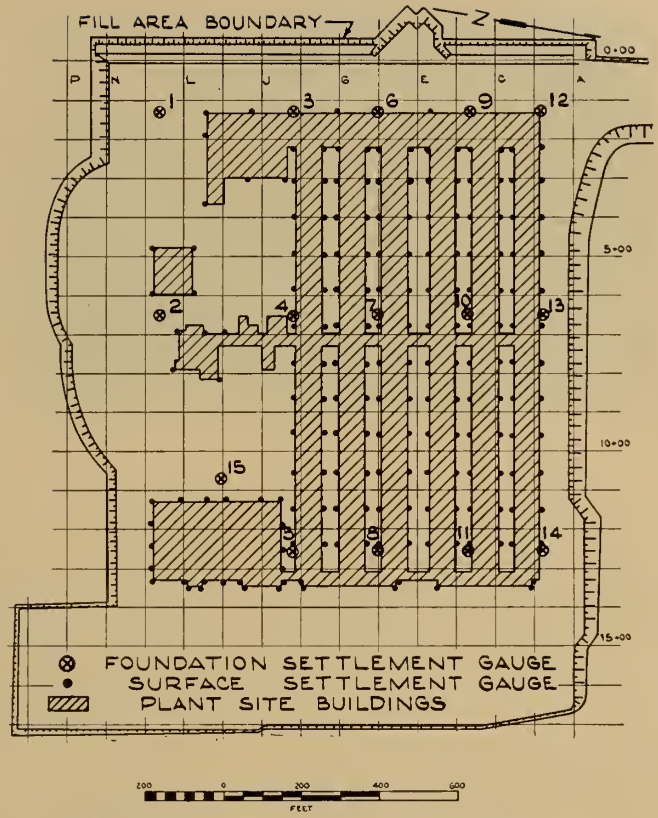



**Fig. 93. Plan showing location of settlement gauges.**

loaded area is to produce high stresses for the full depth to rock, and therefore even with relatively low values of compressive index, the total amount of settlement can be high.

### Estimated Settlements

On the basis of the compressibility characteristics of the soil samples from the preliminary foundation investigations, it was estimated that the maximum settlement below the fill due to consolidation would be about 18 inches, and that the rate of consolidation would be such that about one-third of the total would take place during the placing of the fill and another third within one month after the fill was placed. With these magnitudes and rates of settlement, it was considered that the differential settlements over the area of the fill would not be great enough to cause damage to buildings or to affect adversely the operating conditions for the plant.

### Settlement Gauges

However, it was realized that the soil profile was irregular and that the depth to bedrock probably varied considerably over the area of the fill. For these reasons it was decided to place a series of settlement gauges based at the bottom of the fill and distributed in a regular pattern over the building area, so that the actual settlement behaviour of the area under load could be observed. These observations would permit a correlation with the theoretical analysis to be made and would provide a basis for adjustment during construction to accommodate the actual settlement pattern.

Subsequent to the initial theoretical analysis outlined above, additional soil test results became available from test holes which were put down at the dock and smelter sites during later stages of investigation. These latter data were used for verification of the original analysis, which had been based on the results of the preliminary investigation.

The settlement gauges were three-foot square timber platforms set at the level of the stripping prior to the placing of fill. Pipe extensions were connected to the centre of the platforms and additional lengths were added as the fill was built up. Later, as buildings were erected, 190 settlement plugs were set in the building foundations. A plan of the building area showing location of the settlement gauges is shown in Figure 93. All settlement readings are referenced to a permanent bench mark set in rock adjacent to the site.

### Compacted Granular Fill

The granular fill material was obtained from the Sandhill borrow pit located about three miles north of the smelter site. A view of the face of this pit is shown in Figure 94. The material consisted of an exceptionally well graded and clean gravel-sand. The range in its grain size distribution is shown in Figure 95.

The compacted gravel fill was placed in the summer and fall of 1952. Placement of fill materials was preceded by stripping of surface organic deposits overlying the site. The depth of stripping ranged from three to 15 feet. The granular fill was truck-hauled to the site. An initial base layer of about three feet thickness was placed on the stripped base to provide a stable surface for support of the construction vehicles. Subsequently, the fill was placed in six-inch layers and compacted with four passes of a 50-ton pneumatic tired roller. This particular layer thickness was adopted for reasons of maximum efficiency of travel and dumping of the hauling vehicles, rather than as being necessary for attainment of the specified density. A view of the typical fill operation is shown in Figure 96.

Fig. 94. "Sandhill" gravel pit.

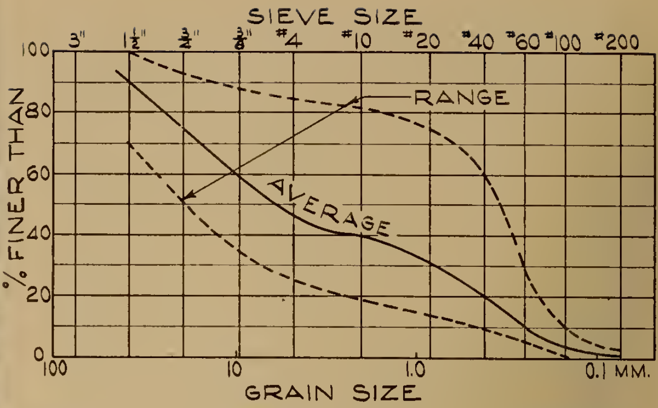



Fig. 95. Range of grain size distribution. Sandhill pit material.

#### Inspection of Fill Placement

Close inspection of the fill operation was maintained to assure proper selection of material and uniformity of compaction for the entire fill. Compaction tests and grain-size tests were made at a field laboratory set up on the site. Both standard Proctor compaction tests and relative density tests were used for control purposes. Due to the lack of fines, the material was not sensitive to changes in moisture content and therefore did not exhibit an optimum moisture content. The density of the compacted fill was determined by in-place field density tests. Dry densities ranging from 130 to 140 lb. per cu. ft. were obtained. These densities corresponded to an average of 97 per cent of standard Proctor optimum density and 95 per cent of maximum density.

A significant property of the granular fill material was its ease of placement under the wet climatic conditions which occur at Kitimat. The fill operation was not stopped at any time by wet weather. Under extreme conditions, the operations were carried on during periods of five inches of rainfall in three days. The fill is of exceptionally high quality. It can be excavated on vertical faces to depths of 10 feet. A view of excavation in the compacted granular fill is shown in Figure 97. No measurable settlement has occurred within the fill.

#### Settlement Records

The observed settlements at the foundation gauges proceeded normally during the placement of the fill and in the one-month period following. However, it became apparent that considerable variation in future settlements from point to point over the smelter site area could be expected. Up to December 1, 1952, the average settlement from the 15 gauges was 1.25 feet, with a range of from 0.6 feet to 1.7 feet. It became apparent during the winter of 1952-53 that the settlements were proceeding somewhat more slowly and would be of somewhat greater magnitude than had been estimated on the basis of the original theoretical analysis. While the settlements were not developing strictly in accordance with the estimated values, a fairly definite pattern was apparent from the observations. The general effect of the settlements was a tipping of the surface downwards toward the southwest corner of the building area. Moreover, a trough of maximum settlement appeared to be developing at the southwest corner of the building area and extending diagonally toward the centre of the fill area. However, the differential settlements were transitional and, when spread over the large dimensions of the plant site, were relatively small.

In view of the observed settlements it became necessary in the late fall of 1952 to assess the effects of future settlements on the building construction program and to revise the assessment during the winter of 1952-53 as additional settlement observations became available. All building construction had been put off for a period of one month following completion of the fill in any area in anticipation of the estimated settlements within this period. The concrete footings and substructure for part of the buildings had been poured in the fall of 1952 and the major portion of the building construction program was scheduled for the summer of 1953. It will be appreciated that settlements which occurred prior to the pouring of footings would produce no harmful effects. Moreover, only the differential settlements occurring after the start of building construction would be significant in causing damage to buildings or in affecting operations of the plant.

#### Adjustments During Construction

The soil test data and the settlement observations were carefully analysed during the winter of 1952-53. Additional soil test data indicated the existence of somewhat more highly compressible clay at depths from 100 to 200 feet below the area of maximum settlement and a more granular soil profile below the area of minimum settlement. Otherwise the soil profile beneath the major portion of the site was fairly uniform. Future settlements were extrapolated for several years ahead on the basis of theoretical time-consolidation curves. Certain tolerances were agreed upon for differential settlements throughout the plant from the point of view of satisfactory plant operation. These concerned such factors as the level of the individual smelter pots and the tolerable differential settlements of the crane rails running the 1,200-foot length of the pot-room buildings. From these considerations it was concluded that if the buildings were constructed sufficiently high above their design elevations so that they would settle to a level position as of January 1, 1955, then differential settlements after this date would not exceed the tolerances set for satisfactory plant operations.

This procedure involved setting each column foundation in the plant at an elevation computed from the recorded settlements in the particular area and from the settlements forecast to January 1, 1955. In the potroom buildings there were two points at which further adjustments could be made during construction after the foundations were set, to compensate for inconsistencies which subsequent settlements records revealed. These were at the bases of the steel columns and at the potroom floor slabs. Each individual smelter pot is also being set so as to be level on January 1, 1955. The adjustment required in a pot setting is usually a half-inch or less, but in some cases has been as high as one inch. However, some foundations for the south potline required adjustments of as much as 12 inches.

One of the complicating factors of this procedure was that the building construction period extended over two seasons. The footings of individual buildings and of sections of buildings were constructed at different times, yet all of these had to be set in proper relation to one another and adjusted to compensate for future settlement, which varied from section to section. Had it been possible to build all of the foundations over the entire building area instantaneously, the problem of setting the building levels to compensate for future settlement would have been relatively simple. It was necessary, however, to take into account the settlements in the periods between setting of adjacent sections of footings. This considerably increased the amount of work and computation involved. The full time services of an engineer were required to make the settlement observations and to compute the building level settings and adjustments in accordance with the above procedure.

The adjustment of building levels did not interfere with normal construction to any appreciable extent, except for a few difficulties with the first settings. In fact, in the case of the individual smelter pots it appears to have facilitated their installation.

### Carbon Paste Plant

A special problem arose in connection with the carbon paste plant building. This is located at coordinates (L, 7 + 00) as shown in Figures 99 and 100. One section of the building is only 50 by 60 feet in plan, but is 136 feet high. It is fairly rigid and heavily loaded. It is located in an area of comparatively low settlements, but the settlement records indicated that future movements would tip the building out of plumb across a northeast-southwest diagonal by several inches. The building foundations were therefore adjusted in the opposite direction to compensate for the settlement to the target date of January 1, 1955 and the steel frame was erected out of plumb by 3 inches at the top. Some 150 strain gauges are being set on the steel frame of the building to detect any serious overstressing in the steel work due to nonuniform settlement. If necessary, it will be possible to relieve such stresses by jacking the columns in the building.

No particular difficulty was encountered by the steel erectors in erecting the steel frame out of plumb. In fact they seemed rather to enjoy the operation, perhaps because of its novelty. The building has been completed for about seven months and it has now been rotated by settlements about half way to the level position with no evidence of any damage to the building.

### Magnitudes and Effects of Settlements

Figure 98 shows a typical settlement plot of the readings from one of the foundation settlement gauges. The total settlement of 2.7 feet up to March, 1954, as shown in this figure, was about average, but the

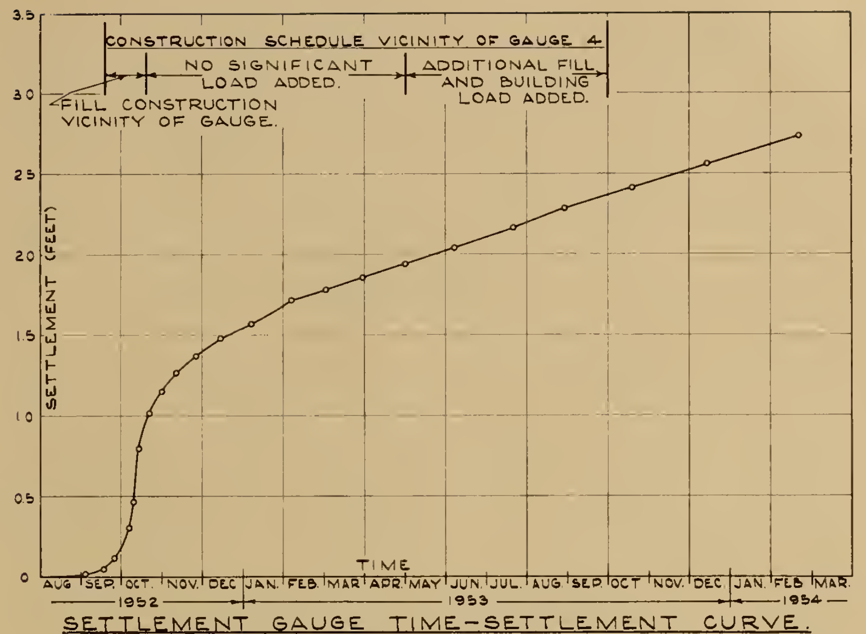



**Fig. 98. Typical settlement plot for one settlement gauge.**

**Fig. 96. (Above) Placing operations for compacted gravel fill.**

**Fig. 97. (Right) Potline looking south. Placing concrete for main air duct entrance to potroom 2C. Excavations for room 2C behind. Footings being poured for room 2A.**

range of total settlements at the various gauges to that date was from 1.2 to 3.6 feet. Of more significance than the plots of total settlements from the start of the fill operation, is the plot of settlement contours over the site during the period from December, 1952, to March, 1954, corresponding to the period since the start of construction of the major portion of the buildings. This plot is shown in Figure 99, and a similar plot for the period of July, 1953 to March, 1954, is shown in Figure 100.

In order to assess the effects of the settlements on the buildings, a program of periodic examination of the buildings has been set up. In general, the sections of the buildings to a height of about 10 feet above ground are of concrete construction. It is to be expected that the effects of settlements on the buildings will be revealed first in these sections of the buildings in the form of cracks. The concrete work in general is of high quality and few cracks have occurred. Records are being kept on those which have developed. Some of these could not possibly be due to differential settlement, but in a few cases they possibly may be. The magnitudes of the cracks which have developed are insignificant with respect to structural damage or unsightliness.

One of the first buildings to be erected is located at the west end of the potroom buildings and within the area of maximum settlement. This building is 250 feet long. Its south end has moved down seven inches relative to its north end, but there is no evidence of structural damage or unsightliness.

### General Considerations

There are many locations in the British Columbia coastal area where similarly irregular subsoil conditions exist and where more highly compressible soils than at Kitimat occur. Foundation settlements associated with fill-loaded areas of large dimensions present a particular problem under the British Columbia coastal conditions. There is a definite economic limit to the extent to which the drilling and laboratory investigations of the subsoil can be justified in establishing the properties and the stratigraphy of the sediments for the purpose of estimating the probable settlement behaviour. Due to the complexity of the geology and the nonuniform deposition of sediments in the coastal terrain, it is doubtful if differential settlements can be accurately predicted from the subsoil investigation alone, regardless of its extent. It is essential, however, to establish the general subsoil conditions, and if these indicate that large settlements are to be expected, then the practical and economical procedure is to assess the magnitudes which can be tolerated and to make provision throughout design and construction to accommodate them. Provision for settlement during construction stages necessitates accurate observation of the settlement pattern. The settlement observations indicate the basis on which the adjustments during construction should be made. The importance of the settlement observations in such cases is paramount and can hardly be overemphasized.

The authors have acted as soil and foundation consultants to the Aluminum Company of Canada. H. G. Dutz, JR.E.I.C., is the resident engineer for the foundation consultants at Kitimat. The contractors are Kitimat Constructors, Ltd.

Engineers of the Aluminum Co. of Canada have contributed materially to the preparation of this paper and to meeting the problems arising from the foundation conditions at the site. √

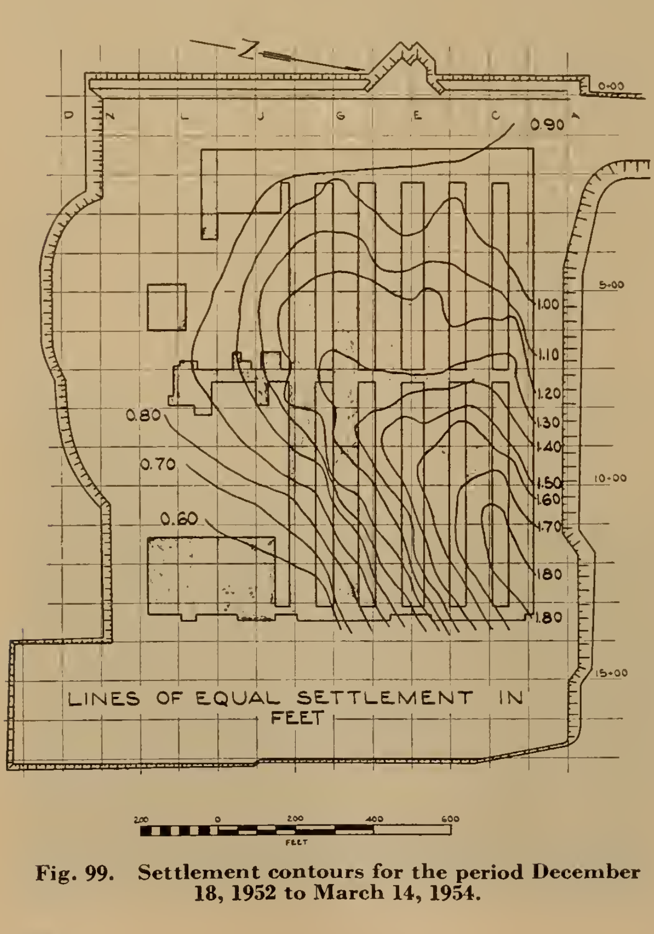



Fig. 99. Settlement contours for the period December 18, 1952 to March 14, 1954.

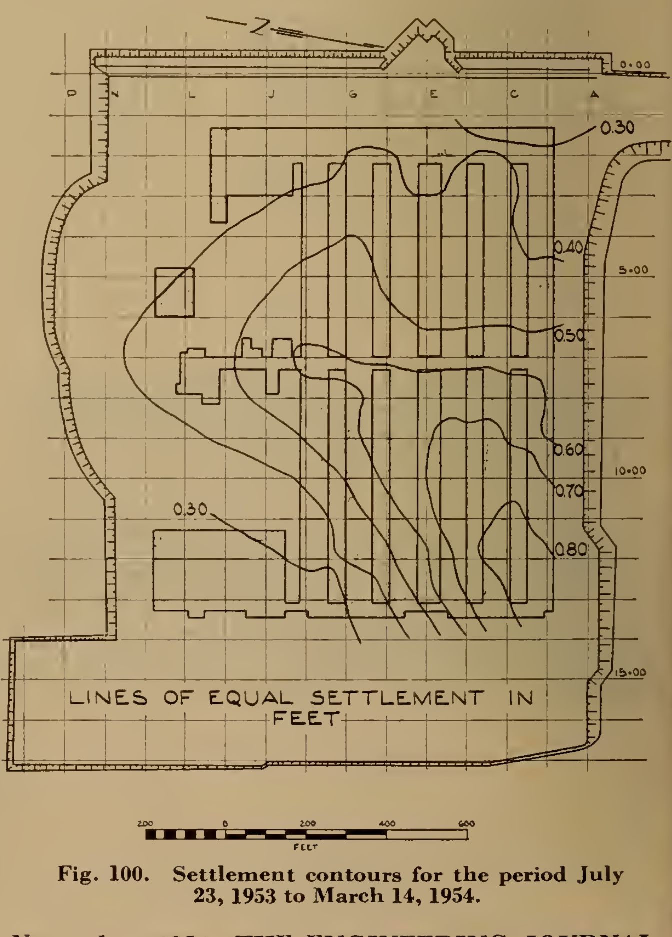



Fig. 100. Settlement contours for the period July 23, 1953 to March 14, 1954.

# Design and Construction of the Kitimat Smelter

*Compiled by the staff of the General Engineering Department, Aluminum Company of Canada, Limited.*

**It is not every day that a large industrial plant is built in the wilds, 500 miles from a base of supply and with only limited transportation facilities. These are among the reasons why readers should find this paper more than ordinarily interesting, describing as it does the design and construction of the Kitimat smelter. The fact that some $5 million worth of construction equipment was used gives some idea of the size of the job.**

The design and construction of a large aluminum smelter at Kitimat presented many problems which would not arise in a conventional industrial area. The location at the head of Douglas Channel is mountainous, heavily timbered and uninhabited except for a few scattered Indian settlements. The only access, for both men and materials, was by air or sea. Thus the original establishment of a beachhead from which to carry out operations was in many ways parallel to a military landing operation.

### Beachhead

Construction commenced during the latter part of March, 1951, when Horie-Latimer Construction Co., Ltd. contracted to build a temporary wharf and scow grid. Construction of the temporary wharf facilities was started before any camps, roads or cleared areas existed. Hence the contractor had to provide a floating pile driving unit, complete with repair shop, accommodation and messing facilities.

The general contractor, Kitimat Constructors, of Vancouver, B.C. chartered a 72-foot coastal boat known as the *Arrowac* and moved into the area on April 16 with 10 men to establish the first beach camp. The first barge, loaded with a bulldozer, small tools, power saws, lighting plant, camp equipment, food supplies, etc., and several prefabricated camp buildings arrived the day after. No docking or unloading facilities were then available. The barge was beached on the tidal flats at high tide, where the bulldozer was unloaded and the materials packed ashore by manpower.

The crew lived aboard the *Arrowac* while a small area was cleared and the first camp buildings erected. Progress was slow, hampered by heavy timber, soggy ground from the spring run-off, and several feet of snow. Fortunately, the contractor was able to bolster his working force by employing Indians from the Kitimat Indian village that lies on the east side of the channel, three miles from the plant site. The first camp buildings were ready for occupancy early in May. Additional forces were brought in by aircraft as quickly as the camp facilities could be expanded. The location of the first camp is shown at D on Figure 101. Figure 102 shows a general view of the camp.

### Temporary Wharf

The temporary wharf was 200 by 60 feet, with a 500- by 20-foot approach section and provided one berth for coastal vessels. The maximum depth of water at low tide was 20 feet. Small freighters having drafts of less than 10 feet could berth on the approach section.

Oil lines were provided on one side of the wharf to discharge fuel to the tank farm nearby. Water lines were provided for fire protection and to supply fresh water to ships and water front equipment.

A scow grid, capable of handling scows up to 120 feet in length with a 50-foot beam and 10-foot draft was built immediately north of the wharf for the off-loading of heavy equipment and supplies.

### Access Roads

Building of access roads over the rugged mountain slopes presented many problems. Not only was the timber heavy and difficult to handle in the rough terrain, which was wet and soft from numerous small mountain streams, but considerable rock and thousands of large tree stumps had to be removed with dynamite. The holes left by blasting filled with water, turning the right-of-way into a sea of mud, bogging down the bulldozers. No gravel deposits existed in the immediate area and a tractor road had to be built two miles north to a deposit near Moore Creek. Heavy equipment moved over the tractor road to the gravel deposit

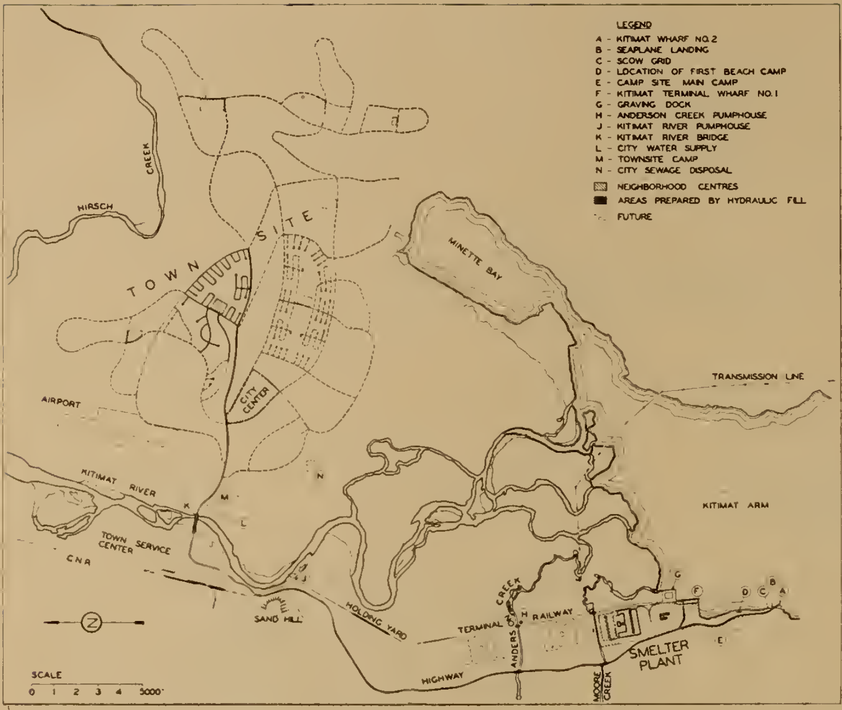



**Fig. 101. General plan of Kitimat area.**

and the construction of roads, preparation of areas for construction buildings, repair shops and permanent camps became possible. Figure 103 shows the construction of a small temporary bridge over one of the small streams. By early December a good tote road had been built four miles up the valley to an excellent supply of gravel. A temporary timber bridge was erected over the Kitimat River and preparations were made to extend the road through to the townsite area.

### Clearing

Clearing operations were slow and costly. Loggers first moved into the area, felled the merchantable timber and moved it out with donkeys and logging arches to where it could be cold decked or transported direct to the saw mill, Figure 104, on logging trucks. The rest of the timber was then felled, bucked up and yarded into huge piles with high lines and burned. Stumps were removed with heavy equipment and stumping powder and piled by cranes.

Burning the green logs and wet stumps was difficult. Picking up the stumps with a crane and dropping them to remove the dirt and mud, careful piling and the use of old tires, fuel oil and blowers to fan the fires produced the best results.

Considerable success was obtained by felling trees into windrows, using a 5-ton steel ball measuring eight feet in diameter, pulled by two large tractors travelling parallel to each other approximately 125 feet apart and several hundred feet in advance of the ball. The felled trees were bunched together as tightly as possible for burning, using several tractors on either side of the windrow. This method was limited to areas where trees did not exceed 12 to 14 inches in diameter after all merchantable timber had been removed. The occasional tree up to 24 inches did not seriously hamper the operation.

### Camps

To complete the first stage of the development at Kitimat on schedule, accommodation for 2,300 men was required. Three camps were established, so men could be housed near the areas in which they were working.

The main camp, established near the smelter site, accommodated 1,000 men and consisted primarily of nine two-story, 72-man bunkhouses. A stern wheeler river boat known as the *Delta King* was purchased, beached on the tidal flats and converted into excellent accommodation for 250 men. One hundred and four temporary houses were erected in the same general camp area for key personnel. A trailer camp was also established for 65 trailers, complete with water, sewerage and power systems.

A second camp for approximately 600 men was established at Anderson Creek, two miles north of the main camp. As road construction and clearing operations for the new townsite got underway, a third camp for 600 men was erected on the east side of the Kitimat River opposite the permanent bridge site. A fourth camp for 500 men was built later to provide additional accommodation for crews working on the housing program.

To provide communications between the various camps, stores, post office, hospital and recreation centre, a regular bus system had to be operated for the convenience of the workmen.

### Shops and Maintenance of Equipment

In order to maintain continuous operation of all equipment and plant, large temporary shops were erected, fully equipped and protected from fire by sprinkler systems and portable fire fighting equipment. Machine work and heavy repairs were carried out in a building 65 by 140 feet. All trucks, busses, jeeps, cars, etc., were maintained in an adjacent building 150 by 100 feet, with spare parts stores on the mezzanine floor. An electrical shop and shops for other trades were all provided in one building 40 by 230 feet. The carpenter shop and saw mill were separate large structures.

### Transport and Handling of Materials and Equipment from Vancouver

Heavy construction and permanent plant equipment and the major part of the building materials were shipped from Vancouver, where large dockside cranes are available for transferring the material and equipment to scows and coastal freighters. The scows were then towed 500 miles up the coast to Kitimat where they were placed on the grid and unloaded.

Some large transformers were shipped direct to Prince Rupert, where the cars and transformers were loaded on a rail barge and towed south to Kitimat. At Kitimat an 85-ton low bed trailer was backed onto the barge. The transformers were jacked up and skidded onto it and hauled to their permanent locations. Unloading of the heavy transformers could only be carried out during low tide periods when the scow was resting solidly on the grid.

Miscellaneous construction material and all foods were brought in by Union and C.P.R. steamship lines and the various coastal freighters.

### Dredging

Providing an access channel to the permanent wharf required the dredging of over three million cubic yards of material from the tidal flat to a minimum elevation of −31. The material ran from silty sand to excellent gravel and was deposited on the tidal flat behind rock moles to provide storage areas and building sites. A 24-inch suction dredge was used, powered by two 2,000 hp. diesel engines. Approximately two and a half million cubic yards of material were deposited in the area south of Potlines 1 and 2 and built up to El. 28.5 or 6.5 feet above high tide.

The building site for Potlines 1 and 2 was filled to grade by gravel hauled in by trucks and consolidated by tractors and 50-ton rollers. However, due to the high cost of preparing building sites thus, it was decided to fill the area for Potrooms 3 and 4 hydraulically. This involved dredging in the harbour area to El. −31, and pumping through 5,700 feet of discharge line to El. 45.5, which required the installation of a booster pump in the discharge line to obtain an economical production rate.

The forest floor and soft silty material was first stripped from the area to be filled. Truck hauled gravel was spread over the area and consolidated to provide a good subbase. The surface was finished on a one per cent slope to a weir, installed in one corner of the area to handle the dredge water. This gradient, which was maintained throughout the dredging operations, kept the water moving at sufficient velocity to carry off all organic material and silt. Figure 105 shows fill being placed in the storage area and tractors being used to compact the gravel.

#### Construction Equipment

Construction equipment required at Kitimat involved an expenditure of approximately $5 million and consisted mainly of the following: 25 cranes, shovels and draglines, 30 bulldozers of various sizes, 82 heavy duty dump trucks, 9 semi trailers, 9 transit mixers, one 6-cubic yard combination mixing and batching plant, 1 aggregate washing and screening plant, 10,000 cubic feet of compressed air capacity, 6,000 kw. of electric power, 43 welding machines and 40 four-wheel drive jeeps and light pick-up trucks.

#### Waterway Improvements

The smelter area is located at the foot of the eastern slope of a mountain range on the west side of Kitimat River. Two mountain streams, Moore and Anderson Creeks, flow down this slope, drop about 100 feet in falls and then continue with decreasing gradient across the plant site and into Kitimat Arm with the Kitimat River as shown by Figure 101. These streams lack natural reservoirs and flash floods occur on them after heavy rainfall and during the spring thaw. In the past, both creeks overflowed their banks due to blockage by fallen trees and other obstructions. While these creeks cross the plant site

**Fig. 102. First beach camp at low tide, temporary wharf in background.**

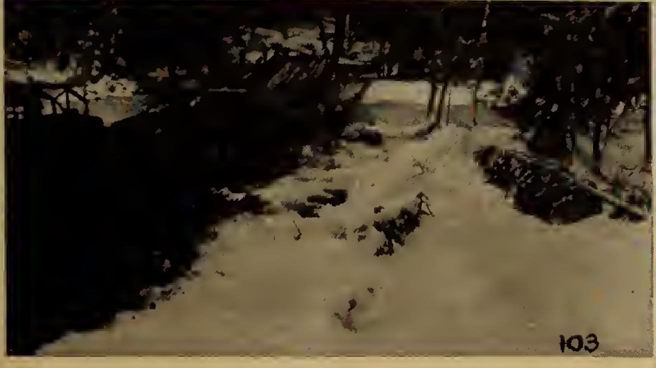
**Fig. 103. Construction of a small temporary bridge over one of the numerous small mountain streams.**

**Fig. 104. Sawmill and cold deck. View looking across plant site area.**

**Fig. 105. Bulldozers placing hydraulic fill in storage building area.**

**Fig. 106. Aerial view, showing improved Moore Creek channel crossing plant site area.**



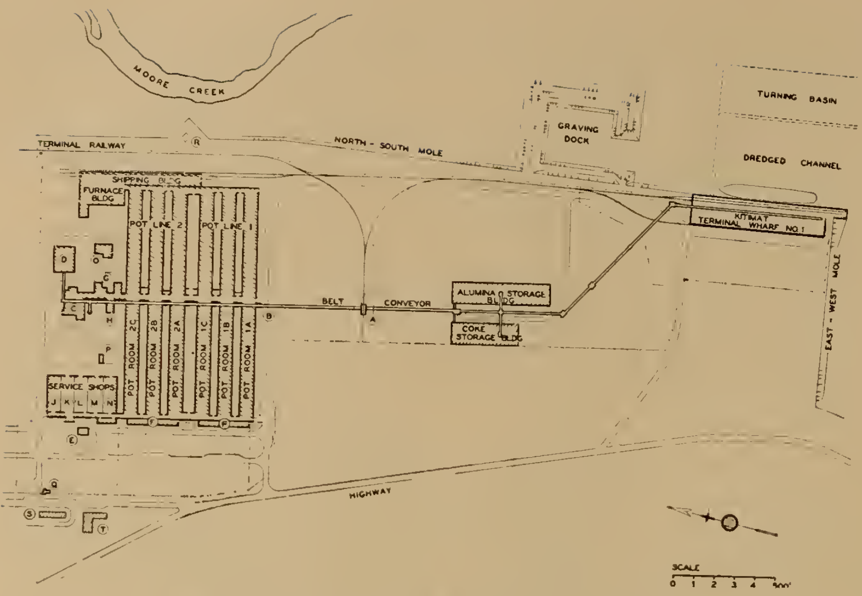




**Fig. 107. Plan of smelter plant and wharf area.**

north of the area under immediate development, their bed levels at the west side of the plant area were higher than the adopted finished grade of the smelter plant. Thus, improvements of the creek channels received considerable study.

Moore Creek, which is approximately 1,000 ft. north of the present smelter plant, crosses the electrical high tension installations, and therefore required complete control. It was necessary to drop the creek channel abruptly in a relatively short distance where it enters the west side of the plant site. This was accomplished by adopting a heavily rip-rapped rapids section 450 feet long on a 6.28 per cent gradient.

In this section, for the designed maximum flow of 3,000 cfs., the width of the channel is 90 feet. At the bottom of this rapids section the flow is controlled by a 50-foot-long cistern and a 90-foot-long convergence into a 40-foot-wide channel with a 0.67 per cent gradient. The improved Moore Creek channel can be seen on Figure 106.

Anderson Creek is approximately three-quarters of a mile north of the present plant and required only partial channel improvement. In spite of a watershed area larger than that of Moore Creek, it was necessary to improve the creek channel only at the two bridges. The upstream section of this creek, at the permanent highway bridge, required realignment and rip-rapping under and upstream of the bridge. The original watercourse remains unchanged from this bridge to within 530 feet of the railway bridge on the terminal railway, where it was necessary to excavate considerably to provide a suitable clearance. The gradient for this channel was established at 2.65 per cent, which necessitated heavy rip-rapping to well beyond the bridge. The excavated gravel material from the channel improvements was used for railway fill.

The studies and design for these waterway improvements were carried out under the direction of Professor Thomas Blench, M.E.I.C., of the civil engineering department, of the University of Alberta, who was retained as consultant.

### Initial Plant Development

The ultimate smelter plant is expected to consist of three groups of smelter or "potline" buildings each containing four potlines. One group will be located south of Moore Creek, another between Moore and Anderson Creeks, and the third group north of Anderson Creek, as shown by Figure 101. The initial plant constructed consists of the southern half of the building group nearest the harbour area and contains Potlines Nos. 1 and 2. In addition the necessary storage buildings, administration buildings and wharf and conveying facilities were included in the initial development.

The area of initial development is shown on Figure 107. The terminal wharf contains ship unloading facilities for the raw materials. A conveyor system delivers these to the storage buildings. Each of the two potlines consists of three separate potroom buildings connected at their ends and centers by passageways. Electrical power for producing aluminum is fed to the west end of the potrooms from the substations and rectifier buildings. Finished aluminum ingots are placed in railway cars in the shipping building, which is immediately adjacent to the furnace or casting building. Auxiliary buildings included in the initial development are located north of the potlines. These include the carbon paste plant for producing electrode and pot lining material; the compressor, boiler, and diesel standby plant buildings; and the necessary service shops required for maintenance.

### Building Concrete Design

The building foundations in the smelter area are spread footings placed on top of the compacted fill with a maximum allowable soil load of 6,000 lb. per sq. ft. The only excavations required were for ducts and pits, etc. After the foundations were in place, fill up to final grade was placed around them.

***Potroom Concrete:*** In the potrooms, Figure 108, concrete is used up to 8 ft. 10 in. above the finished floor to keep all structural steel above the reach of men working around the pots. The concrete columns are

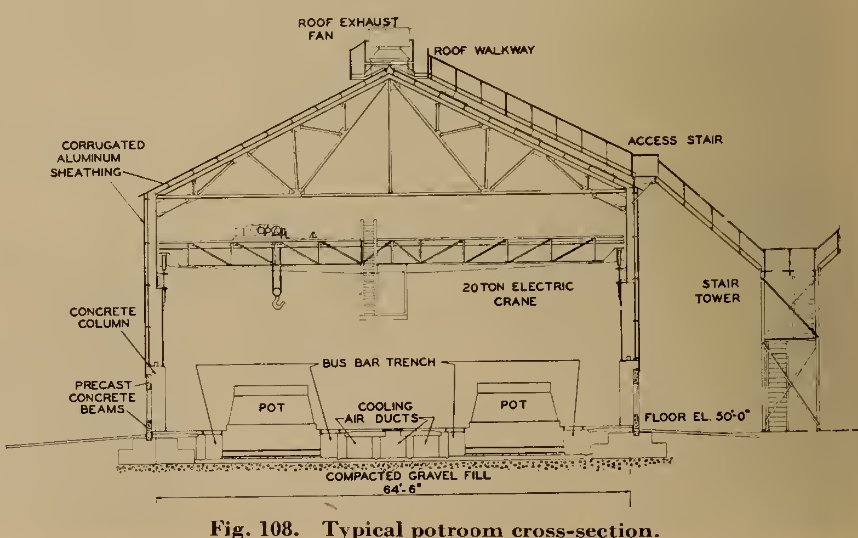



**Fig. 108. Typical potroom cross-section.**

reinforced with vertical steel bars extending into the ground for electrical grounding. The column footings are of plain concrete to prevent disintegration by electrolysis of steel. Between columns, two rows of precast reinforced concrete beams, Figure 109, make up the exterior wall. The lower beams, 2 ft. 10 in. deep by 8 in. wide, were placed on the footings before the columns were poured. The upper beams, 2 ft. deep by 8 in. wide, were placed in seats in the columns after they had been poured and form the lintels over the 19 ft. 6 in. long by 4 ft. 3 in. high openings for the aluminum ventilating doors.

The concrete base floor, 8 in. thick below the pots and 6 in. thick below the air ducts, is placed directly on the compacted fill and is without reinforcing, to prevent stray currents passing between the pots. The pots rest on insulating bricks on this floor. The walls at the sides of the pits and between the air ducts were poured in place. Precast floor slabs with a 6-in. wearing slab form the working floor at the center and side of the building. Removable precast concrete slabs span the pits in which the aluminum bus bars run. The potroom floors are designed to take a 6-ton truck and the passageway building floors to take a semitrailer with a 90-ton load.

***Storage Buildings:*** The alumina and coke storage building foundations are spread footings placed 8 to 10 in. into the hydraulic fill, with allowable soil pressures of 3,500 lb. per sq. ft. The concrete cantilever retaining walls extend to 15 feet above ground and have an expansion joint every 50 feet. These retaining walls are designed to withstand the pressure from stored material at its natural angle of repose. Fig. 110 shows the interior of the alumina storage building. These storage buildings have reinforced concrete reclaiming tunnels below floor level.

The pitch storage building is of similar design, but without tunnels, the walls being designed to resist the pull of reclaiming scrapers.

***Miscellaneous Buildings:*** The conveyor gallery support towers that lie between the storage building area and the smelter area have concrete footings on wood piles. The conveyor galleries have a 2½-in. concrete floor slab.

The two pump houses, the settling basin and the river intake are on spread footing on original soil. A maximum allowable soil pressure of 3,500 lb. per sq. ft. was used.

Among the many concrete structures which may only be mentioned, are foundations for all buildings; foundations for electrical equipment, towers, machinery and tanks; the upper floors in the paste plant; the switch rooms; the wash and locker buildings; the highway bridge over Anderson Creek, which is designed to take 90-ton semitrailer loads; the abutments of both railway bridges; and other miscellaneous structures.

Concrete was specified throughout as 3,000-lb. and a working stress in bending of 1,200 psi. was allowed. Reinforcing steel was specified as structural grade deformed bars and a tensile stress of 18,000 psi. was allowed. Except for these allowable stresses, all concrete design followed the American Concrete Institute *Specification ACI-318-51.*

#### Structural Steel

In general all structural steel was designed in accordance with the American Institute of Steel Construction *Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.* Some modifications to the crane runway horizontal forces were made as noted below.

The most important variations from standard Canadian design practice occur in the assumed snow and earthquake loadings. The snow load was taken as 60 lb. per sq. ft. of horizontal projection for the design of all roof purlins, beams and trusses and 50 lb. per sq. ft. for the design of columns and footings. These loads were reduced in accordance with the National Building Code for all roofs with slopes of 30° or greater.

The earthquake loading for all towers and tanks plus contents was taken as 20 per cent of the vertical load acting in any horizontal direction through the center of gravity of the structure. This is a much higher earthquake factor than is commonly used for this class of structure.

The wind loads listed in the National Buildings Code were used, but were increased by 50 per cent for all conveyor structures and for structures on the wharf. Earthquake and wind loads were not considered to act simultaneously.

The crane loads listed in the A.I.S.C. specification were adopted with the following modifications. The longitudinal horizontal force was doubled for all cranes except the 100-ton electrical repair shop crane. This force was increased to allow for the effect of high speeds on the relatively long runways. The potroom crane runways were also checked for a 50-per cent overload, neglecting impact and horizontal forces, and using a 25-per cent increase in allowable stresses. This overload condition is for pot maintenance only and is not a regular operating condition.

The effect of relatively large foundation settlements required the use of the most flexible type of building frame possible. Buildings were set out allowing for the expected differential settlement, to make the final structure true. Settlement problems also had to be considered in some of the building details. For example, the anchor bolts on most of the crane columns were set with extra projection to allow for possible jacking of the crane runway.

The potroom buildings form a good example of mill type buildings constructed for this plant. (See Figure 108). Six buildings each 64 ft. 6 in. wide and 1,137 feet long were required for Potlines Nos. 1 and 2. The typical bent was made with stepped columns and a Fink type roof truss. This bent was analyzed as a simple structure for vertical loads and as a rigid structure with pinned bases for transverse loads. The pinned bases were used to keep stresses resulting from transverse differential settlement to a minimum. The heavy snow load made it necessary to use a close spacing for the purlins. Sliding type expansion joints were provided in every sixth bay. Figure 111 shows construction of concrete, structural steel and sheeting in progress on the potroom buildings.

The coke, alumina and hard pitch storage buildings have roof trusses designed as three-hinged arches spanning 105 feet, and are spaced at 25 feet center to center. They carry a longitudinal stocking conveyor in the peak. The roof slopes at the angle of repose of the material being stored, as shown by Figure 110.

The conveyor gallery structures presented some interesting design problems. About 4,560 feet of gallery was required. Most of these galleries consist of simple through truss spans about 65 feet long. They have one lateral bracing system located in the plane of the bottom chord. Rigid transverse rings at each panel point resist the lateral wind loads on the walls. Expansion joints are provided by means of pin connected vertical bars.

The total weight of structural steel used throughout the plant amounted to approximately 10,000 tons.

#### Architectural Finish

Aluminum has been employed extensively for the sheathing of the plant buildings. Wherever practic-





**Fig. 109. Precast potroom wall lintels, in place but not yet grouted.**

**Fig. 110. Interior view of alumina storage building, partially filled with alumina.**

**Fig. 111. Potroom buildings under construction showing progress of concrete, structural steel and aluminum cladding.**

**Fig. 112. Carbon paste plant.**

**Fig. 113. Main gatehouse building, service shops in background.**

able, buildings have been designed with sloping roofs sheathed with corrugated aluminum, thus eliminating the maintenance work inseparable from built-up tar and gravel flat roofs. Where low buildings adjoin higher buildings with sloping roofs, the roofing sheets on the lower buildings were applied double, as they are subject to the impact of sliding snow and falling icicles. Where flat roofs were used, the built-up roofing and insulation were supported on aluminum decking. Both the narrow, roll-formed, continuous span type and the standard wider single span type decking were used. They were attached to the tops of steel purlins with standard clips or stainless steel drive screws; the fibreboard insulation and the built-up roofing materials were then applied in the usual manner.

The material used for covering sloping roofs and side walls of all but a few special buildings is industrial weight stucco-embossed corrugated aluminum. This product is a special aluminum alloy sheet 0.032 in. thick, with an integral skin of high purity aluminum on both faces, which provides a maximum of resistance to the corrosive action of chemicals in the atmosphere. The corrugations are 7/8 in. deep at 2⅔ in. pitch and the strength of the finished sheet is such that the same span between supporting members as is normally required for ordinary galvanized corrugated steel sheeting can be maintained. In all cases the corrugated aluminum cladding is attached directly to steel purlins and girts by means of Nelson studs having a special aluminum rivet type tip. These studs were jig welded to the steel and the aluminum cladding was applied by placing the sheet in position and punching the tips of the studs through the aluminum sheet by means of a rubber hammer. The tip of the stud was then riveted down over an aluminum washer. The installation has proved completely satisfactory and is entirely free of rattles. The side laps of all sheets are fastened by means of Southco rivets, a special fastening which, like the Nelson stud, can be installed from the exterior face of the building without requiring the services of a back-up man.

Where insulation was required the same method of application was used, the studs being lengthened to suit, and the insulation being drilled or punched over the studs. Both asphalted fibreboard and rigid type fibreglas insulating boards were used.

Where appearance is important, standard aluminum extrusions of alloy 50S designed for use as cladding were employed. Variations were provided by installing panelling of embossed or plain surfaced aluminum sheets. These extrusions were applied to the face of the steel girts by means of aluminum nuts and bolts, holes for which had been punched in the structural steel. The holes for attaching the panelling were all drilled in place and either nuts and bolts or self-tapping screws used.

It was desired to have the walls of offices, lunch and rest rooms, and toilet rooms of masonry construction

Table 1: Material Chosen

| Description | Aluminum Alloy Alcan | Specification CSA |
|---|---|---|
| Structure Members, shapes | 65-S | HA-5-65-T |
| " " plates | 65-S | HA-4-65-T |
| Bolts and Nuts, | 65-S | HA-5-65-T |
| | (Made of rolled or drawn rod) | |
| Washers, | 65-S | HA-4-65-T |

Table 2: Unit Working Stresses

| | psi | Factor of safety |
|---|---|---|
| Shear, | 12,000 | 2.5 on typical shearing strength |
| Bearing, | 22,000 | 2.5 on typical yield strength |
| Bolts, shear, | 10,000 | 3.0 on typical shearing strength |
| Bolts, tension, | 12,000 | 3.0 on guaranteed yield strength |

so that the interior finish could be painted in restful colours. The exterior walls of these buildings were clad with aluminum attached by Nelson studs to steel angle girts built into the masonry joints at intervals. The exterior face of the masonry was painted with two coats of pitch to provide a vapour barrier, before the insulation and cladding were attached.

Standard aluminum windows were used throughout. Doors in locations where appearance is important are made of aluminum or of solid wood faced with aluminum sheet. Stair-railings are also made of aluminum. Turnstiles in the entrance gatehouses are of aluminum construction.

In the reduction pot and furnace buildings large ventilating openings are provided at the bottoms of the exterior walls. These openings are closed in cold weather by top-hung adjustable hinged doors fabricated of standard aluminum extrusions by rivetting.

Figures 111, 112 and 113, illustrate the typical architectural finish of various plant buildings.

### Aluminum Structures

It is often necessary to paint steel structures located in an industrial atmosphere, but painting structures that support electrical equipment is invariably difficult, costly, and hazardous. If a complete painting job is necessary the conductors must first be de-energized. This may mean that production must be temporarily stopped. To eliminate this, aluminum is used in place of steel in the supporting structures for the electrical equipment in the switchyard at Kitimat. Aluminum is most suitable for this use, because of one very important characteristic, excellent corrosion resistance.

A special specification was prepared *For Towers of Aluminum Alloy for Supporting Electrical Equipment at Kitimat, B.C.* It covers materials, loads, unit working stresses, ratio of slenderness, details of design, bolted connections, fabrication, cleaning and painting, anchor bolts, tower bases and foundations as follows:—

***Material:*** Alcan 65-S alloy—chosen mainly for its medium high strength and corrosion resistant quality. (Table 1).

***Loads:*** (a) *Dead load;* on the basis of a unit weight of 170 lb. per cu. ft. of aluminum in the structure.

(b) *Dead weight of conductors;* given by the electrical engineer.

(c) *Horizontal pulls;* given by the electrical engineer.

(d) *Live load;* 8 lb. per sq. ft. wind on projected area of conductors encased in ½ in. thickness of ice, plus the weight of a ½ in. thickness of ice on all exposed surfaces.

(e) *Wind load on tower structure;* 13 lb. per sq. ft. on all members as projected on vertical plane, disregarding any shielding action.

***Unit Working Stresses:*** Axial tension on net section, 17,500 psi. This

Fig. 114. Ground assembly of aluminum tower structure.

Fig. 115. Erection of aluminum structure in substation area.

Fig. 116. (Right) Aluminum roof access walkway structure.

value represents a factor of safety of two based on the guaranteed yield strength.

Axial compression on gross section

$0.50\left(48{,}000 - 400\frac{Kl}{r}\right)$ for $\frac{Kl}{r}$ equal to or less than 77, with a maximum of 17,500 psi. and $0.50\left[\frac{102{,}000{,}000}{\left(\frac{Kl}{r}\right)^2}\right]$ for $\frac{Kl}{r}$ greater than 77. The expression in brackets is the ultimate compression unit stress. The 0.50 before the brackets represents a factor of safety of two, $K$ is a constant dependent upon the degree of fixity of the ends of the member, $r$ is the least radius of gyration in inches, and $l$ is the unsupported length of column in inches.

Bending on extreme fibres is also 17,500 psi. and other limiting stresses are shown in Table 2.

*Minimum Material:* Minimum size of angles: 2 x 2 x 3/16 in.; minimum thickness of metal 3/16 in.

*Connections:* All the members were joined by ⅝-in. aluminum bolts with the exception of a few locations where ¾-in. bolts were used for extra strength. Welding was not considered because it lowers the strength locally. The bolts and nuts have unfinished hexagonal heads and conform to American Standard B18-2-1941. The threads are National coarse, Class 2 fit, conforming to American Standard B1-1-1935. Eighth-inch washers are used under the nuts, the unthreaded bolt shanks extending completely through the joined parts.

Bolt holes were made 1/32 in. greater in diameter than the nominal diameter of the bolts. Holes were punched in ⅜-in. and thinner material, whereas on thicker than ⅜-in. material they were drilled to finished size.

*Fabrication and Pre-assembly:* Material up to ½-in. thick was either sheared or sawn and material more than ½-in. thick was sawn. Flame cutting is more tedious in aluminum than in steel and it also reduces the strength of the aluminum, therefore this practice was not permitted.

When the material had to be heated for forming, temperature and duration were carefully observed and controlled so as not to impair the inherent strength.

All the structures were pre-assembled in the fabricator's yard to check for any errors in fabrication. This assured a perfect fit and no field modifications were necessary. Where assembly was carried out in a horizontal position, there was no trouble in erecting to the vertical position by means of a mobile crane, because of the lightness of the structure.

*Erection:* The light weight of the component parts and ground level assembly enabled erection to be carried out with ease. (See Figures 114 and 115). Bolts were tightened to a uniform tension by means of an impact wrench.

Structural aluminum is used in many places throughout the Kitimat Smelter. The most extensive structure is the 11,100 feet of walkway on top of the potroom roofs. This walkway is made entirely of aluminum, because of its light weight and its resistance to corrosion. The walkway and its connecting access stairs (See Figure 116) are necessary for potroom exhaust fan maintenance. The supporting members are made of extruded Alcan 65S-T channels and angles. These are bolted to the structural members of the roof. The walkway floor and the servicing platforms are open gratings made from Alcan 65S-T flattened rectangular bars.

#### Overhead Travelling Cranes

As is shown in Table 3 there are 17 electric overhead travelling cranes. The power supply for all cranes is 550 v., 3 ph., 60 c. The bridge travel motions of the 12 potroom cranes and the one furnace building crane are powered by dual motor drives, i.e. one motor is used for driving one of the two wheels at each end truck. The bridge travel motions for each of the other cranes are powered by one motor driving a line shaft which drives one of the two wheels at each end truck.

Because of the long span of the furnace building crane, the trolley and the bridge were constructed of aluminum alloy and in conformity the end trucks also were constructed of aluminum alloy.

To provide for comfort and efficiency of the operators, the cabs of the 12 potroom cranes and of the furnace building crane are air conditioned by a self-contained unit mounted over the top of the cab.

Figure 117 shows the 100 ton electrical repair shop crane.

#### Heating and Ventilating Systems

The larger buildings, such as the service shops and the wash and locker building, are heated by means of unit heaters, while in the smaller buildings and offices convectors or continous finned tube units are used. All units operate on low pressure steam supplied from the central plant and the majority of the unit heaters have individual thermostatic control. In isolated buildings convector-type electric heaters are used. Summer cooling is provided only in the potroom lunch rooms and restrooms, where package air-conditioning units are installed. Separate systems of exhaust are provided wherever dust, fumes, odors or heat are liberated, such as in the food preparation areas, laboratory, welding, forge and sand-blasting shops and the garage.

The largest single system of ventilation is in the wash and locker building, where the supply fans deliver about 40,000 cfm. of filtered and heated air to replace that exhausted from toilet, shower and locker rooms. The locker room exhaust is unusual in that all air from the room is exhausted through the banks of "wet" lockers, where working clothes, often saturated with perspiration, are stored to dry. The lockers are specially constructed to form ducts at the top and bottom, and additional heating coils are provided at the entrances to the bottom ducts to hasten the drying in warm, damp weather. This air may be partly recirculated through activated

**Table 3: Electric Overhead Travelling Cranes**

| Location | Number of cranes | Rated capac. tons | * AISE class | Span | Handles | Supplier |
|---|---|---|---|---|---|---|
| Potrooms | 6 | 20 | 4 | 62′0″ | Molten alum. | Provincial Eng. Co., Ltd. |
| Potrooms | 6 | 20 | 4 | 62′0″ | Molten alum. | Stothert & Pitt, Ltd. |
| Furnace bldg. | 1 | 12 | 4 | 91′10″ | Molten alum. | Stothert & Pitt, Ltd. |
| Shipping bldg. | 1 | 7½ | 3 | 56′10″ | Alum. ingots. | Provincial Eng. Co., Ltd |
| Elec. repair shop | 1 | 5 | 2 | 34′3″ | Equipment. | Sir Wm. Arrol & Co., Ltd. |
| Paste casting bldg. | 1 | 5 | 2 | 37′0″ | Carbon paste. | Provincial Eng. Co., Ltd. |
| Elec. repair shop | 1 | 100 | 1 | 37′0″ | Transformers. | Sir Wm. Arrol & Co., Ltd. |

* Association of Iron and Steel Engineers, *Specifications for Electric Overhead Travelling Cranes for Steel Mill Service.*

carbon filters, although the supply system has sufficient heating capacity to operate with 100 per cent fresh air.

Because of the high humidity in many locations, all ductwork is fabricated of aluminum, except where corrosive fumes or abrasive dust necessitates other materials. Since design velocities and pressures have been maintained at relatively low levels, conventional fabrication methods, with rectangular ducts and bar or pocket slip joints, have been used. The majority of the fans are of the belt-driven centrifugal type, although a considerable number of direct driven propeller fans, with diameters up to 5 feet, are installed in locations where large quantities of heat are generated. These units, mounted on the roofs, have fabricated aluminum housings, thus eliminating the need for protective paint and conforming to the general pattern of the building construction.

#### Plant Electrical System

The electrical system has been designed for maximum security, essential for supplying the aluminum reduction lines. The design at Kitimat envisions the removal of important electrical equipment for maintenance work without shutting down any potline.

The 3 phase, double circuit transmission line from the Kemano hydroelectric development crosses Kitimat Arm and enters the plant area from the east, paralleling Moore Creek, as shown by Figure 101. The high tension lines cross to the substation area at the west end of the potline buildings.

Each potline has its own substation. The main transformers in these banks are rated at 37 mva. High speed air circuit breakers are provided on the high tension side of each transformer bank. The output voltage is regulated by 13.2 kv., step type voltage regulators.

The rectifier buildings, which form the west end of the potline buildings, are supplied with the regulated 13.2 kv. power. Each building contains a bank of ignitron rectifier units supplying direct current, at the required voltage, to the potroom bus. Special attention has been given to the grounding connections throughout this system.

***Diesel Standby Plant:*** A diesel standby plant has been provided to supply emergency power to the plant distribution system and to the townsite area. This plant will ultimately contain five units of approximately 800 kw. each.

***Plant Distribution System:*** The general plant distribution system for lighting and power follows standard industrial practice. Aluminum insulated wire has been used extensively for plant wiring and has proved to be entirely satisfactory.

#### Communications

***Telephone System:*** A 220-line PAX system is installed, 200 lines serving the general plant and 20 lines serving the power operators. The system is capable of ready extension to over 1,000 lines. An emergency sound powered system is installed for the power operators. A telecode unit is incorporated in the PAX and operates in conjunction with the plant signal system.

***Power Line Carrier Equipment:*** Three duplex channels are in operation between Kitimat and Kemano. Each channel provides a voice band and six super audio frequencies for supervisory control, telemetering, etc. Two of the duplex voice channels are connected to the PAX equipment at the terminals for direct plant to plant telephone communication. The third voice channel is utilized for direct communication between power operators.

***Radio Communication:*** Radio communication on various frequencies has been in use during the construction period. These facilities still exist, but have not yet been taken over for the permanent plant.

#### Plant Service Building

***Repair Shops:*** The electrical and mechanical repair and maintenance shops for the initial plant are located at the northwest corner of the present potline buildings and include the forge shop, warehouse, machine shop and electrical shop. Figure 113 shows this building in the background.

The electrical shop is intended to be the permanent center for all major electrical maintenance work for the ultimate plant. It is specially laid out and equipped to service the largest transformers and to permit complete overhaul of rectifier units, in addition to handling other elec-

**Fig. 117. 100-ton transformer crane in electrical repair shop. Showing transformer about to be lowered into pit.**

trical maintenance common to an industrial plant. Large transformers can be brought into the west end of the shop on a semi-trailer. There a 100-ton electric travelling crane (Figure 117) transfers them to a pit for untanking. A 5-ton crane operates on a lower runway to service the main working bay of the shop. The present mechanical shops will eventually be used for routine maintenance of equipment from the first four potlines only and larger mechanical shops and warehouse facilities will then be constructed near the center of the ultimate plant.

***Steam Plant:*** The initial permanent steam generating plant has been limited to an 8,000 kv. electric steam generator of the water resistance type. The steam is used primarily for building heating and is generated at 125 psi. A fuel fired standby boiler will be added later, but an emergency supply of steam is now available from the oil-fired boiler installation that was used during construction.

***Air Compressor Plant:*** Three 1,040 cfm. two stage, electrically driven air compressors are installed adjacent to the boiler room. Two compressors are required to provide air for normal plant services and the third provides reserve capacity.

### Plant Water Supply System

***Water Requirements:*** The principal use for water in the plant is for cooling rectifiers and transformers; these uses account for 92 per cent of the total requirements. Scrubbing of the exhaust gases from the pots also requires large quantities of water; however, cooling water from the transformers and rectifiers is re-used in the gas scrubbers.

The maximum water demand for Potlines Nos. 1 and 2 is five cfs. The future demand is 10 cfs. after Potlines Nos. 3 and 4 have been constructed and 30 cfs. for the ultimate plant development.

The study of possible sources of water supply was hampered by the lack of long-term hydrological data, but four principal sources were considered — Moore Creek, Anderson Creek, Kitimat River and wells. The final decision was to use Anderson Creek as the primary source of supply and to supplement it when necessary by water from Kitimat River. This decision permitted an economical installation for the early stages of the plant with provision for flexible expansion to match plant growth. It also provided a safety factor by having two independent sources of supply.

The services of a consulting engineer, F. C. Stewart, M.E.I.C., of Vancouver, were engaged for the design of water intakes, settling basins and pumping stations.

***Settling Basin System:*** At Anderson Creek the water is collected in a natural pool at the base of a waterfall, from which it flows by gravity to two shallow reinforced concrete settling basins for removal of silt. Four additional units are projected for the ultimate plant requirements. The basins are situated outdoors and are 33 by 70 by 8 ft. deep. Water is distributed across one end by means of seven 10-inch pipes and is removed through similar outlet pipes at the opposite end, from which it flows under a small positive gravity head through a travelling 14-mesh screen to the pump. The depth of water in the basins is maintained automatically at seven feet by a spillway at the inlet end which overflows to the creek. Inlet and outlet pipes may be closed by gates and the basins cleaned by means of plug valves in the bottoms.

***Pumping Station and Intakes:*** The Anderson Creek pumping station is designed to accommodate four horizontal centrifugal pumps each driven by 150-hp. electric motors, three of which are now installed. Two more similar pumping stations are projected for the ultimate plant development.

The Kitimat River intake consists of a closed sheet-pile flume that projects 75 feet from the river bank. The covered top of the flume is 6 feet above low water level and 14½ feet below high water level. The entrance to the flume can be electrically heated by means of elements in vertical 3-in. pipes to contend with slush ice. At the shore end of the flume there is a trash rack, beyond which the water passes through 100 feet of 36-in. buried concrete pipe to a traveling screen in the well of the pumphouse. This pumphouse is designed to accommodate four 200-hp. pumps for the ultimate plant, but only two 100-hp. pumps are installed now. Electrically-driven vertical pumps of the deepwell turbine type are used. The Kitimat River station delivers water to the Anderson Creek settling basins whenever the creek flow is insufficient.

***Type of Piping:*** All pipe lines are buried. Reinforced spun concrete pipe with grouted joints is used for low pressure service, such as the gravity intake lines. The concrete pipeline from Anderson Creek to the settling basins consists of 3,275 feet of 20-in. and of 18-in. pipe. Eighteen inch steel pipe having a wall thickness of ¼ in. is used for pump discharge lines, there being 11,500 feet between the Kitimat River station and the settling basins and 4,100 feet between the Anderson Creek station and the plant. This latter section includes a crossing under Moore Creek. Additional cross-connected lines will be added as the plant expands so that there will be multiple pumping and piping arrangements to guard against failure of the water supply to the plant. The 18-in. steel pipe was supplied in 40-foot lengths, factory-coated inside and out with coal tar enamel and wrapped, according to AWWA specification. Dresser couplings were used for all field joints. The joints were electrically bonded by means of jumper wires over the couplings and electrical leads were connected to the pipe and brought to the ground surface at 1,000-foot intervals, to enable testing the pipe coating and making checks on corrosion.

***Chlorination and Control:*** The entire pumping system is automatically controlled and requires no steady attendance. Chlorine is fed to the suction side of the Anderson Creek pumps by an automatic proportional chlorinator. Operation of the Anderson Creek pumps and regulation of chlorination is governed by a flow meter in the 18-in. pipeline. As a safety precaution, all the Anderson Creek pumps are stopped by abnormal pressures in the line and a surge relief valve is provided to guard against water hammer. The travelling screens are washed automatically as required. The pressure at the inlet to the plant watermains is maintained at 90 psi. by an automatic pressure regulating station at the plant end of the pipeline. Supervisory control of all functions of the entire system is exercised at the plant by means of suitable electrical circuits carried in a cable buried in the ground above the pipeline.

***Water Pipelines — Plant Area and Harbour:***

The water pipelines in the plant area are laid out in a grid system. This permits sections of the system to be shut off for repairs or additions without interrupting the water supply to essential points.

Included in the pipeline system are the fire hydrants, transformer cooling systems, boiler and compressor rooms, wash and locker building and miscellaneous services. A cast iron buried water main carries the water from the plant grid to the harbour area.

All underground water pipelines

in the area are built with Class 250 cast iron pipe equipped with mechanical or bolted gland joints. About 17,500 feet of pipe in sizes from 4 inches to 12 inches were used.

### Sewer Systems

*Storm Sewers:* A study of available meteorological data dealing with precipitation indicated an annual rainfall of about 90 in. and that the Kitimat area is not regularly subject to severe rainstorms. It was, however, considered advisable to design the storm sewers large enough to take care of a rainfall of 5 in. per hour. Since the plant area is, in general, a paved surface, a run-off of 100 per cent was assumed, which, because of large sloping roof surfaces and paved courts, would reach the sewers without any appreciable time lag. Altogether about 13,000 feet of pipe were used in constructing the storm sewer system.

An asphaltic compound jointing material was used which, in addition to withstanding the hydrostatic pressure, would be pliable enough to allow for differential settlement in the filled ground of the plant area. Since the plant area is considerably above sea level it was necessary to use drop manholes at points where the grade line of the plant area slopes sharply towards the tidal flats. These manholes are constructed of reinforced concrete and are lined with vertical planking to protect the concrete from erosion.

*Sanitary Sewers and Septic Tank:* The sanitary sewer system consists of a main trunk sewer and branch lines to the various buildings where sanitary fixtures are installed. About 7,000 feet of vitrified clay pipe ranging in size from 6 in. to 15 in. were used.

The septic tank is of reinforced concrete and consists of two compartments, each being 13 x 26 x 7 ft. deep, and providing a 24 hour retention period. The effluent is discharged into a nearby storm sewer. The sludge is purged through a valve into the sea during receding tides.

### Ship Unloading Plant

In planning the equipment for the wharf, emphasis was placed on the unloading of bulk alumina from ocean-going ships. Although substantial quantities of other bulk materials, such as coal, coke and hard pitch, are also imported by sea, bulk alumina, because of its fine powdery and abrasive nature required special consideration. Also, the shipping requirement of special bulkheads in the holds to prevent cargo shifting while at sea and large feeder chutes in the hatchways to compensate for possible shrinkage due to densification required particular study of unloading methods.

After extensive investigation and study it was decided to equip the wharf with one positive type of unloading equipment in the form of a specially designed crane for discharging all materials and one suction unloading plant for discharging bulk alumina.

*Pneumatic Suction Plant:* The pneumatic suction plant is a completely self-contained travelling tower type of unit and is shown in Figure 118. This plant was designed and built by an English firm, after extensive preliminary experimental work in their pilot plant and consultation with Alcan regarding general requirements and specifications. The plant was erected by Alcan's general contractor under the supervision of an erector supplied by the makers.

As may be surmised from the name, the principle of operation of the pneumatic unloading plant is that of air suction; in operation it may be likened to a large vacuum cleaner. It is equipped with three suction nozzles supported by outreaching pipe booms to allow the nozzles access to the ships' hatches. Air separators, filters, vacuum pumps and other associated equipment are all enclosed in one mobile aluminum-clad steel tower. The rated capacity of the complete plant is 200 tons per hour. Vacuum up to 12 inches of mercury is produced by four 42-in. diameter short stroke pistons operating at approximately 140 strokes per minute. The suction side of these pumps draws air through a nest of cloth filters in series with a large cyclone separator and thence from a central material receiving and settling tank. Leading to this tank are three pipe booms each suspending an 8-in. diameter intake pipe at the end of which is the intake nozzle.

During operation, alumina is induced into the air stream flowing into the nozzle and rises in the vertical pipe, eventually reaching the main receiver in the tower structure. The material is then extracted from this vacuum chamber by two tipper dischargers, which release the alumina into an open hopper without destroying the vacuum in the receiver. From the hopper below the tippers, the alumina is conveyed by means of two 16-in. airslides to the rear of the tower and thence is deposited on the wharf receiving belt.

*Kangaroo Crane:* The kangaroo crane is a 16,000 lb., two-drum, level-luffing, full portal travelling

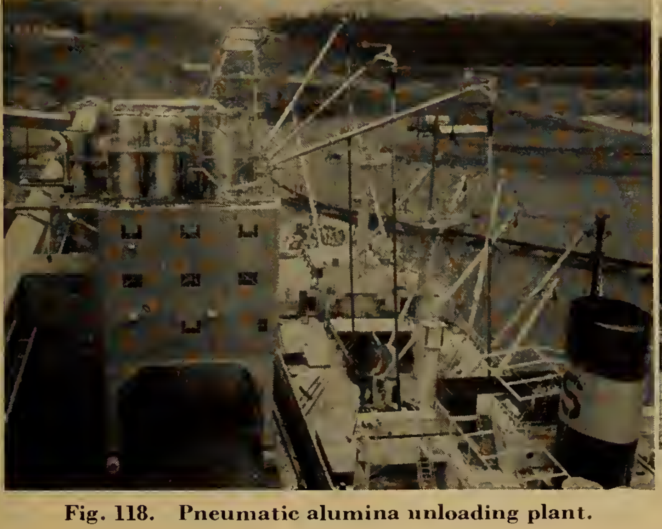


**Fig. 118. Pneumatic alumina unloading plant.**

**Fig. 119. Kangaroo crane—shown helping in assembly of pneumatic unloading plant.**

Fig. 120. Plant conveyor system as seen from Kangaroo crane. Smelter plant in background, storage building in center, and part of pneumatic unloading plant in foreground.

Fig. 121. Aerial view of smelter, showing conveyor gallery crossing potrooms to the carbon paste plant at left.

gantry type. It is named a "kangaroo" crane because it has a hopper located in the gantry structure which permits clamshell operation with hoisting and luffing only. It was designed and built in Bath, England, and was erected during the winter of 1953-54 by Alcan's general contractor under the supervision of the makers. Figure 119 shows a view of the crane in use assisting in the erection of the pneumatic tower.

The kangaroo crane was designed as a general purpose crane capable, with equal ease, of handling bulk commodities with a clamshell and general cargo with a regular crane hook. The properties of alumina indicated that considerable attention must be given to the control of dust loss when using a clamshell, hence special buckets and a dustless receiving hopper were planned with this crane.

The a-c. crane control provides for the following operating speeds: rotation, one rpm.; travel, 50 fpm.; hoist with five-step acceleration to 350 fpm.; and luff at an average of 150 fpm. The two hoisting drums are each driven by a 125-hp. wound rotor motor through spur and helical gearing. Micro switches on each of the four bogie screw jacks are wired in series with a pilot light in the operator's cabin to indicate that the crane is either locked or free to travel. The rail screw-down jacks on the bogies are for the purpose of preventing travel of the crane due to strong winds.

The planned operating cycle of the crane is approximately 50 sec., and the maximum free-digging rate for alumina discharge is approximately 150 tons per hour. "Free-digging rate" is the term used when the clamshell has full unobstructed access through the hatchway to dig into the material in the hold and when the depth of material in the square of the hatch is sufficient to allow the clamshell to fill properly.

The principle of dust control used in the down draft receiving hopper provides a thin air blanket at the top of the hopper with a strong down-draft into the hopper which is induced by a suction fan operating through a large cloth filter.

The kangaroo crane can readily be converted to hook operation by disconnecting the clamshell and installing a hook attached to an equalizer bar. With this bar the crane has a capacity of 16,000 lb. with all four cables — the two closing and two holding lines or—of 10,000 lb. using the closing lines only.

#### Materials Handling and Storage

The plant conveyor system carries bulk materials from the ship unloading towers to the storage and plant buildings. The principal materials handled are alumina, coke, coal, pitch, and smaller quantities of cryolite and aluminum fluoride.

Material leaves the unloading towers by cantilevered conveyors which are a part of each tower structure. These conveyors project through a slot in the covered wharf conveyor gallery. This slot is closed by a series of aluminum shutters which are automatically opened and closed by the cantilevered tower conveyors, as the unloading towers travel back and forth along the wharf. In Figure 118, the cantilevered conveyor of the pneumatic handling plant can be seen extending through the slot in the side of the wharf conveyor gallery. A 42-in. belt conveyor in the wharf gallery carries the unloaded material over a belt scale at the inshore end of the wharf.

From the wharf, a 42-in. belt conveyor system continues to a tower between the alumina and coke storage buildings approximately 2,000 feet from, and 100 feet above, the wharf. From this tower the conveyor system branches three ways; a 42-in. belt crosses over to the roof peak of the 30,750-ton capacity alumina storage building, another 42-in. belt crosses over to the 20,400-ton capacity coke storage building and a 30-in. belt continues on between the storage buildings to a transfer building at ground level at the north end of the storage buildings.

From this transfer building a conveyor gallery containing a 36-in. belt for alumina and a 30-in. belt for other materials run at ground level and under the railway siding at the railway car unloading station. These belts continue beyond this point and rise to the roof peak of the first potroom building. The 30-in. conveyor belt continues over the potroom buildings to the carbon paste plant and pitch storage building, which are approximately 4,000 feet from the wharf. The alumina is carried from the end of the 36-in. belt to each potroom storage bin by a 16-in. airslide system rated at 150 tons per hour. The general layout of the conveyor galleries is shown by Figure 107. Figures 120 and 121 show general views of the conveyor system.

The routes followed by the various materials may be summarized as follows:

All materials travel on the 42-in. belts as far as the storage buildings.

The alumina crosses over to the alumina storage building, where it is distributed by a peak conveyor and a system of air slides. Alumina is recovered from storage by air-slides and a tunnel conveyor under the storage building and is then conveyed by the 36-in. belt and air-slides to the potroom bins.

Coke is distributed within the coke storage building by means of a shuttle conveyor. When coal is being handled, this shuttle conveyor is run out through the south end of the coke storage building, where the coal is stored in the open. Coke or coal reclaimed from storage by tunnel conveyors travels from the transfer building as far as the carbon paste plant by the 30-in. belt conveyor over the potrooms.

The 42-in. conveyors will have an ultimate capacity of 1,000 tons per hour, the 36-in. belts 600 tons per hour, and the 30-in. belts 400 tons per hour.

### Roads, Railways, Drainage, and Fences

***Roads:*** The system of roads at the Kitimat smelter plant is somewhat more extensive than in other Alcan plants because the large transformers will be transported by means of a low-bed semi-trailer. It is also expected that occasionally it will be expedient and economical to truck materials between the smelter and the wharf.

Because of the compacted gravel foundation fill for the smelter plant and a similar road fill over the hydraulically placed area in the harbour, an excellent foundation resulted for the road pavements. The roads, over which the semi-trailer will operate, were paved with a 3-in. hot mix asphaltic concrete pavement placed on a primed, compacted, granular base course. The other roads, designed for normal truck traffic, were paved with a 2-in. hot mix asphaltic concrete pavement. Curbs, gutters and catch basins were not used, except along sidewalks from the main entrance gatehouse to the smelter plant and from the wharf gatehouse to the Kitimat Terminal Wharf No. 1. Elsewhere, the crowned road pavements have a compacted shoulder over which the surface run-off drains into side ditches.

***Railways:*** The Canadian National Railway line from Terrace, passing through the Kitimat River valley will service the light industrial section of the Kitimat townsite, known as "Town Service Centre", and extends southward, terminating at the holding yard. At this point the exchange of railway cars between C.N.R. and Alcan will be made.

The holding yard is 2,000 feet long and, initially, both C.N.R. and Alcan are installing one siding each, on opposite sides of the main line. From this point, the Alcan Terminal Railway is being constructed southward to the Kitimat Terminal Wharf No. 1, approximately 2½ miles distance, with sidings into the smelter plant.

In general, the terrain traversed by the Terminal Railway was wooded up to Moore Creek, south of which the railroad embankment was placed over the prepared fill for the smelter and harbour areas. A 100-ft. right-of-way was cleared, but removal of stumps was carried out only in cuts and in sections where the fill was 3½ feet or less. Two railway bridges, which were formerly used by Alcan on construction of power developments in Quebec, were transferred and re-erected on the Terminal Railway over Anderson and Moore Creeks. Corrugated metal culverts were used as smaller drainage outlets.

A maximum track grade of 0.5 per cent and a 4° curve were used on the Terminal Railway. The conditions at the smelter plant, however, required the use of 14° curves and a compensated grade of 1.35 per cent between the smelter plant and the wharf. The supplied turnouts were manufactured from new 85-lb. rails, but due to shortages 80-lb. relaying rails were used for the rest of the railway. Creosoted turnout ties and untreated track ties of local material were used.

***Drainage:*** The surface drainage from the smelter plant area, except from the electrical substation area, is carried away by storm sewer systems to the original Moore Creek channel. The remaining plant and harbour areas are drained by open ditches to the sea.

Since the terrain westward rises abruptly and the tributary run-off area is considerable, it was necessary to provide deep ditches and large culverts at road crossings. Due to the long ditches and to the outfall elevations determined by the high tide, a minimum grade of 0.33 per cent was adopted.

Provisions were also made for sub-surface drainage by installing a perforated pipeline in an original construction ditch, subsequently backfilled and running along the west end of the compacted fill for the smelter plant. By this means, the ground water table has been maintained at approximately 20 feet below the plant floor level.

***Fencing:*** The Kitimat smelter plant and harbour are enclosed by an all-aluminum security fence. In general, standard fencing specifications applied, using suitable aluminum alloys for various components. The outside security plant and harbour fence is composed of 6-foot high, No. 6 gauge, 2-in. mesh, chain link fabric with three strands of barbed wire overhang. The interior fence enclosures for electrical transformers and the substation differ only in the use of No. 9 gauge fabric and in the elimination of the barbed wire topping. Standard diameter round posts were set in concrete bases.

**Fig. 122. View of nearly complete initial development. Compare with Fig. 104 taken from same location.**

### Conclusion

The various phases of the design and construction of the Kitimat smelter have been covered. Some of the problems of constructing a large industrial plant in an underdeveloped area have been presented. The methods by which they were overcome have been treated in as much detail as space has allowed.

Figure 122 gives a graphic illustration of the progress made over the construction period. This photograph was taken from the same place as Figure 104. The same saw mill building appears in the foreground of both photographs. √

Discussion of

# Technical Papers

## Rational Design for Building Frames with Semirigid Connections

by J. L. de Stein, M.E.I.C., Associate Professor, Department of Civil Engineering, McGill University
*The Engineering Journal*, October 1954 issue, page 1227

**W. Mathison, M.E.I.C.**[1]

The author of this paper is to be congratulated on presenting a clear and very interesting paper which illustrates forcibly how irrational the "conventional" method of design can be under certain conditions.

It is common for rigid frames to be very closely analyzed by calculating the bending moments and axial forces under various conditions of loading with, in some case, allowance for side sway. Very much less time, however, is spent on the design of a structure with semi-rigid connections although the structure itself may be just as important. As pointed out, the design may be very much out of balance, with the beams over-designed and the columns under-designed. While little immediate economy in material may result in allowing for the rigidity of the connections, the over-all factor of safety must be higher, justifying an increase in allowable stresses and consequent economy.

Sufficient data is available for analyzing structures subject to vertical loading and for revising the sections designed by the conventional method as required. As further information comes available perhaps another stage in the successive approximations can be removed by obtaining closer approximations to the eccentricities of the assumed pin-jointed beams to the columns and also closer approximations to the effective lengths of the columns. A further step in the right direction would be the obtaining of $M,\phi$ characteristics for standard column bases.

Other questions raised are:

1. What should the maximum permissable rotation of the connection be? This may be obtained by the analysis of existing structures.
2. How to determine the change in the restraining moment on the beam caused by the wind acting with the dead and live load? When the wind force is removed the final position along line *ce* on figure 4 is not known.
3. The effect of sway with non-symmetrical loading.
4. The effect of the physical properties of the steel on the connection characteristics.

The erection procedure and clearances should also be allowed for. For example, some loading may be applied prior to making the final connection.

[1]Senior Engineer, Montreal Engineering Co.

**S. D. Lash, M.E.I.C.**[2]

Steelwork designers have long been accustomed to design structures assuming that the joints have little resistance to rotation and then to build them with relatively stiff joints. They take the stiffness into account when it is evident that such stiffness is essential to the safety of the structure and ignore it at other times. A historical study will show the reasons for this apparently irrational procedure. At one time most trusses were pin-connected and building frames consisted of simple beams resting either on the top of cast iron columns or on simple brackets or walls. In these circumstances there was little difference between theory and practice. Today this is no longer true and Mr. de Stein has performed a useful service by drawing our attention to the fact.

One probable reason for the irrational behaviour of steel designers is that they feel happier about neglecting bending moments in columns if at the same time they are also neglecting restraining moments in beams. It is common for example to assume the effective span of a girder framed into columns as the centre to centre spacing of the columns. This assumption is usually quite unjustified. The column itself does not induce any appreciable end slope in the beam and the connection of the beam to the column transmits a considerable moment. As a consequence of these two effects, the true effective span of the beam may be from 4 to 6 *feet* less than the centre to centre spacing of the columns (See for example the Final Report of the Steel Structure Committee pp. 133 and 183). There can be no justification for neglecting such a large factor.

As far as beams are concerned, an allowance for end restraint means a saving in weight. For columns, increased moments will usually mean increased weight. The values of moments given in Tables I and II by Mr. de Stein are impressive, but it would have been more convincing if he had shown what influence these moments would have upon the final weight of the structure.

It can be argued of course that the moments are being applied to the columns whether the designer recognizes the fact or not, and that so far failures of columns have not occurred. Therefore it will be maintained that it is not necessary to make allowance for moments in columns due to ordinary vertical loadings. This argument simply means that the factor of safety used in the design of columns is sufficiently great to take care of known factors deliberately ignored by the designer. It is not an entirely satisfactory situation.

The problem of making proper allowance for the restraint of connections when designing beams is not fundamentally difficult but there are several variables to be considered. Mr. de Stein has mentioned beam depth and the properties of the connection itself; in addition, the following will also affect the degree of restraint:

(a) The magnitude of the load—a connection giving 60% restraint at working load may only give 40% at twice working load.

(b) The distribution of the load—the degree of restraint will not be the same for a concentrated load as for a uniformly distributed load, and

(c) The moment of intertia of the beam—the restraint will not be the same for a heavy WF beam as for a standard I. The writer made an attempt to devise a simple design procedure which gave consideration to all these variables and this appeared as Appendix "G" to the first edition of the National Building Code. It is not known whether much use has been made of the provisions of this Appendix but it seems probable that it has been largely ignored. At least it does not appear in the new edition of the Code. Possibly steel designers are not really interested in saving steel.

[2]Professor of Civil Engineering, Queens University.

Whilst it is easy to suggest a simple and rational method of designing beams in steel frameworks the same is not true with respect to columns. A continuous column is a highly involved structural member, a fact made abundantly clear by the Progress Reports of the Column Research Council of Engineering Foundation. It is possibly significant that Mr. de Stein does not discuss this problem at all. Yet it is surely reasonable to expect some consideration of it in a paper entitled "Rational Design for Building Frames". One eould go further and point out that Mr. de Stein's paper is more concerned with analysis than design. This is to some extent inevitable with any indeterminate structure but this inevitably may explain the apparent unpopularity of a rational approach. Steel designers unlike their colleagues concerned with reinforced concrete, do not seem to be much interested in relatively complicated design procedures.

**R. H. Quintal, M.E.I.C.[3]**

The analysis of semi-rigid connections for structural steel members, presented by Professor de Stein shows quite clearly that the actual stresses in a beam or a column may be quite different than the values which we would find by using standard design assumptions. This, of course, appears quite disturbing in view of the fact that a certain amount of under-design may take place due to the partial redistribution and carry-over of some efforts from one member to the next.

However, the carry-over factors as described by Professor de Stein have been obtained in the only possible way that we know of, which is through measurement of stresses on laboratory test structures probably loaded only to values which will keep the stresses below the elastic limits.

We wonder, therefore, if an analysis based on the limit design theory, which would take into consideration the plastic flow of over-loaded members, would not give for many critical cases carry-over values somewhat below the values indicated by Professor de Stein's theory.

We realize, of course, that in many cases it may prove more satisfactory and it would be definitely safer to limit the stresses to values well below those which will produce plastic flow, but the question here becomes one of the refinement of the design and since in some cases justification can be found for the introduction of semi-rigid connection factors, we see no reason why the further step of estimating the stresses through limit design should not be considered.

It should also be noted that steel erection, especially with rivet connections, can be subjected to parasitic stresses and conversely field connections may not have a rigidity comparable to that of laboratory test members.

It is felt, therefore, that the present paper may serve a useful purpose for certain designs but only if other factors such as the ones already mentioned are studied as well.

[3]Foundation Engineering Division, Racey, MacCallum and Associates.

**Dr. G. G. Meyerhof, M.E.I.C.[4]**

In an interesting paper the author advocates a method of semi-rigid frame design, which was developed by the Steel Structures Research Committee of the Department of Scientific and Industrial Research of Great Britain some 20 years ago.(1) This Committee investigated for seven years the behaviour of steel building frames by extensive theoretical analysis, laboratory research and full-scale observations on a number of large buildings in London. As a result of this work a suggested Design Code was published in 1936 (1), which not only contained all the information required for the design of steel building frames with semi-rigid beam-column connections, but also raised the allowable steel stress from the previous 18,000 p.s.i. to 20,000 p.s.i. (corresponding to a reduction of the factor of safety from 2.2. to 2.0) on account of the more rational method of design.

Application of the new design procedure in practice showed, however, that it did not lead to any significant economy in steel but merely reduced the weight of the steel in the beams by up to about 20 per cent and increased the steel in the columns by a similar amount when compared to the standard design of frames ignoring the rigidity of connections. Since in addition the new method was more laborious and time consuming in the design office, it unfortunately did not gain support from the engineering profession.

In the meantime further research on the behaviour of bare steel frames has shown(2) that the real factor of safety of structures can only be determined from an estimate of the collapse load of frames, which requires an approach based on a plastic method of design (limit design). Moreover, the encasement of steel members in many buildings and the provision of floors and walls leads to a composite behaviour of structures, which differs appreciably from that of bare frames and has recently become the subject of further study(3). It is suggested that these recent methods will lead to a more rational design of steel building frames than the previous elastic analyses.

[4]Supervising Engineer, Foundation of Canada Engineering Corporation Limited.

**J. L. de Stein, M.E.I.C.**

The writer would like to thank those who have submitted discussions to his paper.

Mr. Mathison agrees that when a rational analysis is made an increase in allowable stresses is justified. He also indicates other problems which are pertinent to the design of structures with semi-rigid connections.

Prof. Lash suggests that a rational design method for steel structures would not be popular with steel designers due to the complexity of the analysis. He notes however that a method which parallels the true behaviour of the frame has some merit. The forces on each component of the frame are known. The deformation of each component at design loads is known. Even though a rational method may not be warranted for every-day design, it would appear that an occasional analysis would help the designer to better understand the behaviour of structures. This would probably be of benefit to his general design methods.

Both Mr. Quintal and Dr. Meyerhof indicate that a rational design method should be "based on a plastic method of design (limit design)." For many structures with standard web connections it would appear that an excessive deformation of the connections would take place before any major portion of a beam or column was in the plastic stress range. Maximum permissible movements and rotations might eventually be specified, and these would govern the design in many cases.

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# Abstracts of Current Literature

Abstracts of articles appearing in current technical periodicals

## BRITAIN MODIFIES POLICY ON MACHINERY IMPORTS

*Foreign Trade*, v. 102, n. 3, August 7, 1954, pp. 26-27

British industry has been given the green light on re-equipping its factories with American and Canadian machinery that will reduce production costs. The Minister of State, Board of Trade, made the following announcement late in June.

" . . . the Government, while still unable in our present balance of payments situation to remove licensing restrictions on imports of dollar machinery, consider that some of the severity of the existing restrictions can be relaxed. Accordingly, in future, more favourable consideration will be given to applications for import licences whenever the Board of Trade are satisfied . . that a dollar machine will reduce costs and that no alternative non-dollar machine offering roughly similar advantages is available."

### *Priority Requirements Dropped*

Couched in these terms, import restrictions still look formidable. Where, then, does the "relaxation" come in? It consists of eliminating the paramount criterion by which import licence applications have hitherto been judged—essentiality. Up to now, applications not passing the test of end-use essentiality have generally been refused, unless savings in cost weighed very heavy in the balance. Machinery in the main, will henceforth be admitted regardless of the relative importance of the industry in which it will be used.

The Government has not given a precise definition of the types of machinery that will be affected by the new ruling. For the present it will apply to all machinery, parts and ancilliary equipment required for manufacturing, production and services (either commercial or public). The bulk of the items affected are electrical and other machinery listed under Class D, Division 15 and 16 of the Import List, 1954, of which the following are the main headings:

Division 15—Machinery other than Electric:

Power generating (except electric) machinery; engines of all types; agricultural machinery; metal-working machinery; pumps; mechanical handling equipment; excavating, earth-moving machinery; mining machinery; woodworking machinery; portable power tools; paper-mills and pulp-mill machinery; printing and bookbinding machines; laundering and dry-cleaning machines; textile machinery; air-conditioning machines; refrigerating machinery; air and gas compressors; boot and shoe-making machinery; centrifugal drying and separating machines; electric lamp and valve-making machinery; food and drink preparation machinery; tanning and leather-working machinery; tobacco, cigar and cigarette-making machinery; bearings, ball and roller; cocks and valves.

Division 16—Electric Machinery, apparatus and appliances:

Generators; motors; valves; electronic, cathode ray tubes; apparatus for telegraphy, telephony, radio, television and radar; welding machinery; signalling apparatus (including traffic signals); industrial radio-frequency equipment; electro-medical apparatus; portable power tools; electric cables, wires, strips and strands, insulated; accumulators; electrical ware (including insulators) of porcelain; insulating materials; radio-testing equipment; scientific electrical instruments; electric machinery, apparatus and appliances, not elsewhere specified.

In addition to the foregoing a number of eligible items drawn from other sections of the Import List are subject to the new ruling: e.g., electronic tubes, hand tools and scientific instruments. In all cases, however, import licences will only be considered for machinery or equipment for production purposes. For example, electronic tubes will be considered for commercial or industrial use but not for private television receivers.

## MACHINING HARD METALS WITH ELECTRIC SPARKS

*The Engineer*, v. 198, n. 5136, July 2, 1954, pp. 11-12

The "Sparcatron" process makes use of the energy in an electric spark to blast away particles of metal as the arc strikes the workpiece.

The principle of the "Sparcatron" process is that an electric spark is caused by the sudden breakdown of a dielectric separating two electrodes: if the workpiece to be machined is made to be one electrode and another electrode of opposite polarity is brought to within the breakdown point of the dielectric separating them, the ensuing spark will remove a minute particle of the workpiece. For a spark to occur at all, a finite gap must always exist between the two electrodes. With any dielectric under a given set of conditions, the occurrence of a spark discharge depends on the size of the gap and the potential difference across the electrodes. Another elementary factor upon which the "Sparcatron" process relies is that an electric spark will always bridge the shortest point of the gap between the electrodes. Because of this fact, whatever cross section or contour the electrode may have, the removal of metal in the workpiece will follow the pattern of the electrode exactly. Although the original spark discharge may take place from any point on the face of the electrode, as soon as this discharge has occurred, material at that point on the workpiece is removed and the gap there becomes larger than elsewhere; sparking must therefore take place from another point on the electrode and so on until the complete surface of the electrode is covered. At this stage a minute thickness of material will have been removed from the workpiece, following the exact shape of the electrode. Theoretically, sparking will then cease because the overall gap between the electrode and the workpiece is greater than that required for a spark discharge under the prevailing conditions. However, if a practical means of maintaining the gap at the optimum value can be applied, and the generation of spark discharges made repetitive and continuous, metal removal will continue indefinitely or until the hole is fully pierced or the desired sunken contour is achieved.

We have established that the base profile and surface contour of the electrode is exactly the same as the aperture to be cut. However, the fact that a gap, however small, exists between the electrode and workpiece, means that the electrode must be smaller on all dimensions, by an amount equal to the spark gap, for a given finished size. Also, for a given voltage difference between the electrode and the workpiece and for a given dielectric separating them, the spark gap must be maintained at the correct "breakdown" distance. Provision must also be made for generating properly spaced spark discharged in a continuous sequence.

Here three practical factors must be considered. First, the length and intensity of the individual spark impulses and the length of the intervals between them must be carefully controlled to prevent the formation of a continuous arc. Secondly, provision must be made to control the intensity of the sparking effect over a wide range because the surface quality obtained with this process (as in others) depends upon the cutting rate; the higher the surface quality required the slower must be the cutting rate. Thirdly, the point of spark application must be kept under precise control, because the accuracy of the resulting cavity is related to the spark gap. For example, the resulting diameter of a plain circular hole will be that of the electrode plus the radial clearance which constitutes the spark gap. As the accuracy of machining is so closely related to the spark gap and is therefore bound up with the electrical characteristics of the system, it follows that the spark gap should be kept as small as compatible with operational requirements, including that of cutting speed.

Although spark machining may, in theory, be carried out with electrode and workpiece separated only by air, in practice a liquid dielectric is used, principally for its cooling effect, but also for certain electrical properties. Generally, the liquid employed is ordinary paraffin, although specially prepared liquids may be used. Although paraffin is inflammable, no ignition of the liquid can take place because the cutting point is fully immersed and insufficient oxygen is present to support combustion.

The electrode may be fashioned from almost any soft material which forms a good electrical conductor, brass is generally recommended because it is easily worked and almost any form of electrode, from an intricate die shape to a simple piercing tool, can be produced quickly. In many cases it is necessary to machine only the first electrode since, if the product is an extrusion or forging die, it is a simple matter to arrange for a number of pieces to be worked in brass from the original die to serve as future electrodes. In all such cases a very simple method of reducing the workpieces on all dimensions in order to provide the clearance required for the spark gap is to dip it in a suitable reducing acid, thereby converting it into an electrode.

The surface produced by spark-cutting has a non-directional finish (unlike the grooved finish of mechanical grinding and turning) and has special oil retention properties. Furthermore, the changeover from rough to finish machining involves merely the switching out of condensers and can be carried out instantaneously without interrupting the cutting. For example, suitably "stepped" or tapered electrodes enable holes to be rough pierced at a fast rate (using a high condenser value) during the first part of the electrode and then finished machined for the latter part of the electrode simply by switching to a low condenser value.

The process can be applied to the grinding of carbide tool tips where the absence of friction heat eliminates surface stresses and microcracks. It is also possible to completely finish-harden parts and then finally machine by spark-cutting without fear of distortion.

## GADGETS—THEIR PRACTICAL PERFORMANCE IN WATER CONDITIONING

B. Q. Welder, Everett P. Partridge, *Refrigerating Engineering*, v. 62, n. 6, June, 1954, pp. 49-53, 108-116

Most human beings want to get something for nothing. Even the engineer with his basic knowledge that one can get out only what one puts in as far as energy and matter are concerned will hopefully buy a ticket that may give him a new auto if his number happens to be drawn. Add to this basic human trait the current belief that, tomorrow or possibly the day after, science will provide an easier way of meeting each of our needs and you have an explanation for the many millions of dollars gambled annually on gadgets.

Let's define what we mean by gadgets. For the purpose of this paper they are special devices requiring substantially no technical control which are alleged to treat water by nonchemical means so that the familiar troubles caused by depositions of scale or sludge, by corrosion and cracking, or by the accumulation of organic slimes will plague us no more. Usually it is claimed they have additional powers for good—for example, one or another will eliminate any objectionable taste and odor from water, or remove slag deposits from the outside of the tubes in a boiler fed with water passed through the gadget, or improve the taste of a cigarette laid on it.

The promotion of gadgets is currently at one of its periodic peaks. Any thoughtful scientist or engineer naturally tends to suspect the claims of universal utility, the explanations in pseudoscientific gobbledygook of how each gadget is supposed to function by electrical or catalytic or supersonic means, and the warm testimonials from obviously well meaning but uncritical users. The scientist and engineer may even feel compelled to state with courage and conviction their conclusion that these promotions are the bunk. Always, however, the practical man in the plant wonders if the experts could be missing some new truth not yet fully appreciated.

In the present paper we propose to take an objective look at what the gadgets themselves have accomplished when applied to specific water problems in specific plants. The body of this paper will therefore comprise condensed case histories each observed at first hand by one of our field engineers.

The case histories end rather monotonously with the gadget tossed on the junk pile. Here and there in the technical literature, however, there is a claim of a beneficial effect or a possible explanation. Finally, we consider the methods customarily employed in promoting gadgets and what can be done by the man in the plant to protect his equipment, his company, and himself.

For obvious reasons we have not considered testimonial letters as adequate evidence that a gadget had solved a problem of scale or corrosion. We have not offered to spend the substantial amount of money which would be required to study in detail the facts behind such testimonial letters.

The answer from our experience is "gadgets do not prevent scale and corrosion under the varied conditions met in practice." If there were a way of achieving a consistent record of satisfactory results, then some gadget should have succeeded in establishing itself more generally than has been the case.

In the main, gadgets are actually sold to plants by men of good reputation working for an established local company handling plumbing supplies or small items of plant equipment. In the early stages of a promotion, these salesmen are honestly enthusiastic. Later, faced with more and more instances in which a gadget has failed to produce the anticipated results, they may respond with anything from apology to argument. Admittedly, they know only what has been told them by the promoter.

The man with a gadget to promote faces an intriguing series of problems. If he is aware of past experience, he realizes that he must make some fast bucks and get out. He can, of course, dissolve a dying venture under one name and start up again with a similar gadget under a new name. He can also shift his campaign from one part of the country to another, keeping one jump ahead of a disappearing reputation. He can even work on a global scale, bringing to eager Americans the gadget which no longer is able to find a market in England or France.

The promoter has two powerful influences working for him, social hysteresis and personal pride. He can count on a period of from one to three years before the lag in communication of practical results from plant to plant has pretty well killed off further prospects. This period of hysteresis may be prolonged by the very human reluctance of the person who has been taken to admit the fact. Customers who have given testimonials during an early period of enthusiasm are not prone to confess that the gadget actually did not perform during the long haul.

Faced with the necessity of working fast, the promoter naturally avoids as much as possible the man with technical training. Instead, he aims his campaign below the engineer and above him. If he cannot sell the nontechnical operator, perhaps he can intrigue the plant manager or the vice-president.

What course of action is practical for the man in the plant besieged annually by a new promoter with a new gadget? Some engineers of native intelligence and good training have been known to follow a policy of trying out each device offered to them. Such a solution is perhaps an eminently practical one when the gadget has been recommended to the vice president by an influential friend over the luncheon table. It does lead immediately to the citation of the company by the promoter as a satisfied customer. Many a large corporation has been startled to find itself in such a position as a result of having installed—and subsequently discarded—a gadget in some obscure corner of the organization.

Another course of action might be to ask for evidence that the practical performance of the gadget in question has been reported objectively by a reputable engineer before some technical society. This is a slow, hard way of building acceptance employed by companies which intend to remain in business indefinitely. If a gadget has achieved a useful result, then let the engineering profession have the opportunity to take a thorough, critical look at all the pertinent data.

## STANDARDISATION OF PALLETS

*The Engineer*, v. 198, n. 5136, July 2, 1954, p. 1

There was much trade and general interest manifest in the recent meeting of the Pallets Committee of the International Organisation for Standardisation, which was held at the British Standards Institution's headquarters in London in June. It was attended by forty-four delegates from many parts of the world and at the meeting of the main committee, six resolutions concerning the dimensions and loading of standard pallets were agreed. It was decided that the maximum height from the ground to the underside of the top deck should be 5 in., the minimum height for the passage of forks from any side should be 3⅞ in. and the width of wing pallets should be 3½ in. Maximum tolerances to be allowed on the length and width of standard pallets were specified. The minimum rating for pallets of 32 in. by 40 in. and 40 in. by 48 in. should be 1000kg. and the minimum stacking load 4000 kg, the question of test loads being deferred. A third I.S.O. standard size of pallet of 32 in. by 40 in. was recommended for final approval. The group's next meeting, which is to be held in a few months' time in Amsterdam, will be concerned mainly with matters affecting the handling of pallets at ports, with particular reference to a proposed international stevedores pallet. Requests were made that expendable pallets, chamfering of pallets, and the minimum percentage area of bottom decks of pallets should be added to the agenda and it was also agreed that in future discussions of pallets consideration should be given to their use by all forms of transport, whether by sea, river, road, rail or air.

## SITTING DOWN TO ONE'S WORK

*The Engineer*, v. 198, n. 5136, July 2, 1954, p. 18

There are, of course, people in this world who expect their employees when at work not only to work hard but also to look as if they were working hard. That, no doubt, is one of the reasons why so many appliances continue to be designed for operation by people standing up instead of sitting down. There is a lesser air of activity about people who are sitting down. There is even a suspicion in some people's minds—we recall a memory from childhood of an over-active aunt—that to permit people to sit down is to encourage slackness. Such people, of course, would regard the provision of comfortable seats of ample width and a padded back rest as a positive invitation to sloth. Why, an employee might even fall asleep in one of them! Yet, in fact, what is there wrong in making people as comfortable as possible at work? There was a time, was there not, when drivers of omnibuses sat on hard uncomfortable boards with no more protection from the inclement elements than a multiplicity of overcoats and a stretched piece of canvas could afford. We cannot say that we have observed any noticeable falling away in their driving skill since they have been shut away in warm glass cubicles and seated upon upholstered comfort; though, no doubt, their powers of caustic comment upon others' driving has suffered now that they are less audible than they used to be. In any event, we should retain a sense of proportion about this matter of standing or sitting. For as is remarked in the annual report of the Chief Inspector of Factories "as a cause of fatigue, prolonged sitting is secondary only to prolonged standing." Perhaps that is why editors, in common with many other sedentary workers, feel so tired by the day's end, though we like to pretend the cause is the amount of work we get through.

In industry there is a growing tendency for managements to provide seats for workers even when they are not compelled by law to do so. If seats are not provided all kinds of things tend to be pressed into service as a substitute, sometimes to their own detriment, sometimes to that of those using them. There was the operator observed sitting on the edge of an opened drawer which can hardly have been designed to carry such a cantilevered load. For ourselves, we remember in our younger days balancing upon a piece of four-by-four timber in the pattern shop. Of course, it will be argued that even when seats are provided those for whose comfort they are intended often scorn to sit upon them. But this is not always merely another example of human contrariness. It is more likely that something is wrong with the seats! For if seats are provided they need to be set in the right places and to be of the right height. To those whose opinion of human nature is low the fact that unsuitably designed, unsuitably placed, seats are not used ought, indeed, to be immensely encouraging. Does not their neglect suggest that far from workers being tempted into slackness by such consideration for their comfort, they are much more concerned to get on with their jobs? Nor when seats are well-placed and of the correct height and are yet not occupied should one leap hastily to the conclusions that they are not appreciated. "There is an amusing explanation as to why girls in an ice-cream factory were seen sitting on milk-drums instead of the more orthodox seats available; it was a cold day and the drums were filled with warm water."

We could not help wondering how much of the work still done standing in many engineering works could, in fact, be done at least as satisfactorily sitting. In the past when operators were constantly machining jobs of an "on-off" character, when the operation of the machine required the exertion of much muscular effort, when the worker was expected to grind his own tools, set his own machine, pick up rough parts for machining and set down or take away completed work, standing, because it allows so easily for movement around and about, was obviously more convenient than sitting. But nowadays, many machines are designed for repetitive production and controls are so well-placed that the operator hardly has the need to move his feet from the start to the finish of the day's work. Would there by any insuperable difficulty, for example, in designing a turret lathe for a sitting operator? We do not know. Yet we do think that in the majority of engineering works a number of jobs are done standing that could as easily be done sitting.

## CONTINUOUS ALUMINIUM-EXTRUSION PRESS FOR CABLE SHEATHING

*Engineering*, v. 177, n. 4612, June 18, 1954, pp. 794-795

Great interest has been shown in recent years in the development of techniques for sheathing electric cables with aluminium instead of lead, largely because of the high cost and comparative scarcity of the latter metal. Considerable progress has been made and some thousands of miles of aluminium-sheathed cables are already in use. Hitherto, such cables have generally been produced by what is known as the "tube-sinking" process, in which the conductors and insulating material are first drawn into a long aluminium tube of suitable diameter, which is then reduced by drawing the tube with the conductors and insulating material in position through a die, thus closing the aluminium down into close contact with the insulation. Such cables have proved quite satisfactory, but suffer from the drawback that they cannot be made in continuous lengths as can lead-sheathed cables.

One of the difficulties of sheathing cables by the extrusion process used in lead sheathing is that the temperature necessary for aluminium sheathing by extrusion is normally higher than is required for lead, so that there is some risk of impairing the properties of the insulation. British Insulated Callender's Cables, Limited, have been studying the problem for some years and have now overcome the initial difficulties, at least as far as low-voltage cables are concerned, so that they are able to produce aluminium-sheathed cables by the direct extrusion process in practically unlimited lengths.

After careful preliminary studies and experimental work the company reached the conclusion that in a normal production process of sheathing cables with aluminium by extrusion, it would be necessary to use commercial grades of aluminium in the form of solid billets; that extrusion temperatures should not exceed 300 deg. C.; that it must be possible to produce sheathed cables in long continuous lengths; that there must be satisfactory welds between successive billets; that the charging time must be kept as brief as possible to prevent overheating while the cable is stationary in the press; and that deformation and metallurgical defects at "stop marks", that is the point of the sheath which is in the die while the cable is stationary for re-charging, must be avoided.

As no existing press covering all these requirements was available, the company co-operated with the Loewy Engineering Company, Limited, in designing a suitable press and the result of their combined efforts, known as the Alsheath press, is now installed in the Prescott works. The press comprises two horizontally-opposed hydraulic cylinders, each of which is 45 in. in diameter and is operated at a pressure of 4,280 lb. per square inch giving a force of about 3,000 tons. The cable passes through the press in a direction at right angles to the axis of the cylinders, which permits the use of solid billets and reduces to a minimum the length of cable exposed to the heat of the press. Twin billets are used and are extruded through a common core and die to form sheaths ranging from 1.4 in. to 3.5 in. in diameter.

The billets, which are cylindrical, are charged into an electrically-heated furnace six at a time, leaving from the other end of the furnace in pairs at a temperature of about 280 deg. C. They then run down roller conveyors to a point below the level of the extrusion chamber of the press, whence they are raised, in a cradle, and turned round at right angles so that they lie on the axis of the hydraulic cylinders. They are pushed simultaneously into opposite ends of the extrusion chamber, by the action of the rams, the continued slow motion of which forces the metal out through the dies in the form of a sheath surrounding the cable. The extrusion chamber is heated and is kept under a vacuum while extrusion is proceeding. It should be mentioned that the extrusion tools are mounted in such a way that their positions and the gap between them remain constant, irrespective of expansion or contraction due to temperature variations. Special controls ensure that the extrusion of the two billets is constantly balanced and the mechanical loading facilities provided enable a pair of billets to be re-charged in a few seconds. The major movements of the press are controlled by servo-operated valves and the control can be made fully-automatic or individual, as desired.

Sufficient experience has now been obtained to show that the "stop-marks" are satisfactory from the dimensional and metallurgical aspects, and they have been found to comply with bend-test requirements and to withstand a high hoop stress. The welds formed between successive billets (as distinct from the "stop-marks") cannot be discerned on the extruded sheath and the top and bottom welds, which are unavoidable in right-angle extrusion, resemble those formed in the conventional lead press. Aluminium of 99.8 per cent purity is employed and with an extrusion temperature of 280 deg. C. the sheaths are in the lightly-annealed condition. The tensile strength is 5 to 6 tons per square inch, and the elongation is 30 to 50 per cent on a length of 2 in., in the longitudinal direction of the sheath, depending on diameter and thickness. A fine grain is found in all parts of the sheath, including the "stop-marks,". With these properties it will be clear that the springiness associated with cold working is largely eliminated.

## CALIFORNIA SUNSHINE AT WORK

*Chemical Engineering*, v. 61, n. 7, July, 1954, pp. 124-126

Hottest spot on earth—that's the focal point of this solar furnace now being used by engineers at Consolidated Vultee Aircraft Corp. for testing basing properties of materials at high temperatures.

With ideal sky conditions, estimated temperature at the 5/16 in. dia. focal point of the parabolic reflector is 8,500 deg. F. This is well above temperature levels achieved by the oxyacetylene torch (5,800 deg.) and the carbon arc (6,300 deg.).

Basic part of the solar furnace is the 120-in.-dia. polished aluminum mirror. Radiation from the sun is collected by the mirror and reflected to the focal point at a distance of 34 in. from the center of the mirror.

In order to keep the focal spot in one location over an extended period of time, the mirror is mounted in a gimbal ring so that the polar axis of the mounting is parallel to the earth's axis. A clock mechanism driven by a synchronous motor coordinates movement of the mirror with that of the sun.

Sky haze and clouds greatly reduce the efficiency of the solar furnace. In order to obtain more dependable performance, Convair plans to move the quipment from its present San Diego, Calif., location to a nearby mountain top—possibly Mt. Palomar—where sky conditions would be vastly superior.

The solar furnace is eminently suited for testing materials at high temperatures. The heat is "clean"—there is no interference from combustion products or other possible contaminants. Nor is there any interference from electric or magnetic fields. Heat-treating or melting and freezing of samples can be observed up to the highest temperatures available, and heating and cooling times are very short. And any other type of furnace which even approaches these temperatures would face the problem of preventing the furnace structure itself from melting.

Materials to be tested can be enclosed in a quartz envelope filled with any desired atmosphere. The glass itself, outside the focal point, is not destroyed by the high temperatures at the focal point within.

A bridge structure spanning the mirror a short distance beyond the focal spot supports the specimen holder. After part of the sample melts, adjacent regions are moved into the focal spot by means of a motor-driven screw. The bridge also supports a cylindrical barrel about 18 in. in diameter. This is used to shade a part of the mirror from the specimen so that the intensity of solar radiation concentrated on the specimen can be controlled.

The mirror has a central opening 22 in. in diameter which permits easy observation of the focal spot area from a position on the ground behind the mirror. A telescope mounted at this opening permits the observer to see details of heating or melting, magnified about 20 times.

Convair is testing many different kinds of materials, both ceramics and metals. Information developed in this program is expected to be of great value in solving problems associated with engines and friction.

## BELGIAN NATIONAL RAILWAYS

### Survey of the Electrification Programme

*Electrical Review*, v. 155, n. 1, July 2, 1954, pp. 3-7

The electrification of the Belgian National Railway system is being carried out at 3,000 V d.c. and up to the present four lines have been electrified; Brussels Nord to Antwerp Central (in 1935), Brussels Midi to Charleroi (in 1949), Linkebeek to Antwerp Nord (in 1950), and Brussels Midi to Ghent (in 1954). To these should be added the six tracks of the Nord-Midi loop, which connects the Nord and Midi stations in Brussels.

The grid system in Belgium is highly developed so that adequate supply facilities are available for the establishment of traction substations wherever they may be required.

The Belgian National Railways adopted trolley wires of the compound type and this system has been retained. In certain cases, however, use is made of simple catenary suspensions with one or two contact wires or of a simple tramway type suspension.

Until 1950, the lines of the two tracks were permitted to be suspended on independent supports consisting either of latticework posts or of I-beams with large flanges. Since then the lines have been suspended on rigid gantries, all the units of which are made up of I-beam section irons with large flanges, spaced at 63 m on straight sections.

The mechanical tension of the contact wires is regulated by means of automatie counterweight tension devices installed at about every 1,200 m. The principal and auxiliary carrier cables are interrupted only at the section divisions.

The tracks at platforms may be either insulated separately or in groups; the lines outside the stations may be split up into sections, both to facilitate maintenance and to simplify fault location. The corresponding sections are normally shunted by disconnecting switches, which are often remote controlled, and can be operated on load. The protection of the lines against lightning is carried out by over-voltage fuses installed in the substations and section boxes.

At present the Belgian National Railways have available 47 electric rail-cars and 26 electric locomotives, representing rolling stock supplied during the years from 1935 to 1950. A further 15 rail-cars and 50 locomotives are in the process of being supplied. Two sets of rail-cars comprising 79 and 38 units respectively are on order, as well as 83 locomotives.

The 25 rail-cars brought into service in 1950 were ordered on account of the electrification of the Brussels-Charleroi line. Their construction is lighter than in the preceding cases, and the JH starting equipment was installed in them after the test carried out on the 1946 prototype. Their maximum speed is restricted to 105 km.-hr. to reduce the consumption of electric power by stopping trains (more rapid elimination of starting resistances). For the first time general use was made of electric lighting using fluorescent tubes (fed by d-c.).

The rail-car brought into service in 1951 is a prototype built in the workshops of the Belgian National Railways with a view to carrying out tests at 140 km.-hr.

The motors are nose-suspended, and the transmission is by rigid gears. All the bogies are fitted with a traction motor. The bogie chassis are made of cast steel. The guiding of the axle boxes is carried out by connecting rods according to the system already used by Alsthom on a large number of locomotives of the French National Railways, in Holland and in Spain. The axle boxes run in roller bearings.

Studies of locomotives were carried out during the war and the Belgian National Railways chose the BB type, having a weight of 80 tons, with nose-suspended motors, a power of 2,200 hp. and a maximum speed of 100 km.-hr. The locomotives would be suitable for towing both passenger and goods trains.

While Belgian manufacturers sent in an offer for locomotives of this type, a Swiss concern proposed the purchase of three locomotives similar to the machines Ae 4/4 used by the Berne-Loetschberg-Simplon Company (but naturally designed for 3,000 V d-c.), with bogies according to the S.L.M. (Winterthur) system, motors completely suspended, Brown-Boveri disc transmission and a maximum speed of 130 km./hr. The Belgian National Railways agreed to try these out.

The Belgian manufacturers, when invited to present an offer for mixed high-speed locomotives, put forward a different solution: nose-suspended motors with unilateral transmission using rigid gears (according to the American method), and bogies with horn plates.

The choice was guided by the criterion of satisfying certain important conditions: the use, as far as possible, of equipment and units which were identical with those already in service; the choice from among the units in service of those which had reached the highest stage of improvement and development while at the same time offering sufficient guarantee of good working; the adoption of systems which had already been tried out in actual service, which offered ease of maintenance and overhaul, and which simplified the running of the train; while taking the above considerations into account, the purchase price had to be the lowest possible and the cost of operation the minimum.

The new locomotive, series 122, is a carefully worked out combination of the particular features of the locomotives of series 120 and 121 (locomotive 120 already possessed certain features in common with locomotive 101; pantographs, ultra-high-speed disconnecting switch, motor-fan groups, motor-compressor groups).

The traction motors are identical with those of the locomotives of series 120 (the difference in power is solely due to a modification in the rules of definition laid down by the International Electrical Engineering Committee). They are of the series type, without compensating windings, and can be shunted 72 per cent. The electrical equipment incorporates contactors controlled by camshafts.

The equipment is grouped into blocks. One of these blocks comprises the starting resistances with their fans, two camshafts controlling respectively the 33 contactors of the resistances and couplings and the 10 contactors of the shunting, control and safety relays, and the electro-magnetic contactors of the auxiliary motors. Another group comprises the ultra-high-speed disconnecting switch and the auxiliary apparatus.

The starting of the locomotive is automatic. There are four economic running positions in series (full field and different positions of shunt) and six in the series-parallel coupling. Starting is carried out under the control of an acceleration relay, the setting of which may be regulated as desired by means of a control installed on the driver's switchboard. These locomotives are controlled by a single driver and the equipment is fitted with a "dead-man's" handle.

The work of electrification has brought with it in many places important alterations to stations as well as far-reaching modifications in the signalling arrangements. Advantage has been taken of this fact to bring about the general substitution on electrified lines of luminous signalling for systems using signalling arms. A type of luminous signal is being used which, besides the normal lights, has a panel for indicating direction (luminous arrows) and one to indicate speed restrictions (luminous figures).

# FROM MONTH TO MONTH

**Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers**

## Nechako-Kemano-Kitimat

Once again the *Journal* presents a fascinating story of engineering achievement. The great power and industrial development in British Columbia on which the world has been gazing for so many years is now an accomplished fact. The story in all its details is to be found within the pages of this volume of the *Journal.*

Back in the April, 1944 issue, the *Journal* was devoted exclusively to telling the story of another great engineering achievement. That story was called "The Saga of the Saguenay", and was made up of five excellent papers, which described the history, design and construction of the great Shipshaw power development at Arvida. There is a close relationship between that project and the one described in this issue. The main point tying the two together is that the owner in each case is the same. The Aluminum Company of Canada, Limited is the enterprising organization that has seen the great potential of Canada and has backed its faith so substantially. Such confidence in this young nation has been a great factor in aiding Canada's startling development.

The story of Kitimat is the greatest of its kind as far as this country is concerned. The *Journal* is delighted to bring it in one volume to the engineers of Canada. *There have been papers presented before this, some technical, some popular, but this is the whole story, told for the first time as a single story.

The *Journal* feels that it has a responsibility to provide an outlet for Canadian engineering stories. This feeling of responsibility springs not only from a desire to encourage Canadians to write their stories, but as well from the realization that they are the literature of the profession and there must be a repository for them.

The *Journal* is indebted to the officers and engineers of the Aluminum Company. They have given splendid co-operation and support. The result, as shown herein, is believed to be the "biggest and best" ever produced in Canada. It is the hope of the editor and staff that the company will derive as much pleasure and satisfaction from this publication, as do the publishers.

*Published earlier in *The Engineering Journal:*
Nechako-Kemano-Kitimat Hydro Electric Power Development and Aluminum Reduction Plant, F. L. Lawton and J. S. Kendrick, v. 35, n. 9, Sept. 1952, p. 915.
Electrical Engineering and Operating Aspects of Alcan's B.C. Project. J. T. Madill, v. 36, n. 4, April 1953, p. 362.

## The Cover Picture

The cover picture is a sketch map illustrating the territory where the Nechako-Kemano-Kitimat development was carried out. It shows the relative locations of the principal features, i.e., the Kenney dam, the existing tunnel (double line), the future tunnel, and the powerhouse at Kemano, the transmission line and the smelter at Kitimat.

## UPADI 1954

The Pan American Federation of Engineering Associations, whose title in Spanish provides the abbreviation "UPADI", held their third conference in Sao Paulo, Brazil, from August 2 to 6, 1954.

The Engineering Institute is a member of UPADI and was represented at this meeting by James A. Vance, Vern B. King and E. R. Jacobsen of Sao Paulo.

There are 21 countries represented in the membership of UPADI. Besides Canada and the United States there are: Argentina, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Chile, Republica Dominicana, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Panama, Paraguay, Peru, Puerto Rico, Uruguay, Venezuela.

The United States' membership is in the name of the Engineers Joint Conference, the membership of which is made up of seven of the leading engineering societies.

The conference program was made up of business sessions for five days and concluded with excursions to other parts of Brazil and other South American countries. Reports from the Institute delegates indicate that the conference was a great success. Much business was completed and

**Luis Giannattasio, Uruguay, president of UPADI, opened the discussions of the third conference in Sao Paulo. From left to right: James A. Vance, M.E.I.C., Carada; James Todd, United States; Dr. Giannattasio; Luis V. Migone, Argentina; President-elect Francisco Saturnino de Brito, Brazil; and Enrique M. Pelaez, Uruguay, alternate for El Salvador.**

on the social occasions many new friendships were made and old ones renewed.

The Institute delegates have emphasized the values to be obtained from such a Pan American conference. Next to the United States, South America is our nearest neighbor and might well become a great factor in the economic life of Canada. The people of that continent can use many things we have in Canada, including our industries for the practical training of their engineers and our universities for their theoretical training. It is believed by those who have studied these things, that a conference of professional people such as is UPADI, can become a real factor in developing good international relations and promoting the interchange of ideas between the engineers and the industries.

The Canadian delegates point out the desirability of getting more Canadians to attend UPADI conferences. They believe that Canada has a real part to play in this field. One delegate says in his report, "Our participation in UPADI should not be influenced by distance. The next conference will be in Mexico City in 1956. Can we not have many Canadians there who have an interest in South and Central America and in Mexico? These people can use our initiative, our ability to get along with others, our friendship and our sincere interest in them. Shall we pass up such opportunities? I hope not."

The minutes of the business sessions have not been received and therefore there can be no report on that important part of the conference at the moment. However, as the material is received, it will be reported in the *Journal.*

# Engineering Education

In its 68 years of existence the Engineering Institute has participated in many conferences and discussions on education. It is doubtful if any of them have provided as much useful and interesting information as did the joint ASME-EIC conference held at Clarkson College, Potsdam, N.Y. on October 7 and 8.

The fact that the conference was an invitation affair, limited to 200 people, meant that everyone present had come because he was interested. Thus it was that everyone attended every minute of every session, which was the real reason why the meeting was so outstanding.

The opinion of delegates, expressed on all sides, was that this was the best conference of its kind they had ever attended. That opinion was held by educationalists as well as by employers. The resolution passed unanimously at the concluding session summed up the approval of all, when it recommended that the ASME-EIC International Council, give prompt consideration to a follow-up conference to develop the ideas further—perhaps to conclusions that would be revolutionary in the engineering education systems on both sides of the border.

The theme of the Conference was "Trends in Mechanical Engineering Education." From the beginning it was evident that the word "mechanical" could have been left out of the title. Everything that was said was just as applicable to any or all branches of engineering as to mechanical.

The main theme was broken into two parts, one for discussion each day. The first day's subdivision was "Can Present Mechanical Engineering Curricula be Improved?" The answers were all firmly in the affirmative. Some of the suggested improvements were startingly novel, but

**The academic procession at Clarkson College.**

**Members of a panel discussing the subject, "Can Present Mechanical Engineering Curricula be Improved?" From left to right: E. G. Bailey, R. J. Askin, M.E.I.C., H. N. Meixner, Thos. D. Jolly, D. C. R. Miller, M.E.I.C., Wm. G. Van Note, Henri Gaudefroy, M.E.I.C., E. A. Allcut, M.E.I.C., Geo. B. Thom, and C. Richard Soderberg.**

after due explanation and consideration, were quite generally approved. The revolutionary thinking of at least one panel member, is indicated by his statement that mathematics is greatly overrated as a gauge of a person's aptitude for engineering. He pointed out that only a very small percentage of engineers ever used their higher mathematics and yet many potentially good engineers are kept out of the field because they do not meet the high requirements in mathematics. He thought the basic sciences were much more useful.

For the second day the subdivision of the main topic was "Dangers of Over Specialization in the Curriculum." Here again it was soon apparent that the word "over" could have been left out of the title. The speakers and discussors were attacking all specializations, even advocating in some instances that the recognized branches such as civil, electrical, mechanical, etc., should be eliminated as separate courses in an undergraduate curriculum. It was surprising to discover that almost everyone, even the educationalists on the platform and on the floor, agreed that specialization was a mistake.

It was evident that these ideas should be studied further. They are revolutionary of course, but with the unanimity apparent at this conference, it seems the educationalists and the employers are looking for a change. It is likely the International Council of the two societies at their meeting in New York in December will determine some program of further study.

### Speakers and Discussions

The panel members for the first day when the subject was "Can Present Mechanical Engineering Curricula be Improved?", were R. J. Askin, vice-president, Abitibi Power and Paper Co., Limited, Toronto, and E. G. Bailey, a past-president of A.S.M.E. and chairman of the board of Bailey Meter Company. These two represented industry and the employer. Representing the universities were E. A. Allcut, professor of mechanical engineering, University of Toronto and C. Richard Soderberg, dean of engineering, Massachusetts Institute of Technology. The discussion leaders were Henri Gaudefroy, dean of engineering, Ecole Polytechnique, Montreal, and George B. Thom, chairman, department mechanical engineering, Newark College of Engineering, representing the academic side. For industry there was H. N. Meixner of E. I. du Pont de Nemours & Co., Inc. and D. C. R. Miller, director and general manager, Dow Corning Silicones Limited, Toronto.

Presiding over the session was Thomas D. Jolly, vice-president, Aluminum Company of America, Pittsburgh.

On the second day the subject was "Dangers of Overspecialization in the Curriculum". The moderator was Dr. A. G. Christie, professor emeritus of mechanical engineering, Johns Hopkins University, Baltimore, an ex-Canadian and a graduate of Toronto University.

The panel members for the universities were D. L. Mordell, professor and chairman, department of mechanical engineering, McGill University, Montreal, and Jess H. Davis, president, Stevens Institute of Technology, Hoboken, N.J. For industry the representatives were Karl B. McEachron Jr., General Electric Company, Erie, Pa., and R. S. Sproule, manager, hydraulic department, Dominion Engineering Works, Montreal.

### Dinner and Banquet

The lunches both Thursday and Friday were held informally in the cafeteria of the beautiful new Lewis House, but for the dinners on the same days there were more formal programs. On the Thursday the speakers were the presidents of the

**Part of the head table at dinner on Friday evening. From left to right: Ralph S. Damon, David W. R. Morgan, D. L. Thomson, M.E.I.C., W. A. MacIntosh, Wm. G. Van Note, D. L. Mordell, M.E.I.C., I. R. Tait, M.E.I.C., A. G. Christie, M.E.I.C., Edward McHugh, D. M. Stephens, M.E.I.C., and C. E. Davies.**

two societies, Dr. Lewis K. Sillcox and D. M. Stephens. Dr. Wm. G. Van Note, president of the college was in the chair.

On Friday the locale was changed to the spacious dining room of the new Clarkson dormitories. Dr. W. A. MacIntosh, principal and vice-chancellor of Queen's University was chairman and Dr. D. L. Thomson, dean of the faculty of graduate studies and research of McGill University, spoke on "Post Graduate Education in Engineering".

#### Convocation

A feature of the two day program was a special convocation on Friday afternoon, tendered as a tribute to the profession. Under the presiding genius of Dr. Van Note, four engineers were honoured — two Americans and two Canadians.

The convocation speaker was Ralph S. Damon, chairman of the board of trustees of Clarkson College, and president, Trans World Air Lines.

For Canada, two officers of the Institute were presented to Dr. Van Note, one, D. M. Stephens, the president of the Institute, to receive a doctorate of engineering, the other I. R. Tait, a vice-president of the Institute to receive a doctorate of science.

The two Americans were David W. R. Morgan, vice-president Westinghouse Electric Corporation who was made doctor of engineering, and Frederick S. Blackall Jr., president and treasurer of the Taft-Pierce Manufacturing Co. and a past-president of A.S.M.E., who became a doctor of science.

The whole faculty of Clarkson participated in the academic procession. Their colorful gowns and hoods, added brilliance to the already brilliant scene, and rivalled the colour of the leaves and the sparkle of the sunlight, filtering through the trees. It was a perfect day for a great occasion.

#### Attendance

As in any other conference it is the type of people who attend that give the conference significance. The attendance at Potsdam was made up of persons whose attendance and attention was of unusual significance to engineering education.

There were presidents of four distinguished educational institutions, Rensselaer, Stevens, Clarkson and Queen's. In all there were representatives, and in many cases they were the deans of engineering, of twenty-four universities. From Canada representatives were sent from eight institutions, Nova Scotia Technical College, University of New Brunswick, Ecole Polytechnique, McGill, Queen's, R.M.C., Toronto and Saskatchewan.

**Panel members for the discussion on "Dangers of Overspecialization in the Curriculum". From left to right: Karl B. McEachron, Jr., Jess H. Davis, A. G. Christie, M.E.I.C., D. L. Mordell, M.E.I.C., and R. S. Sproule, M.E.I.C.**

From the United States the following institutions were represented: Clarkson, Rensselaer, Johns Hopkins, New York, Cornell, Rochester, Connecticut, General Motors Institute, Rhode Island, Stevens, Norwich, Lafayette, Pratt, New Hampshire, M.I.T., and Newark, sixteen in all.

As far as Canada was concerned the two delegates from the geographic extremes were Dean I. M. Fraser, Saskatoon, and Professor Max Baker from Nova Scotia Technical College at Halifax. Canada's representation included all degree granting institutions except four, which was a very gratifying showing.

#### Appreciation

To Dr. Van Note the president of Clarkson, to Edward H. McHugh, dean of engineering and Professor Mochel and his committee workers, the members of the Institute are greatly indebted. It was Dr. Van Note who sparked this whole project and who gave inspirational leadership throughout all the arrangements and the conference itself.

It would be difficult to find more delightful surroundings and facilities than those offered at Potsdam. Even the weather was perfect, which showed up to great advantage the beautiful campus of Clarkson. The hospitality of the Clarkson people, offered so generously and so frequently gave the whole gathering a feeling of friendliness and ease. From every aspect it was a successful conference.

Transactions will be published as soon as possible, to include the addresses and many of the discussions. Members of the Institute interested in securing copies should advise Headquarters as soon as possible. Such information will be helpful in determining the number to be printed.

## Papers for the Annual Meeting, Toronto 1955

It is Council's desire to make it known to the membership that papers are now being sought for the annual meeting in Toronto next May. The Papers Committee is ready to receive submissions, which should be addressed to Headquarters.

The personnel of the committee are as follows: E. R. Smallhorn, chairman, Montreal; J. Benoît, vice-chairman, Montreal; L. P. Bonneau, Quebec; A. W. G. Clark, Vancouver; C. E. Frost, Montreal; H. Gaudefroy, Montreal; R. M. Hardy, Edmonton; A. R. Harrington, Halifax; F. L. Lawton, Montreal; W. H. Paterson, Toronto; H. S. Van Patter, Montreal.

# Nominees for Office

A list of nominees for office, as reported by the Nominating Committee, appeared on page 1270 of the October 1954 issue of the *Journal*. Since that time the committee has reported the selection for president as follows:

President.................. Richard E. Heartz................ ..Montreal, Que.

# Correspondence

**Comment on the *Journal***

Dear Mr. Editor:

I would like to comment on the ever improving high quality and interesting variety of papers printed by *The Engineering Journal*. The care and detailed organization of the *Journal* are a reflection of the thoroughness of the publication committee. Engineers in every phase of Canada's industry, education and government find the "acquirement and interchange of professional knowledge" stimulating and informative.

(The correspondent also made some useful comments on one of the *Journal's* technical papers, which will be printed in an early 'Discussion' section. Ed.)

Henry A. Spencer, M.E.I.C.,
Industrial Engineer,
Research Council of Alberta,
Edmonton.

**Record of Distinguished Engineers**

To the Editor:

Canada has every right to be proud of her engineers and of their accomplishments, but especially so of the more distinguished ones. Yet I know of almost nothing in print to commemorate them. If biographical material is not soon collected and recorded, they will become only memories and tenuous memories at that.

How should distinguished engineers be selected? My own idea is that the subject should have been deceased long enough for public opinion to have accepted him as really distinguished. As falling in this category, I can think of some of the military engineers of the French regime, of Colonel By, of Sir Sanford Fleming, of Sir Casimir Gzowski and of Sir John Kennedy; doubtless there are others whose names do not occur to me.

As a project for the branches, I suggest that each go back into the engineering history of its area and see how many engineers it can find there who qualify under the above rough criterion. With a list prepared in this way, a writer would know what he was looking for and could go about collecting the necessary information for a biography from all available sources, not forgetting family records.

I do not envision any of these biographies as long. Rather they would be short enough so that they could be published in two or three instalments in the *Journal*, perhaps finally to be combined into a modest book. I believe our readers would find them interesting.

I should be happy to hear from any of the branches concerning this matter, which I have been turning over in my mind ever since I learned that the late Professor Peter Gillespie, M.E.I.C., was thinking along similar lines.

R. De L. French, M.E.I.C.,
7481 Upper Lachine Road,
Montreal.

# Voulez-vous des écrits en français?

Nous nous sommes aperçu qu'on a l'impression que les écrits publiés dans les pages du *Journal* doivent être exclusivement en anglais. Ce n'est pas le cas. Le *Journal* existe pour présenter les points de vue des membres dans les deux langues. Mais si les auteurs canadiens-français ne nous donnent pas l'opportunité de connaître leurs travaux techniques, comment pourrons-nous atteindre notre but. Par conséquent, les amis français, nous vous prions de soumettre vos écrits. Nous les recevrons avec plaisir et espérons publier une proportion en français de temps à autre.

# E.I.C. Branches Entertain the President

**The Brockville, Kingston and Cornwall Branches entertained President Stephens at a dinner meeting on October 5 in Brockville. From right to left: Councillor H. B. Brewer, Mrs. Hawkes, C. H. R. Campling, chairman of the Kingston Branch, Mrs. Wright, J. S. Waddington, chairman of the Brockville Branch, President D. M. Stephens, Past-President R. L. Dobbin, and J. Hawkes, chairman of the Cornwall Branch.**

Upper left. President D. M. Stephens presented O. M. Solandt with a certificate of Honorary Membership in the Institute during the luncheon given in his honour in Ottawa on October 4. From left to right: L. Austin Wright, Dr. Solandt, Mr. Stephens, and R. E. Hayes, chairman of the Ottawa Branch.

Lower left. At the Ottawa luncheon. From right to left: W. E. Macklon, E. H. Bowler, W. G. Robson, M. P. MacMartin, A. R. Morse, W. G. Purvis, R. R. Jackson, Gordon Sutherland and Claude Howard.

Upper right. Reception held on the evening of October 4 by the Ottawa Branch in the Gloucester Street mess, R.C.A.F., in honour of President Stephens and Dr. O. M. Solandt. In this group, left to right: Mrs. Laidlaw, D. S. Laidlaw, R. E. Hayes, Mrs. Pennock, W. B. Pennock, Mrs. Sutherland, Thomas Foulkes, S. M. Steeves, M. C. Baker, Mrs. Baker and Mrs. Steeves.

Lower right. Ottawa reception. Left to right: Mrs. Ballard, B. G. Ballard, Mrs. Wright, L. Austin Wright, Mrs. Stephens, D. M. Stephens, Mrs. Hayes, and R. E. Hayes.

Below. Eastern Townships Branch dinner held in the president's honour on September 15. From left to right (seated): Mrs. J. B. Stirling, Mrs. Sylvio Rousseau, L. Austin Wright, Mrs. D. M. Stephens, Gaston Masse, chairman of the Eastern Townships Branch, Mrs. G. M. Dick, D. M. Stephens, Mrs. Gaston Masse, and J. B. Stirling. Left to right (standing): J. H. Barnacal, Bruce Bradley, Mrs. Gaetan Cote, G. M. Dick, Mrs. R. L. Dunsmore, Alderman Sylvio Rousseau, Mrs. Bruce Bradley, Mrs. J. H. Barnacal, R. L. Dunsmore, and Gaetan Cote.

# *Thirty-five Years Ago*

**Comment on the *JOURNAL* of November 1919**

The *Journal's* standards have changed over the years, as is well illustrated by a paper entitled "Can the Standard Measure of Value be Improved?" by an unknown author, but dated from Winnipeg, that appeared in the issue we are reviewing. It was a detailed and somewhat contentious discussion of the gold standard, with the conclusion that perhaps gold had outlived its usefulness and that value should be based on something else. The writer offered a unit he called a "navillus" (for nothing), to be used as a basis for any future payments, e.g., a contract price would be fixed in terms of "navilusses" ("navilli"?). When the contract was signed the value of the dollar and the navillus would be the same, but the value of the latter would fluctuate with the selling price of a long list of materials. As an example, the author suggests including gold and other metals; steel rails; coal; cement; grain; apples; meat; wool, cotton and flax; sugar, coffee and tea in the list, each item in proportions varying from 0.1 per cent to 10.0 per cent of the total. Then when a payment was to be made on the contract, the first step would be to calculate the current value of a navillus. If this had increased by, say, 6 per cent since the contract was signed, the contractor would be entitled to 6 per cent more in dollars than the engineer's estimate indicated was due him.

The purpose of the paper was a laudable one. In effect it was an attempt to accomplish by rather intricate means what we can now accomplish by the use of index figures of costs issued by government agencies. Readers must have noted with a smile that, after discussing his proposals at length, the author added a postscript, which expressed some surprise that his thoughts were not original. A somewhat similar scheme had been advocated by Lowe and Scope in 1825 and a book dealing with the matter by Prof. Irving Fisher, the distinguished Yale economist, was in press.

Reading of this kind on economic matters never hurt any engineer, but the *Journal's* present policy would probably be not to publish such a paper. It would no doubt gladly accept papers of an economic nature which apply directly to engineering affairs, but the author of a general paper, such as this, would probably be told that he would be better advised to seek publication elsewhere.

### A Member in Legislature

The *Journal* crows a little over the election of an Institute member, A. W. Gray, of Westport, Ont., to the Ontario legislature, "where it is expected he will soon make a name for himself." An engineer in politics is still something of a curiosity; in spite of urging from within and without the profession, engineers just don't take to public life.

The *Journal* was not very optimistic about the employment outlook, but "conditions in civil engineering show a slight improvement . . . it is in the industrial field that the greatest and most hopeful prospects for engineering employment are promised . . . There is also noticeable a slight but well defined stiffening of salaries being offered." The only two positions advertised with salaries mentioned were both in the teaching field — an instructor in civil engineering at $1,800 and a professor of mechanical engineering at $2,400.

### The Advertisers

Our regular advertisers were still with us in November, 1919, but we fail to find any new ones. And, according to modern ideas, the advertising hadn't much punch, just a list of products in many cases, with an occasional advertiser going so far as to include a cut or two. Today we hope and believe that our advertising pages get almost as much attention as the text, but who could work up much enthusiasm over the 1919 version?

After some months of study, the committee appointed by the Toronto Branch to draw up a schedule of acceptable salaries for engineers submitted its report, and this schedule was published in the *Journal* for November, 1919. We cannot, of course, reproduce it in full here and there would be no point in so doing, as it is not of much interest today. However, so that readers may compare the committee's recommendations with those of more recent schedules, we may quote a few typical items.

Chief engineers were rated at from $10,000 to $12,000 per year; engineers at the heads of departments at from $4,000 to $7,500; resident engineers at from $2,000 to $2,400 with expenses; designers and draftsmen at from $1,500 to $3,000 and surveyors at from $1,500 to $2,400. It is noticeable that in a number of cases, although the committee provided a classification, it did not make any salary recommendation, perhaps because it felt incompetent to do so.

This schedule was published without comment other than the committee's own introductory remarks — that it is based on pre-war living costs. One wonders if the committee expected the high cost of living brought on by the war to decline much. If so, it was mistaken; the cost of living did decline after 1918, but it never got back to prewar figures.

### The Branches

Council's report in this *Journal* occupied only half a column, because its October meeting was held too late to allow of publication in November, but three of the branches were out in full force. The Niagara Peninsula Branch had had some social doings — a dinner dance, and some technical activities — an inspection trip over the new Welland Canal. The Toronto Branch was asking for nominations for its annual elections.

The Ottawa Branch had recently listened to Gen. C. H. Mitchell, who spoke to it on "Reconstruction and Civic Development", and to Noulan Cauchon, who talked about the planning of Ottawa. It also provided the *Journal* with some notes about seven engineers from the staff of the Hydrographic Survey who were granted commissions in the R.N.V.R. and thus joined the Surveying Service of the Admiralty. They helped in some degree to replace members of this service who had enlisted for active service or who had already become casualties. The Montreal Branch published its program for the 1919-20 season. It also extended its congratulations to Past-president G. H. Duggan, who had just received an L.L.D. from Queen's University.

On August 9, 1919, there was a disastrous dust explosion in a grain elevator at Port Colborne, Ont., so it was appropriate that the Montreal Branch should hear an explanation and account of the affair from J. A.

Jamieson, who had designed the elevator.

**Honorary Member**

The *Journal* announced that H.R.H. the Prince of Wales had accepted honorary membership in the Institute and published not one, but two, portraits of him, one in full military uniform and the other in civilian dress, acknowledging the greetings of the crowd.

Messrs. William Gore and William Storrie described "The Toronto Drifting Sand Water Purification Plant" in this *Journal's* leading paper. The Ransome filter operated by gravity. It was so designed that the upper portion of its sand bed was continuously removed, washed and replaced, which made it possible to operate for long periods without shut-downs for complete washing. This filter did not use preliminary sedimentation; the alum dosage was from 0.85 to 1.50 grains per Imperial gallon.

The Toronto plant had ten units and its average capacity was 60 million Imperial gallons per day; it was used to supplement the output of the existing slow sand filters. There were, of course, the usual screens, pumps, chemical feeding apparatus and the like. Storage for 1,500 tons of coal was provided; the temperature in the interior of the coal pile could be taken by dropping a thermometer into pipes permanently installed in the coal bunker.

This plant operated for some years, but was ultimately abandoned for reasons of which this writer is not aware. So far as he knows, this was the only plant of its kind ever built in Canada and it may have been unique. The bacterial efficiency of the pilot plant, operated for some months before the main plant was built, was good — 99 per cent — so poor efficiency was probably not the reason for putting it out of commission.

## C.C.A. Meeting at St. Andrews

Construction industry executives convened at the Algonquin Hotel, St. Andrews, N.B., September 10-12, to mark the 1954 Maritime regional meeting of the Canadian Construction Association. The conference was attended mainly by Maritime construction men but delegations from Central and Western Canada were also in attendance.

The co-ordinated efforts of government, industry, owners and designers to reduce seasonal unemployment in the construction industry even further was urged by Raymond Brunet, O.B.E. of Hull, president of the Association. He stated that on the average there were 25 per cent fewer construction men working in February than in the peak month of September.

C.C.A. officers at Maritime regional meeting, St. Andrews, N.B. From left to right: John N. Flood, M.E.I.C., immediate past-president, Saint John; W. G. Malcom, national vice-president, Winnipeg; R. Brunet, president, Hull; and A. Turner Bone, M.E.I.C., national vice-president, Montreal.

Mr. Brunet warmly approved the recent announcement by the Federal Minister of Labour, Hon. M. F. Gregg, that Federal public works would be so timed as to provide "the maximum amount of employment during the winter months". Canadian industrialists were commended for their setting up of a committee to study similar action in the case of industrial buildings. "Success in any program to reduce seasonal unemployment in the construction trades would depend on the participation of owners and architects and engineers who were designing the projects."

Factors tending to restrict wintertime construction cited by Mr. Brunet included habit, pressure of work in design offices and the widespread idea that winter construction work was excessively costly. "Winter construction costs are not as high as is commonly believed," said Mr. Brunet. Factors reducing the costs were: lower prices frequently quoted by contractors during the off season; more plentiful supply of materials and labour; better supervision and planning due to the availability of key men. Mr. Brunet stated that earlier completion dates through wintertime construction often compensated the owner for any additional construction costs involved.

Mr. Brunet advocated getting projects "closed in" before bad weather set in so that interior work could be carried out during the winter; utilization of developed winter construction techniques; scheduling repair and maintenance work during the winter months and the award of contracts in the spring to allow an early start of construction operations.

"A brief glance at the large sum of money paid out of the unemployment insurance due to seasonal unemployment last winter surely is sufficient reason in itself to show that a levelling out of industrial activity during the various seasons is very decidedly in the public interest" concluded Mr. Brunet.

Other matters discussed during the business sessions included a report on the year's labour negotiations in the building trades, the St. Lawrence Power and Seaway Project, seasonal unemployment in the construction industry, "pre-qualification" systems for bidders on public projects, housing and highway construction, apprenticeship training and relationships between general and trade contractors.

## News of Other Societies

The eighth Canadian soil mechanics conference will be held this year in Ottawa, Ont., on December 16 and 17. Sessions will be held in the Building Research Centre at the Montreal Road Laboratories of the **National Research Council.**

The program will include short papers on a variety of subjects, as well as a business meeting, and sessions on December 17 will be devoted to a discussion of soil mechanics laboratory techniques and problems related to frost action.

Information may be obtained by writing to the secretary of the Associate Committee on Soil and Snow Mechanics, National Research Council, Ottawa.

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There will be an international conference on combustion during 1955 under the joint sponsorship of the **Institution of Mechanical Engineers** and the **American Society of Mechanical Engineers** (29 West 39th St., New York 18).

The main conference will be held at the Massachusetts Institute of Technology, Cambridge, Mass., on June 15-17, and will be followed by a conference in London, England, on October 25-27, at which the same papers will be presented.

An advance program lists forty papers, and groups them into five main topics: general, boilers, industrial furnaces, internal combustion engines, and gas turbines.

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The golden anniversary annual meeting and engineering display of the **Society of Automotive Engineers** (29 West 39th St., New York 18, N.Y.) will be held January 10-14, 1955, in Detroit, Michigan.

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A schedule of events planned by the **Institute of the Aeronautical Sciences** (2 East 64th Street, New York 21) is as follows: December 17, the eighteenth Wright Brothers Lecture, at the U.S. Chamber of Commerce Building Auditorium, Washington, D.C., (Bo Lundberg, director, Aeronautical Research Institute of Sweden, lecturer); December 20, Los Angeles, and December 22, Cleveland, the Wright Brothers Lecture (repeated); January 24-28, 1955, the twenty-third annual meeting and honors night dinner, Hotel Astor, New York City.

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The Vancouver section of the **American Institute of Electrical Engineers** opened the current season with a smoker on September 30, and has also put into effect the plan to hold a 5.30 p.m. discussion group dinner meeting and an 8.00 p.m. meeting on the first Monday of each month.

Officers of the Section are: H. O. Bulmer, chairman; J. T. Turner, vice-chairman; R. B. Carter, secretary-treasurer; M. A. Thomas, assistant secretary-treasurer; and committee chairmen L. B. Stacey, R. C. Stewart, M. Bradwell and E. Wolstencroft.

Information about the program can be obtained from J. T. Turner (c/o B.C. Electric Railway Co. Ltd., Oakridge Transit Centre, Vancouver, B.C.)

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The congress of the **European Federation for Chemical Engineering** for 1955 will take place in Frankfurt am Main, May 14-21, 1955, on the occasion of the ACHEMA XI—chemical apparatus and equipment exhibition and congress.

The preparatory work for the congress is being done by the DECHEMA Deutsche Gesellschaft fur chemisches Apparatewesen, Frankfurt a.M. 13.

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## Elections and Transfers

At a meeting of Council held in Montreal on October 15, 1954, a number of applications were presented for consideration and on the recommendation of the Admissions Committee, the following elections and transfers were effected:

*Members:*

R. J. Balfour, *Ottawa*
A. E. Bradley, *Toronto*
J. Brown, *Sherbrooke*
W. Collinson, *Toronto*
R. F. DeGrace, *Ottawa*
M. Dorais, *Quebec*
T. C. Fenton, *Jasper*
J. H. Goodwin, *Toronto*
A. Harvey, *Toronto*
J. G. Knowlton, *Ottawa*
R. P. Matthews, *Montreal*
C. C. McLaren, *Montreal*
R. W. Powell, *Toronto*
A. A. Ravins, *Sarnia*
N. W. Smithson, *Toronto*
J. M. E. L. Tummers, *Montreal*

*Juniors:*

A. P. V. Bennett, *Toronto*
E. D. Blix, *Montreal*
J. M. Booth, *Hamilton*
I. J. H. Clarke-Pounder, *Sherbrooke*
P. A. Conway, *Oshawa*
J. N. Greggain, *Kapuskasing*
R. W. McBain, *Windsor*
H. R. Schaeffer, *Sherbrooke*

*Transferred from the class of Junior to that of Member:*

G. E. Cook, *Fort William*
S. E. Halme, *St. John's*
A. F. Inderwick, *Ottawa*
C. N. Kirby, *Ottawa*
G. D. Sharon, *Vancouver*
D. W. G. White, *Cambridge, Mass.*
D. Maclaren, *Buckingham*

*Transferred from the class of Student to that of Junior:*

B. N. Runnalls, *London*

*The election of the following candidates can only become effective when the prescribed examinations have been passed:*

*For Admisison as Junior:*

W. D. Knopp, *Goose Bay*

*The following Students were admitted:*

*University of Alberta*

F. K. Hess

*University of Toronto*

R. K. Brayley, J. M. Hubicki
G. Campitelli, R. V. Robinson

*McGill University*

H. O. Byleveld, K. A. Kontus
A. Ghitis, J. D. O. Morgan
J. B. Haire, P. de Villers

*Nova Scotia Technical College*

D. V. Crowe, J. E. Howard

*Mount Allison University*

R. H. Jones

*St. Mary's University*

D. H. Currie

*University of New Brunswick*

A. H. Cunningham, D. E. B. Moffatt

*Cambridge University*

D. C. J. H. Meredith

**Applications through Associations:**

By virtue of the co-operative agreements between the Institute and the Association of Professional Engineers, the following elections and transfers have become effective:

Alberta

*Members:*

H. Bailey, G. A. McNeill
J. R. Harvey, R. E. R. Stanfield
D. M. Marshall

*Junior:*

R. J. Durrant

*Students:*

G. W. Carter, N. G. Stanford

*Junior to Member:*

W. M. Balke, J. A. L. Smith
J. M. Matthew

Saskatchewan

*Members:*

G. L. Bell

*Juniors:*

H. A. Sejbjerg

*Junior to Member:*

P. A. Inglis

Quebec

*Member:*

H. Z. Goldstein

# NEWS OF THE ASSOCIATIONS & CORPORATION

**Information received through co-operation with the provincial organizations**

## Nova Scotia

### Personal Notes

**T. B. Lusby,** has been recently appointed Deputy Minister of Public Works for the Department of Highways and Public Works of Nova Scotia. Mr. Lusby has recently served as councillor for the Nova Scotia Association.

**Dr. J. H. Sexton,** the energetic chairman of the Public Relations Committee, has recently been a patient at the Victoria General Hospital in Halifax, and has now returned to Wolfville. Best wishes are extended to Doctor Sexton for an early recovery.

**Morris Dean,** chairman of the Examining Board for the Association, who has been seriously ill for the past two months is slowly improving, and it is hoped that he will be able to take part in affairs of the Association soon.

### Maritime Meeting and C.G.A.

The month of September was a very interesting one for the engineers of the three Maritime Provinces and Newfoundland. Many members from each province attended the Maritime Professional Meeting at the Pines Hotel, Digby, Sept. 8-11. Some of the members also had the privilege of attending the meeting of the Eastern Branch of the Canadian Good Roads Association which was held at Keltic Lodge, Sept. 14-16. At this meeting, congratulations were extended to Dr. R. W. McColough, for his contribution to the success of the organization of this important branch of the Canadian Good Roads Association.

### The Journal Erred

J. E. Clarke, president and news editor for the Association of Professional Engineers recently received a letter from J. P. Vaughan of the department of highways and public works regarding the shield representing Nova Scotia in the heading of this section. In part the letter reads as follows:

Dear Mr. Clarke:

. . . The shield shown for the province of Nova Scotia is not the proper shield of this province. The shield shown was in use for a time following Confederation, but in 1929 was revoked by a Royal Warrant of King George V, in favour of the proper Armorial Achievement of Nova Scotia, which was granted this province by King Charles I in 1625.

I think that you, as president of the Association of Professional Engineers of Nova Scotia, should advise the editor of the Engineering Journal concerning this matter so that Nova Scotia may be represented by the proper Armorial Achievement.

J. P. VAUGHAN.

Editor's Note:

Our thanks go to Mr. Vaughan and Mr. Clarke for bringing our attention to this error. The province of Nova Scotia is now correctly represented with the shield, "a cross of St. Andrews, ---, charged with an Inescutcheon of the Royal Arms of Scotland."

## Quebec

### Quebec Now Has Six Universities, Not Five

In the October "News of the Corporation" we announced the opening of Sherbrooke University and we stated that it was the fifth university in the Province of Quebec. Actually it is the sixth.

In March 1948, a Provincial Charter was granted to Sir George Williams College conferring upon it degree-granting authority as "a college or university within the Province of Quebec". Up to the time, the College had operated under the Charter of the Montreal Y.M.C.A. with which it is still integrated organizationally.

Besides Sherbrooke University and Sir George Williams College, the four other Quebec Universities are: Laval, McGill, Montreal and Bishop's.

### Courses on Effective Speech

For the past two years, the Corporation has organized highly successful courses on the art of effective speech.

It was felt by Council that its public relations program encompassed the sponsoring of such courses. They were established particularly to develop among the members of the profession, speakers who could voice the achievements of engineering. This policy is in conformity with the general motto of our P.R. program: "Silent Service is not enough".

A third series of courses is now in progress. All told, a hundred professional engineers have been trained to master the important art of the spoken word. Each one of them has been enthusiastic about the encouraging results he has experienced.

### Pot Pourri

Le **docteur Adrien Pouliot,** doyen de la Faculté des Sciences de l'Université Laval à Québec et ancien président de la Corporation, revient d'un séjour au Royaume-Uni et en France, où il a été invité à donner des conférences devant plusieurs sociétés savantes. A Toulouse, on lui a décerné un titre honorifique d'un nouveau genre en le créant "Grand Module de l'Ordre de l'Engrenage". Sa tournée en Angleterre avait été organisée par le British Council. En France, il était l'invité du gouvernement et des Chambres de Commerce.

Laval University in Quebec City is now offering engineering courses in all major departments: civil, electrical, mechanical, mining, metallurgical, geological, and chemical. A school of mechanical engineering has been opened this year with nine students entering the fourth of the five year course. **Mr. L. P. Bonneau,** a member of the Corporation's Board of Examiners has been appointed director of studies of the new school.

The Council is pleased to announce the appointment of **Mr. Lucien Tremblay, Q.C.,** as legal adviser of the Corporation. Mr. Tremblay is highly regarded in legal circles; he is one of the two legal counsel for the Tremblay Commission (Royal Commission of Inquiry on Constitutional Problems). Following a new policy, the Council of the Corporation has retained his services to attend all Council meetings.

## Ontario

### News of the Members

**H. U. Graf,** of the Massey-Harris-Ferguson organization has recently been moved from Marquette-les-Lille, France, to Cologne, Germany, where he is works manager of Massey-Harris-Ferguson G.m.b.H.

Mr. Graf, who is a graduate of the Swiss Federal Institute of Technology, Zurich, was earlier with the company's plants in Toronto and Brantford.

**Dr. J. A. Sparrow,** who for ten years has been in charge of penicillin and five chemicals for Ayerst, McKenna and Harrison, of Montreal, has been transferred to the International Division of the same company. He is presently in Sao Paulo, Brazil, as technical adviser for the new Fontoure Wyeth penicillin plant.

**Herbert C. Powell,** has recently retired from the Toronto Hydro-Electric System after forty-four years' service in that organization.

Following public and high schooling in his birthplace, Hamilton, Ont., Mr. Powell graduated in electrical engineering from the Pratt Institute of Brooklyn, N.Y., in 1909. The following year he joined the Toronto Hydro-Electric System as a power engineer. In 1919 he was placed in charge of the statistical department and has held the title of statistician since that date.

**E. A. Washburn,** of Stratford, has succeeded A. B. Manson, as general manager and secretary-treasurer of the Stratford Public Utilities Commission. Mr. Manson retired from that post on August 1st after serving the City of Stratford for forty-two years.

Mr. Washburn, a Queen's graduate of 1943, was manager of Ingersoll's public utilities before moving to Stratford in 1950 and becoming assistant general manager of Stratford's P.U.C.

**William P. Bobbs,** of Toronto, has entered private practice in the field of machine and tool design. To his new work he brings considerable engineering experience and practical knowledge in tool design and making. Former positions held by Mr. Bobbs include that of chief tool designer of the A. V. Roe gas turbine development section, Malton; chief draughtsman at Modern Tool Works Ltd., Toronto; and chief engineer Canaero Consultants Ltd., Toronto.

**Ralph B. Chandler,** of Port Arthur was recently tendered a complimentary dinner by a large number of fellow workers and friends on the occasion of his retirement as manager of the Public Utilities Commission of Port Arthur.

Following his graduation from the University of Toronto in 1912, Mr. Chandler spent several years in Alberta and Saskatchewan. In 1917 he moved to the Lakehead and until 1933 was associated with C. D. Howe & Co., of Port Arthur. From 1923 to 1933 he was consulting engineer and a partner in that company. In 1935 he was appointed manager of the public utilities commission of Port Arthur.

E. A. Vigars, who since 1946 has been assistant manager, succeeds Mr. Chandler.

**J. J. Traill,** has retired from the Hydro-Electric Power Commission of Ontario and is now engaging in private practice as a consulting hydraulic engineer at 4 Ludlow Avenue, Toronto 18, Ontario.

Mr. Traill is a graduate of the University of Toronto from which he also received the professional degree of C.E. From 1910 to 1920 he was on the staff of the University, latterly as assistant professor of hydraulics. In 1920 he joined Ontario Hydro's hydraulic engineering staff. Prior to his retirement he was hydraulic engineer of the Commission.

**William Turner, Jr.,** has moved from Toronto to Montreal where he has assumed the position of controller for Canadian Ingersoll Rand Co. Ltd.

## Manitoba

### Highway Officials' Chairman

**Gerald B. Williams,** chief engineer, Highways Branch, for the Province of Manitoba and president of the Association of Professional Engineers of Manitoba, has been elected chairman of the Association of Western Canada Highway Officials at their annual convention in Victoria, B.C. This group is mainly concerned with highway construction standards for Canada. Mr. Williams was elected to this body in absentia.

### Resignation

**E. M. Scott,** has recently resigned his position as chairman of the Engineering Professional Development Course sponsored by the Winnipeg Branch of the E.I.C., in order to participate in a power systems engineering course sponsored by the General Electric Company. Mr. Scott, who is an engineer in the assistant planning division of the Manitoba Hydro Electric Board, has been transferred to Schenectady, N.Y., in order to take the course.

## British Columbia

### B.C. Electric Forms New Firm

On September 17 A. E. Grauer, president of the B.C. Electric, announced the formation of a new engineering company, a subsidiary of the B.C. Electric, to be known as the British Columbia Engineering Company Limited.

The new company combines the engineering staff of the B.C. Electric's engineering division with the staff of the British Columbia International Engineering Company Limited.

Thomas Ingledow, has been named the president of the new company and W. G. Huber, the general manager, the same position he presently holds with the B.C. International Engineering Co. Limited.

The new firm will do civil, mechanical and electrical engineering and will not confine its work to that for the parent company, although this is estimated at $150,000,000 over the next five years. Mr. Grauer said, "Every effort will be made to secure jobs of a heavy engineering nature and bring this business to British Columbia."

The B.C. Engineering Company will operate from 717 West Pender Street, the present offices of the B.C. International Engineering Co.

### New Appointments

At the same time Mr. Grauer announced the following top executive changes within the B.C. Electric Company:

**Dr. Harry L. Purdy** has been named executive vice-president and now takes over the responsibility for the firm's general sales division and industrial relations sub-division.

**Thomas Ingledow,** who has been in charge of most of the post-war expansion program becomes vice-president and executive engineer.

**Jack H. Steede,** who has been the executive assistant to Mr. Ingledow for nine years, has been named chief engineer.

**Sigurdur Sigmundson** has been appointed general manager of the Transit Division.

**John R. P. Powell,** a U.B.C. graduate in 1945, becomes the executive assistant to Dr. Purdy.

### Short Course in Photogrammetry

A short course directed to the practicing engineer, geologist, forester or cruiser who uses aerial photographs and simple air-survey tools will be held at U.B.C. from Dec. 13 to Dec. 17. The introductory sessions, comprising the first three days of the course, will be devoted to basic techniques of translating photographs into planimetric maps and determining differences of elevation, using simple instruments and draughting equipment. Final sessions will be concerned with specialized topics such as forestry interpretation, geological interpretation, and civil engineering applications.

Full time course lecturers will be Professors H. R. Bell, S. H. DeJong, J. H. G. Smith of the university staff, and Dr. Lyle G. Trorey.

Limited accommodation will be available in the university dormitories in the Youth Training Centre. Room and board can be provided at the rate of $3.40 per person per day. For further information write to the Extension Department, University of British Columbia, Vancouver 8, B.C.

### Canadian Committee on Counselling in Engineering and Science

The Canadian Committee on Counselling in Engineering and Science was formed some years ago by the Engineering Institute of Canada, The Canadian Institute of Mining and Metallurgy and The Chemical Institute of Canada to provide counselling services for students interested in engineering and science. In 1952 the committee was reactivated after being dormant for some time and invitations were issued to the Associations throughout Canada to join in its activities. Council of the B.C. Association considered that any participation which the Association played in this committee should be through Dominion Council. Other Associations preferred to participate independently, but recently advised that contributions for 1954 had been few and the committee was faced with a deficit of some $800. Several of the other Associations had contributed to the committee independently, in addition to the contribution made by Dominion Council. It was therefore decided that the B.C. Association should also contribute to the activities of the committee, but that this contribution should be through Dominion Council; consequently, a grant of $100 was authorized to be forwarded to Dominion Council to be added to their contribution to the committee.

# Personals

**News of the Personal Activities of Members of the Institute**

**Dr. David B. Steinman,** M.E.I.C., New York consulting engineer, has been recently honoured with the Legion of Honour by the Government of France, and with the gold medal by the Government of Italy. The citation accompanying the French award recorded Dr. Steinman's professional achievements and his contributions toward strengthening international relations. In the presentation of the Italian award to Dr. Steinman who has prepared plans to span the Strait of Messina to Sicily, he was referred to as the "greatest bridge designer". The Rev. Felix A. Morlion, rector of the International Catholic University for Social Studies, made the presentation in the name of a committee of representative Italians.

**Dr. C. J. Mackenzie,** HON.M.E.I.C., former president of Atomic Energy of Canada, Ltd. was recently named recipient of the 100-guinea R. B. Bennett Empire Prize.

The award is the fourth since being established in 1945 by the late Viscount Bennett, once Prime Minister of Canada, and the second to a Canadian.

It is awarded every three years "for the most outstanding contribution from the Dominions, India, Burma and colonies to the promotion of the arts, agriculture, industries and commerce of the overseas Empire during each intervening period."

Dr. Camsel, Canadian geologist, received the first award in 1945.

**A. W. Howard,** M.E.I.C., general manager of Calgary Power Ltd., has been elected president of the Canadian Electrical Association.

A native of Calgary, Mr. Howard attended Central High School there and later graduated with a B.A.Sc. degree from the University of Toronto.

He joined the staff of Calgary Power in 1935 and four years later became associated with Montreal Engineering Co. Ltd. in Montreal. In 1948 he rejoined Calgary Power Ltd. and was appointed general manager in 1952.

**R. M. Robertson,** M.E.I.C., manager of operations for Dominion Bridge Company Limited, has been selected by the Rt. Hon. C. D. Howe, HON.M.E.I.C., Minister of Defence Production, to succeed A. P. Craig, now vice-president in charge of sales for Trans-Canada Pipe Lines Ltd., to direct Canada's $450,000,000 naval ship-building program.

Mr. Robertson joined the Dominion

R. M. Robertson, M.E.I.C.

Bridge Company in 1909 as a junior draughtsman. He entered McGill University in 1913, but his studies were interrupted from 1916 to 1919 when he served with the Canadian Engineers with the rank of captain. He continued his studies at McGill after the war, graduating in 1920 with a B.Sc. degree. That same year he joined the bridge department of the Canadian Pacific Railway.

He returned to the Dominion Bridge Company in 1924. He was appointed designing engineer of the Eastern Division in 1948, and assistant chief engineer of the Company in 1952. He was appointed to his present position with the Company in 1953.

**R. W. Willis,** M.E.I.C., formerly chief engineer in the structural steel division of the John T. Hepburn Company in Toronto has been appointed chief structural engineer of the St. Lawrence Seaway Authority in Montreal. He will be responsible for all structural engineering design, and will have under his direction three major divisions, namely lock structures, retaining walls, bridge piers and all other heavy foundations; lock equipment, including gates, fenders, valves and other miscellaneous structural features; and bridge superstructures.

A graduate of Queen's University, class of 1937, Mr. Willis has been previously associated with Canadian Bridge Company at Walkerville, and the Standard Steel Construction Company at Welland.

**L. J. Scott,** M.E.I.C., has been appointed managing director and assistant secretary of Canadian Zurn Engineering Limited.

A graduate in mechanical engineering of McGill University, class of 1923, Mr. Scott has been associated as manager of the company's operations in Canada. Canadian Zurn Engineering Limited is an affiliate of the J. A. Zurn Manufacturing Company of Erie, Pa., and is engaged in the manufacture and sale of building drainage, industrial, marine and power transmission products.

L. J. Scott, M.E.I.C.

**F. Austin Brownie,** M.E.I.C., has been elected president of Canadian Utilities Limited in Edmonton.

Mr. Brownie received his B.A. and B.Sc. degrees from the University of Alberta. In 1935 he joined Northwestern Utilities Limited, and five years later became assistant to the general manager of Canadian Western Natural Gas Co. Ltd. Subsequently he served as assistant to the president, was appointed general manager and named president of Alberta's two large natural gas utilities in 1949. He has been a director of Canadian Utilities Limited for several years.

**H. G. Hughson,** M.E.I.C., construction engineer for the province in the New

H. G. Hughson, M.E.I.C.

Brunswick Department of Public Works, has resigned as councillor of the Institute. He has been elected to the council of the City of Fredericton, and in view of the fact that he was the candidate of the Fredericton Branch he feels that he should devote all his spare time to city affairs. It is a matter of interest to note that Mr. Hughson headed the poll.

**M. F. Keith Leighton,** M.E.I.C., structural engineer with Canadian National Railways in Moncton, has been elected chairman of the Moncton Branch of the Engineering Institute.

Mr. Leighton, a native of Moncton, received his civil engineering degree from the University of New Brunswick in 1949.

Previous to graduation, from 1941 to 1943, Mr. Leighton was a member of the original crew that surveyed and laid out the Goose Bay Airport in Labrador. During this time he held the positions of rodman, foreman and inspector, and worked on various types of construction with the Department of Transport.

During the summers of 1947 and 1948 he served as instrumentman with the highway division of New Brunswick Department of Public Works and was employed on highway diversions, draughting, mapping and setting grades. The following summer he was instrumentman with Canadian National Railways with the terminal engineer at Cape Tormentine, N.B., where he was in charge of surveys, setting grades and taking soundings for dredging.

Upon graduation Mr. Leighton was appointed structural engineer with the bridge department of Canadian National Railways. In this position he is responsible for the inspection of steel bridges and timber trestles, design of steel and timber bridges, design of reinforced concrete structures such as abutments, piers, retaining walls and slabs.

**P. V. Palmer,** M.E.I.C., has been appointed chief engineer of Howard Smith Paper Mills Limited in Montreal.

Mr. Palmer, a graduate of Ecole Polytechnique, class of 1945, has been formerly employed by Manitoba Paper Company Limited and Arborite Company Limited as plant engineer in Ville LaSalle, Que.

**J. C Anderson,** M.E.I.C., is vice-president of Atlas Asbestos Company Limited of Montreal. He was previously production manager of the company.

Mr. Anderson graduated in civil engineering from the University of Toronto in 1939.

**Frank Edward Ayers,** M.E.I.C., Fort William city engineer, has been elected chairman of the Lakehead Branch of the Engineering Institute.

A native of Saskatoon, Sask., Mr. Ayers is a graduate of the Saskatoon Technical Collegiate and of the University of Saskatchewan, receiving his B.Sc degree in civil engineering in 1943. During 1945 to 1946 he undertook postgraduate study on advanced strength of materials at the University of Saskatchewan.

During the summer of 1942 Mr. Ayers served as chainman in the Saskatoon division of the Canadian National Railways and upon graduation joined the Royal Canadian Engineers with the rank of lieutenant.

At the close of the war he was an instructor for a year at the University of Saskatchewan, after which he joined the Canadian National Railways as instrumentman in the Port Arthur division. He was appointed to his present position in 1947.

**D. H. Johnston,** M.E.I.C., has been appointed manager of manufacturing in the Canadian General Electric Company's electronic equipment department.

Mr. Johnston is a graduate in electrical engineering of Queen's University, class of 1941. His wartime service included two years on the Inspection Board of the United Kingdom at Research Enterprises, Toronto, and two years "on loan" as an air radio officer to the Royal Navy's Fleet Air Arm.

D. H. Johnston, M.E.I.C.

He joined Canadian General Electric in 1947 and was engaged in sales and product planning work on mobile communication, broadcast and television, and defence equipment until 1952, when he became successively supervisor of production control and manager of the manufacturing sub-section in the electronic equipment department. In his new position, Mr. Johnston is responsible for material control, production control, planning and wage rate, assembly and test, quality control and works facilities.

**Frederick Hubert Clark,** M.E.I.C., hydro-electric engineer with Bowaters Newfoundland Pulp and Paper Mills Co. Ltd., has been elected chairman of the Corner Brook Branch of the Engineering Institute.

Mr. Clark was born in St. John's, Nfld., and attended Bishop Field College and Memorial University College there. He enrolled in the Nova Scotia Technical College in 1941, graduating with a B.Eng. degree in mechanical engineering in 1943.

During the summer months of 1937 to 1939 he was employed by the Department of Natural Resources as chainman, instrumentman and chief of party on topographical surveying in St. John's, Nfld. During the following summer he served as mechanic's helper with the McNamara Construction Company at Torbay, Nfld.

In 1940 and 1941 Mr. Clark was employed first as draughtsman and later as assistant chief draughtsman with the United States Army Engineers at Fort Pepperrell, Nfld.

Upon graduation in 1943 he joined the Royal Canadian Air Force as aeronautical engineer officer, serving until 1945 when he entered Construction Equipment Co. Ltd. in Toronto as sales and service engineer.

He was associated briefly in 1946-1947 as power plant design engineer with Canadair Ltd. in Montreal, and then entered Bowaters Nfld. Pulp and Paper Mills Co. Ltd. of Corner Brook, as hydro-electric engineer.

**T. R. Wingate,** M.E.I.C., previously assistant to production director with Dowty Equipment Limited in Cheltenham, England, has joined Messrs. Associated Industrial Consultants Limited of London. He expects to return to Canada later this year to join the Canadian office of the company.

Mr. Wingate is an associate member of the Institution of Mechanical Engineers of Great Britain.

**William Watson,** M.E.I.C., St. John's, Newfoundland branch manager of Canadian General Electric Co. Ltd., has been elected chairman of the Newfoundland Branch of the Engineering Institute.

Mr. Watson was born in St. John's, Nfld., and was educated at Bishop Field College, Mt. Allison Academy and University, and McGill University where he obtained his B.Sc. degree in electrical engineering in 1924.

William Watson, M.E.I.C.

He began his engineering career in the summer of 1923 as junior engineer with the Sir W. G. Armstrong Whitworth Company at Deer Lake, Nfld. He remained with this company for a

year after graduation and then undertook the test course of the General Electric Company in Schenectady, N.Y. and Pittsfield, Mass. In 1927 he entered the commercial engineering department of the company in Schenectady. Toward the end of the same year he was appointed company representative in St. John's, Nfld.

He was named to the position of manager of Canadian General Electric Co. Ltd. in St. John's in 1949.

**Dr. F. W. Gray,** M.E.I.C., of Victoria, B.C., has been a member of the Institution of Mining Engineers of Great Britain for 50 years and his name has been recorded by Council in the Annual Report.

N. Webster, president of the Institution, recently offered Mr. Gray on behalf of the Council cordial congratulations on his achievement, and sincere appreciation of his valuable support of the Institution over this very long period.

**W. R. Way,** M.E.I.C., vice-president of The Shawinigan Water and Power Company in charge of the generation and transmission department has announced the following department organizational changes. **E. W. Knapp,** M.E.I.C., who has been with the department since 1925, and chief electrical engineer for the past three years, is appointed engineering assistant to the vice-president. Manager and assistant manager, respectively, of the department are **J. M. Sharpe,** M.E.I.C., and **A. L. Hough,** M.E.I.C.

Also announced were the formation of an engineering division of the department to merge the former communication division and the system planning division; the appointment of personnel to that new division; and the change of name of the field engineering division, with headquarters at Shawinigan Falls, to be known now as the field services division.

**J. M. Crawford,** M.E.I.C., formerly superintendent of the planning division, has been appointed chief engineer of the newly-formed engineering division. **B. C. Hicks,** M.E.I.C., assistant superintendent of the former system planning division and protection engineer, is named superintendent of protection in the new division.

**Eugene E. Gareau,** M.E.I.C., formerly assistant to the division engineer in the generation and transmission department of the Field Engineering Division of the Shawinigan Water and Power Company in Shawinigan Falls, Que., has been promoted to the position of divisional engineer.

Mr. Gareau has been associated in various positions with the company since graduation in electrical engineering from McGill University in 1943.

**C. H. R. Campling,** M.E.I.C., assistant professor on the staff of the Royal Military College, has been appointed chairman of the Kingston Branch of the Engineering Institute.

**C. H. R. Campling, M.E.I.C.**

A native of Melville, Sask., Mr. Campling attended Melville Public School and Queen's University where he received his B.Sc. degree in electrical engineering in 1944.

During 1944 and 1945 Mr. Campling served with the Royal Canadian Signals with the rank of lieutenant, and at the close of the war became instructor in the department of mathematics at Queen's University. In 1948 he became research engineer in the servomechanisms laboratory of the Massachusetts Institute of Technology where he also received his S.M. degree.

The following year he was employed in research on magnetic amplifiers with the National Research Council; and in 1950 he was appointed assistant pro-

fessor at the Royal Military College where he was responsible for the installation of the electrical power laboratory, and the organization and teaching of courses on the power aspects of electrical engineering.

He is a member of the Institute of Radio Engineers.

**Dr. Lyle G. Trorey,** M.E.I.C., announces that he has combined with Blanchet and Associates Limited, geological engineers, to form Blanchet, Trorey and Associates Limited, civil, geological and photogrammetric engineers, of Calgary and Vancouver.

Since the war, Dr. Trorey has been associated as a principal in the development and application of aerial survey of techniques to many major industrial developments in this country. During this time he has acted as consultant and adviser to Commonwealth and other governments and agencies, and to industry.

In World War II he organized, trained and commanded the aerial mapping company of the Royal Canadian Engineers, carrying out operational mapping for the Canadian Army overseas in the northwest European theatre. Concurrently he initiated classified radar-photogrammetric and all other development projects for the War Office and for the Canadian Army.

Dr. Lyle G. Trorey, M.E.I.C.

Dr. Trorey was born in Vancouver. He received his B.Sc. degree in engineering from the University of British Columbia, and his Ph.D. degree from the University of London.

He was employed on the engineering staff of the contractors on arterial highway construction in the United Kingdom, and upon his return to Vancouver, he was associated for some years with the B.C. Forest Service during which time he was closely connected with early developments in aerial survey and photomensuration techniques. After several years of highway, river protection, transmission line, and airport work for both the British Columbian and Federal governments, he opened an office in Vancouver as a consulting engineer.

Dr. Trorey is a graduate member of the Institution of Mechanical Engineers, London, a member of the Association of Professional Engineers of British Columbia and Ontario and of the Dominion of New Zealand, the Canadian Institute of Forestry, the Empire Forestry Association, the American Society of Photogrammetry and an associate member of the Royal Photographic Society.

**J. W. Millar,** M.E.I.C., chief mechanical

J. W. Millar, M.E.I.C.

officer of the Ontario Northland Railway in North Bay, Ont., has been elected chairman of the Nipissing and Upper Ottawa Branch of the Engineering Institute.

Mr. Millar was born in Scotland and came to Canada at the age of three. He received his public and high school education in Revelstoke, B.C., and his B.A. and B.A.Sc. degrees from the University of British Columbia in 1926 and 1927, respectively.

He served from 1923 to 1930 as a machinist apprentice with Canadian Pacific Railways in Revelstoke and Winnipeg, acting as assistant dynamometer car operator in Winnipeg in 1929. The following year he was appointed assistant chief draftsman (mechanical) in the locomotive and car department, and two years later locomotive shop foreman in Sutherland, Sask., and Kenora, Ont.

He was appointed shop engineer in the Winnipeg Weston shops in 1934, becoming locomotive foreman in Wynyard, Sask., in 1936.

Mr. Millar was transferred to Vancouver as general locomotive foreman in 1938.

He joined the department of Railways of the Province of British Columbia in 1943 and remained in that position until 1947 when he was appointed superintendent of Pacific Great Eastern Railway in Vancouver. A year later he was named to his present position as chief mechanical officer with Ontario Northland Railway in North Bay.

Mr. Millar is a member of the Association of Professional Engineers of British Columbia and of Ontario, the American Society of Mechanical Engineers, the Canadian Railway Club and the Toronto Railway Club.

**G. B. Thompson,** M.E.I.C., is assistant engineer with McCurdy Radio Industries Limited in Toronto.

A B.A.Sc. graduate in engineering physics of the University of Toronto, class of 1947, Mr. Thompson was formerly associated as development engineer with Northern Electric Co. Ltd. in Belleville, Ont.

**H. Brian White,** M.E.I.C., has joined the Aluminum Company of Canada, Ltd. in Montreal where he is with the transmission line section of the electrical development division.

From 1949 to 1954 Mr. White was with B.C. International Engineering Co. Ltd., Vancouver, where he worked on the design of the transmission line and other phases of the Alcan Kemano Kitimat project.

A graduate of the University of Toronto in structural engineering, class of 1944, he is a member of the Corporation of Professional Engineers of Quebec.

**Campbell Fraser,** M.E.I.C., division engineer of the Ontario Department of Highways for the Kingston area for past two years, has been transferred to Toronto.

He is a graduate of Queen's University in civil engineering, class of 1934.

**William M. Walker,** M.E.I.C., assistant system planning engineer with the British Columbia Electric Co. Ltd. in Vancouver, is now on loan for a two-year period with Atomic Energy of Canada Ltd. in Chalk River where he will conduct research into applying atomic energy to industry.

Mr. Walker is a graduate of the University of British Columbia in electrical engineering, class of 1945.

**J. Richard Cavanagh,** M.E.I.C., a 1944 graduate civil engineer of the University of Toronto, has entered private practice in Toronto. Mr. Cavanagh, who is from Winnipeg, is one of five brothers who are all professional engineers.

He was formerly a consultant in patent matters with Fetherstonnaugh & Co. in Toronto.

**Lt. Cmdr. W. J. Reynolds, R.C.N.,** M.E.I.C., 1949 chemical engineering graduate of the University of Toronto, has been transferred from H.M.C.S. *Naden*, Esquimalt, B.C., to H.M.C.S. *Algonquin*, Halifax.

**R. M. Rutherford,** M.E.I.C., formerly assistant chief engineer with the Public

Utilities Commission in Victoria, B.C., is now chief engineer with Inland Natural Gas Co. Ltd. in Vancouver, B.C.

Mr. Rutherford graduated in electrical engineering from McGill University in 1938.

**P. S. Sidney-Smith,** M.E.I.C., formerly municipal engineer for the Township of Chilliwack, B.C., has been appointed city engineer at Hopkins, Minn.

He is a civil engineering graduate of Queen's University, Belfast, Ireland, class of 1949.

**Samuel Glover Anderson,** M.E.I.C., is attached to the special contract department of the Bell Telephone Company of Canada in Montreal. He was previously in the special services engineering department of the Manitoba Telephone System in Winnipeg.

Mr. Anderson graduated in electrical engineering from the University of Manitoba in 1949.

**John S. Slater,** M.E.I.C., is associated with Pembina Pipe Line Company Limited in Edmonton, Alta. He was formerly senior civil engineer with Consulting Engineers B. D. Bohna and J. L. Miller Ltd. of Vancouver.

Mr. Slater graduated in civil engineering from the University of British Columbia in 1944.

**G. L. Archambault,** M.E.I.C., formerly sales manager of Northern Equipment Limited, has been appointed manager of Raymond Distributing Company Ltd., manufacturers of industrial aluminum windows in Montreal.

G. L. Archambault, M.E.I.C.

Mr. Archambault is a 1939 mechanical engineering graduate of McGill University.

**E. J. Robertson,** M.E.I.C., formerly associated with Bepco Canada Limited in Montreal, is now installation project supervisor with Canadian Aviation Electronics Ltd. in Montreal.

He received his B.Sc. degree from the University of Manchester in 1930

**P. E. Goodwin,** M.E.I.C., recently formed with two others the Defiance Engineering and Microwave Corporation, designers and manufacturers of electronic components in Wakefield, Mass. He is treasurer and chief engineer.

Mr. Goodwin was previously assistant to the president of Diamond Manufacturing Corporation and Diamond Microwave Corporation in Wakefield, Mass.

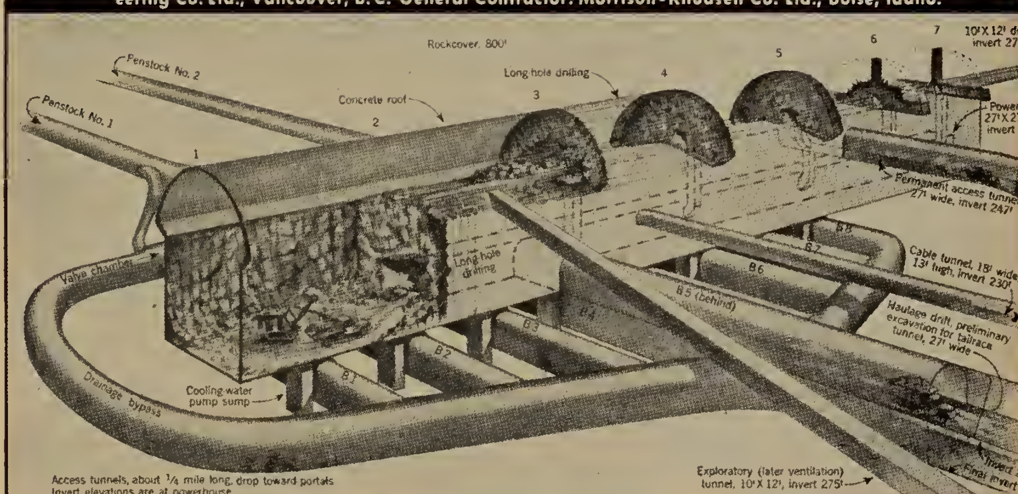
He is a member of the Institution of Mechanical Engineers of Great Britain and of the American Society of Mechanical Engineers.

**G. MacGregor,** M.E.I.C., is associated with the Manitoba Power Commission in Winnipeg, Man. He was previously electrical draughtsman with Canadian Vickers Ltd. in Montreal.

Mr. MacGregor received the higher national certificate in electrical engineering in 1949.

# *largest of its kind...*

**ALCAN-KEMANO-KITIMAT POWER DEVELOPMENT**
Owner: Aluminum Company of Canada, Ltd. Engineer: British Columbia International Engineering Co. Ltd., Vancouver, B.C. General Contractor: Morrison-Knudsen Co. Ltd., Boise, Idaho.




## another noteworthy ALCAN power project where POZZOLITH* was employed in concrete

Alcan's 13-year experience with Pozzolith—Shipshaw Dam in 1941, Arvida Plant, Peribonka Power Developments No. 1 and No. 2 and others—led to its use in building the great Kemano-Kitimat power project, a portion of which is shown here.

Alcan engineers employ Pozzolith to assist them in meeting their high standards of strength control, and requirements of flow and workability without excessive bleeding or segregation.

Whatever the materials or conditions, Pozzolith with its adaptations facilitates the production of concrete of specified qualities, and at a lower cost than by any other means.

***POZZOLITH** . . . reduces unit water content up to 15% for a given placeability, and fully complies with the water-cement ratio law. Adaptations of Pozzolith permit rigid control of entrained air. Produced in three standard formulations—High Early Pozzolith, Normal Pozzolith and Low Heat Pozzolith—to give the results required under varying job conditions.

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TORONTO 9, ONTARIO

**Henri F. Beique,** M.E.I.C., has been appointed assistant general manager of the Quebec Power Company and the Quebec Railway, Light and Power Company.


Henri F. Beique, M.E.I.C.

Born in Montreal, Mr. Béique studied at the College Ste. Marie and Mont St. Louis College, and later at Lycee Louis-le-Grand in Paris for two years, receiving his B.A. from the Sorbonne in 1930. Returning to Canada, he obtained his degree in electrical engineering from McGill University in 1936.

Joining the Shawinigan Water & Power Company in 1936, he was transferred to Quebec Power Company in May of 1937 and was successively appointed assistant superintendent of the power division in 1938, superintendent in June of 1942, general superintendent of the Quebec Power Company in 1946 and general superintendent of the Quebec Railway, Light and Power Company in 1950.

Mr. Béique is a member of the Corporation of Professional Engineers of Quebec and of the American Institute of Electrical Engineers.

**Lionel Swift,** M.E.I.C., superintendent of the electricity division of the Quebec Power Company has been appointed


Lionel Swift, M.E.I.C.


Nearly
400,000 KVA
of high-voltage
FERRANTI TRANSFORMERS
distribute power for Aluminum Company of Canada at
KEMANO & KITIMAT
One of the four—71,000 kva, OFW, single-phase, 60 cycle, 55°C, Ferranti generating transformers is shown here ready for installation inside the 134 foot high, arched cavern at Kemano. Ferranti also supplied three—37,000 kva, OFW, single-phase, 60 cycle transformers, which were installed at Kitimat to step the voltage down for the smelter and the city of Kitimat. Ferranti was the only company called upon to supply transformers for both the generating and receiving end of this tremendous project... a total of nearly 400,000 kva. We are proud to have contributed our engineering and manufacturing experience and we extend our heartiest congratulations to the men of Alcan for their courage and foresight.
F
FERRANTI
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LIMITED
MONTREAL - TORONTO - WINNIPEG
Also sold at all offices of the
Northern Electric Co. Ltd.

general superintendent of operations.

Mr. Swift is a native of Shawinigan Falls, where he received his early schooling and where he worked for some years before starting his studies at McGill University; he graduated in electrical engineering in 1934 and spent the following two years on the Shawinigan Water and Power Company training course.

He worked at Thetford Mines and the system office at Shawinigan Falls up to 1939 when he came to the Quebec Terminal Station as assistant to E. Chartier.

In 1945 he was transferred to the Quebec Power Company and successively occupied the positions of superintendent of the engineering department, assistant superintendent of the power division, and finally in October, 1946, superintendent.

He is a member of the Corporation of Professional Engineers of Quebec, and the American Institute of Electrical Engineers. He is also assistant professor in the electrical department of Laval University.

**Maurice D'Amours**, M.E.I.C., has been named superintendent of operations in the electricity division of the Quebec Power Company.

Mr. D'Amours was born in Rivière du Loup. He received his B.A. in 1941 and graduated from Laval University as electrical engineer in 1945.

Maurice D'Amours, M.E.I.C.

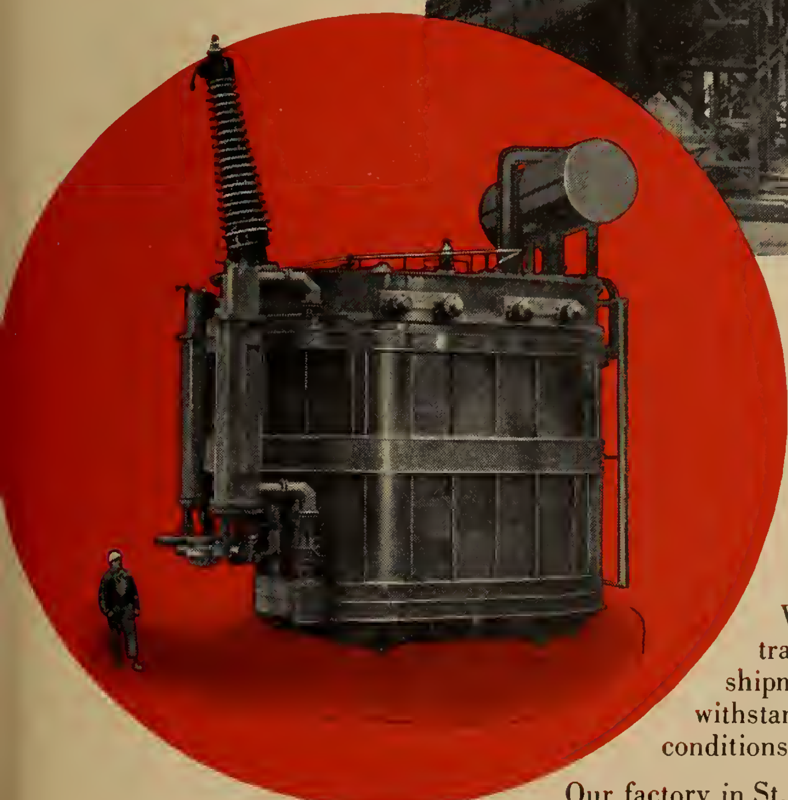
He entered the service of the Quebec Power Company in the same year and has since successively occupied the positions of distribution engineer, superintendent of the Quebec district, and superintending engineer of transmission and distribution until June of this year when he was named assistant superintendent of the electricity division.

He is a member of the Corporation of Professional Engineers of Quebec, and is also the president of the Engineering Alumni Association of Laval University.

**Pierre A. Duchastel**, M.E.I.C., superintendent of the engineering department of the Quebec Power Company, has recently been appointed chief engineer.

Born in Outremont, Mr. Duchastel studied at Mont St. Louis. He entered McGill University in 1934 and gradu-

# ONE OF THREE AT KEMANO



One of three 71,000 KVA English Electric power transformers goes into position at Kemano. The bank steps up the 213,000 KVA output from two generators to 301,400 volts for transmission to the smelter at Kitimat.

We completely impulse tested these transformers for 1050 KV BIL before shipment to prove the transformers could withstand anticipated lightning or other surge conditions.

Our factory in St. Catharines is equipped to design, build and impulse test the largest high voltage transformers.

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Offices in Halifax, Montreal, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver
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Pierre A. Duchastel, M.E.I.C.

ated in electrical engineering in 1938.

He started his career with Ferranti Limited in England and was later transferred to the Company's Toronto office. From 1941 to 1945 he was on loan to the National Research Council in Ottawa on war work as assistant research engineer.

He joined the Quebec Power Company in April, 1946, and occupied the position of electrical engineer. In 1950 he was named superintendent of the engineering department.

He is a member of the Corporation of Engineers of the Province of Quebec, and of the American Institute of Electrical Engineers.

**G. F. Kelly,** M.E.I.C., has been recently named assistant chief engineer of the Quebec Power Company.

A native of Halifax, Mr. Kelly studied at St. Mary's University and the Nova Scotia Technical College from which he graduated in 1943.

From the time of his graduation until March, 1946, he served with the Royal Canadian Navy in Ottawa, on the North Atlantic and with the British Admiralty in England.

He joined the Quebec Power Company in April, 1946, as assistant electrical engineer and became assistant superintendent of the engineering department in February, 1950.

G. F. Kelly, M.E.I.C.

He is a member of the Corporation of Professional Engineers of Quebec and of the American Institute of Electrical Engineers.

**C. S. Nicoll,** M.E.I.C., formerly associated with Fraser Brace Terminal Constructors in Saint John, N.B., has been appointed branch manager of Defence Construction (1951) Ltd. in Halifax.

He received his B.Sc. degree from Acadia University in 1935.

**C. J. Jamieson,** M.E.I.C., formerly chief engineer with Sylvanite Gold Mines Ltd. of Kirkland Lake, has organized the firm of Junek & Jamieson Construction Co. Ltd. in Sarnia, and has served as its president and general manager since 1951.

Mr. Jamieson is a McGill University mining engineering graduate of 1935.

**L. A. W. Davis,** M.E.I.C., is defence research technical officer with C.A.R.D.E. in Quebec City. He was previously electrical test engineer with Canadian Vickers Ltd. in Montreal.

Mr. Davis received his national certificate from Melbourne Technical College in 1950.

He is a member of the Institution of Electrical Engineers.

**E. G. Taylor,** M.E.I.C., is associated with the Department of National Defence (Army) as deputy to the engineer in charge of sanitation and roads section, design division. He is located in Ottawa.

Mr. Taylor was previously senior engineer with C. A. Meadows & Associates Ltd. in Toronto. He is a 1948 graduate in civil engineering of Queen's University, Belfast.

**H. G. E. Rhodes,** M.E.I.C., is associated with the city's engineering department in Regina.

A graduate in electrical engineering of the University of Manitoba, 1933, Mr. Rhodes has been engaged since his return from R.C.A.F. service, in equipment sales and private consulting work.

**H. G. E. Rhodes, M.E.I.C.**

**P. H. Morgan,** M.E.I.C., is construction consultant with Aluminum Laboratories in Montreal. He was previously British West Indies project manager with Sprostans Ltd. in Shooters Hill, Jamaica.

**Herbert M. Edwards,** M.E.I.C., has been appointed to the permanent staff of Queen's University as assistant professor of civil engineering.

He recently returned from Purdue University where he received his master's degree in traffic and highway engineering. He received his B.Sc. degree from Queen's University in 1944.

**Donald R. Kline,** M.E.I.C., has been appointed director of the sub-contract department of the H. F. Campbell Construction Company in Detroit, Mich. He was formerly purchasing agent of the company.

Mr. Kline is a mining engineer graduate of the Nova Scotia Technical College, class of 1941.

**Capt. (L) John Deane, R.C.N.,** who was formerly stationed at Sorel, Que., as principal naval overseer of Marine Industries Ltd., is now at Naval Headquarters in Ottawa where he is assistant chief of Naval Technical Services (Ships). In his present position he is assistant to Rear Admiral Knowlton who is responsible for all ship building and ship repair in the Royal Canadian Navy.

Capt. Dean is a 1934 graduate in electrical engineering of the University of British Columbia.

**Kenneth R. Shipley,** M.E.I.C., has been transferred by Imperial Oil Limited in Toronto to the pipeline division as assistant chief engineer.

A graduate of the University of Toronto, class of 1935, Mr. Shipley has been associated with the company for many years.

**P. Maguire,** M.E.I.C., formerly structural engineer with the Canadian Bridge Company in Walkerville, Ont., is now design and contracting engineer with the Sarnia Bridge Company in Sarnia, Ont.

Mr. Maguire received the higher national certificate from South East Sussex Technical College in 1951.

**A/C V. H. Patriarche, R.C.A.F.,** M.E.I.C., has been promoted from the rank of group captain and his position is that of chief of training at Air Force Headquarters in Ottawa. He was previously with No. 2 group, Ottawa.

A/C Patriarche received his B.Sc. degree from the University of Manitoba in 1929.

**D. L. MacKinnon,** M.E.I.C., has been transferred by Foundation Company of Canada Ltd. from Gaspe, Que., to Montreal.

Mr. MacKinnon received his B.Sc. and M.Sc. degrees in civil engineering in 1939 and 1944, respectively.

**Raymond A. Frigon,** M.E.I.C., who, for the past two years has been program officer in the United Nations Technical Assistance Administration in New York, has joined the Department of Public Works of the Federal Government as executive assistant to the chief engineer.

**A. D. Lindsay,** M.E.I.C., formerly associated with the Stone & Webster (Canada) Company in Trail, B.C., has joined the Hydro-Electric Power Commission of Ontario at Cornwall, Ont.

He is an associate member of the Institution of Civil Engineers of Great Britain.

**Geoffrey P. Webb,** M.E.I.C., a 1952 London University graduate, has joined the Aluminum Company of Canada as a system operation engineer at Shipshaw, Arvida.

Mr. Webb was previously associated with the power and transformer sales section of the apparatus division's marketing department of the Canadian General Electric Company in Toronto.

The following engineers have accepted positions with the St. Lawrence Seaway Authority: **Frith Jof Ness,** M.E.I.C., **Duncan McIntyre,** M.E.I.C., **Keith Ogilvie Whyte,** M.E.I.C., **William James Weymark,** M.E.I.C., **Charles Elmer Scott,** Jr.E.I.C., **Keith Leslie Coldwell,** Jr.E.I.C., **Donald McLeod Ripley,** Jr.E.I.C., **Frederick Ivor Morton,** Jr.E.I.C., **Ernest Joseph Rossi,** Jr.E.I.C., **Kenneth Saville Flitton,** Jr.E.I.C., **Douglas St. Elmo Cameron,** Jr.E.I.C., **Arland Edgar Benn,** Jr.E.I.C., **Walter Edward Webb,** Jr.E.I.C., and **Emeric George Leonard,** Jr.E.I.C.

**William L. Booth,** Jr.E.I.C., who graduated in civil engineering from the University of Toronto in 1946, is design engineer with Abitibi Power and Paper Company Limited, and is at present located at the Iroquois Falls Mill.

Previous to joining the company, Mr. Booth was on the staff of the Hydro-Electric Power Commission of Ontario and Margison & Babcock in Toronto.

**H. Raymond Beck,** Jr.E.I.C., one of the first Canadian industrial engineers to receive the Athlone Fellowship, has returned to Toronto after two years' studies in the United Kingdom. He completed advanced training in electrical engineering including the application, design, manufacture, test and operation of electrical signal equipment, and earned the Diploma of Membership of the Imperial College in London.

Mr. Beck, a signal engineer for Canadian National Railways in Toronto, was granted leave of absence to accept the Athlone Fellowship award.

He is a graduate of the University of Manitoba, class of 1947, and holds a B.Sc. degree in electrical engineering with gold medal honours.

**R. R. Ritchie,** Jr.E.I.C., a 1947 graduate in electrical engineering of the University of New Brunswick, has joined Calgary Power Limited in Calgary. He was previously associated with Montreal Engineering Co. Ltd. in Montreal.

**E. Lundman,** Jr.E.I.C., a 1947 graduate in civil engineering of the University of Manitoba, has resigned as town engineer of Dauphin, Man., and is now employed by the Harper Construction Company in Winnipeg.

**J. C. Finch,** Jr.E.I.C., a 1947 graduate in civil engineering of McGill University, is on the staff of DuPont Company of Canada Ltd. as design engineer in Montreal.

He was previously technical assistant with Canadian Industries Limited in Maitland, Ont.

**J. L. Kendry,** Jr.E.I.C., is industrial engineering supervisor of the Canadian products division of Canadian Johns Manville Co. Ltd. in Asbestos, Que.

A graduate in mechanical engineering of the University of Saskatchewan, class of 1947, Mr. Kendry was formerly associated as methods engineer with the Stanley Tool Co. of Canada Ltd. in New Britain, Conn.

**William Koropatnick,** Jr.E.I.C., assistant district engineer with the highways branch of the Department of Public Works, has been transferred from Boissevain, Man., to Winnipeg.

Mr. Koropatnick has been associated with the Department of Public Works since graduating in 1949 in civil engineering from the University of Manitoba.

**Kenneth Henry Williamson,** Jr.E.I.C., is on the staff of the special contract department of the Bell Telephone Company of Canada in Montreal.

Previous to joining the company, Mr. Williamson was in England on an Athlone Fellowship. While there he was associated with Messrs. Siemens in London for two years.

Upon graduation from the University of Manitoba in electrical engineering in 1949, Mr. Williamson became telephone transmission engineer with the Manitoba Telephone System.

**R. W. McQueen,** Jr.E.I.C., a graduate of the University of Alberta in chemical engineering, class of 1949, has been appointed operations engineer in the producing department of Imperial Oil Limited's Edmonton district.

He was previously development engineer in the producing department of the Leduc District.

**Donald F. Martin,** Jr.E.I.C., a graduate of the University of Saskatchewan in civil engineering, class of 1949, is now district engineer with the Department of Public Works at Penticton, B.C.

He was formerly associated with Stone & Webster of Canada, Limited in Trail, B.C.

**F/L Norman Bruce Flavin, R.C.A.F.,** Jr.E.I.C., is now specialist officer on test equipment of armament systems at Air Material Command in Rockcliffe, Ont.

He was previously technical armament officer at R.C.A.F. Station North Lufienham, Rutland, England.

F/L Flavin received his B.Sc. degree in chemical engineering from the University of Alberta in 1950.

**F. H. Bruce Chisholm,** Jr.E.I.C., a 1950 graduate of McGill University in mechanical engineering, is now mill engineer with the Canadian International Paper Company in Temiskaming, Que. He was previously associated with the New Brunswick International Paper Company in Dalhousie, N.B.

**J. A. MacGregor,** Jr.E.I.C., has been appointed manager of the Public Utilities Commission of Sault Ste. Marie, Ont.

He has been with the Public Utilities Commission since 1950 and for the past two years has been in charge of all outside work.

Mr. MacGregor graduated in electrical engineering from the University of New Brunswick in 1950.

**George Schotch,** Jr.E.I.C., has been transferred as assistant superintendent with Canada Cement Company Limited from plant No. 1 in Montreal East, to plant No. 8 in Port Colborne.

Mr. Schotch is an electrical engineering graduate of the University of New Brunswick, class of 1950.

**James L. Carveth,** Jr.E.I.C., formerly employed by Interprovincial Chemicals Limited, has joined the staff of L. E. Neil Carr, Calgary consulting engineer.

Mr. Carveth received his B.Sc. and M.Sc. degrees in chemical engineering from the University of Alberta in 1950 and 1953, respectively.

**F. J. Caissie,** Jr.E.I.C., formerly resident engineer with Central Mortgage and Housing Corporation at R.C.A.F. Station Bagotville, Que., has been appointed a project engineer with Defence Construction (1951) Limited at Valcartier Military Camp.

Mr. Caissie received his civil engineering degree from the University of New Brunswick in 1950.

**J. Robert Demers,** Jr.E.I.C., is a consulting engineer in Rimouski, Que. He was formerly structural engineer on the staff of the City of Montreal.

Mr. Demers graduated in civil engineering from McGill University in 1950.

**J. P. Beauregard,** Jr.E.I.C., recently returned from the United Kingdom where he was a graduate trainee with Rolls-Royce Ltd. in the Aero-Engine Division, and has joined the gas dynamics section of the mechanical engineering division of the National Research Council in Ottawa.

Mr. Beauregard received his B.Eng. and M.Eng. degrees in mechanical engineering from McGill University in 1950 and 1952, respectively.

**P. J. Rivard,** Jr.E.I.C., has been granted leave of absence by the soil mechanics and materials division of P.F.R.A. at Saskatoon to accept a temporary appointment as an exchange visitor at Harvard University where he will serve as assistant to Professors Casagrande and Terzaghi and will also provide a liaison for the research work on highly plastic clays being carried on at Harvard and at the University of Saskatchewan by P.F.R.A.

Mr. Rivard received his B.Sc. degree in civil engineering from the University of Alberta in 1948, and his M.Sc. degree in 1950.

**G. L. Bancroft,** Jr.E.I.C., a 1950 graduate in chemical engineering of the University of British Columbia, is now manager of Bumstead-Woolford Ltd. in Vancouver, B.C.

Previous to joining this company, Mr. Bancroft was sales representative with Canadian Industries Limited in Regina.

**J. M. Lawrence,** Jr.E.I.C., was recently appointed refinery engineer with the British American Oil Company at the Calgary refinery.

Mr. Lawrence joined the company after graduation in chemical engineering from the University of Alberta in 1950.

**F. R. Mullen,** Jr.E.I.C., a graduate of the University of British Columbia in electrical engineering, class of 1950, is now Canadian Aviation Electronics representative at the R.C.A.F. Station in North Bay, Ont.

Previous to joining Canadian Aviation Electronics in Montreal in 1953, Mr. Mullen was associated with Northern Electric Co. Ltd. in Montreal.

**F. D. Priestly,** Jr.E.I.C., has been transferred by Canadian Westinghouse Company Limited from Hamilton to the apparatus division in Montreal.

Following graduation in electrical engineering from the University of Alberta in 1950, Mr. Priestly was associated with Saskatchewan Power Corporation in Regina.

**Harold Edson Thornham,** Jr.E.I.C., a 1950 graduate in mechanical engineering of the Nova Scotia Technical College, is on the staff of Construction Equipment Company Ltd. in Halifax.

Since graduation he has been employed by Milton Hersey Co. Ltd., Cameron Contracting Limited in Halifax, and Richard and B. A. Ryan Ltd. in Montreal.

**W. G. Thompson,** Jr.E.I.C., has accepted the position of plant manager with Pioneer Electric Alberta Ltd. in Red Deer, Alta.

A 1950 graduate in electrical engineering of the University of Manitoba, Mr. Thompson was previously associated with Reliance Electric & Engineering (Canada) Ltd. in Welland, Ont.

**L. R. Bergklint,** Jr.E.I.C., a University of British Columbia 1951 graduate in electrical engineering who joined the Canadian Westinghouse Company in 1951 as a student engineer, has been appointed manager of standard motor and control sales in the industrial products division.

L. R. Bergklint, Jr.E.I.C.

Upon completion of the company's graduate student apprentice training course, Mr. Bergklint entered the estimating and pricing section of the motor and control sales department. In 1952 he became supervisor of industrial control sales and has since carried out numerous important industrial projects for Westinghouse.

During World War II he saw service in Europe with the Canadian Armoured Corps and at present holds the rank of major in the 5th Technical Regiment, R.C.E.M.E. (Militia). He is a member of the Association of Professional Engineers of the Province of Ontario and of the American Institute of Electrical Engineers.

**H. F. McCoubrey,** Jr.E.I.C., a 1951 graduate in civil engineering of the Nova Scotia Technical College, has returned from Tanganyika, British East Africa, where he has been associated with the Public Works Department, and has joined the staff of Kilborn Engineering Co. Ltd. in Toronto. He is design engineer in the municipal branch.

**N. Sawitski** Jr.E.I.C., is now located at the R.C.A.F. Station at Uplands Airport as technical representative for Canadian Aviation Electronics.

Mr. Sawitski is a 1950 graduate in electrical engineering of McGill University.

**Stanley Mazure,** Jr.E.I.C., a 1950 graduate in electrical engineering of Queen's University, has been transferred within the DuPont Company of Canada Limited from the Textile Fibre Division in Kingston, to the Engineering Department in Montreal.

**Dr. Ross Edwin Chamberlain,** Jr.E.I.C., who received his B.Eng. degree in civil engineering from McGill University in 1951 and his Ph.D. degree in structural engineering from the University of Birmingham in 1953, is now associated with the structural design department of Dominion Bridge Co. Ltd. in Lachine, Que.

**K. Czerwinski,** Jr.E.I.C., who is on the staff of A. D. Margison and Associates in Toronto, is now on loan to the design division of the Department of National Defence (Army) in Ottawa.

Mr. Czerwinski, a 1951 graduate in civil engineering of Polish University College London, was previously assistant engineer with Dr. P. L. Pratley, Montreal consulting engineer.

**R. L. Denison,** Jr.E.I.C., a 1952 graduate in mechanical and electrical engineering of the University of Sydney, has been transferred by Canadian Locomotive Company, Ltd. from Nelson, B.C. to Kingston.

**H. E. Sears,** Jr.E.I.C., formerly junior design engineer with Aluminum Company of Canada Ltd., is resident construction engineer with the engineering department of the City of Hamilton.

He is a graduate in civil engineering

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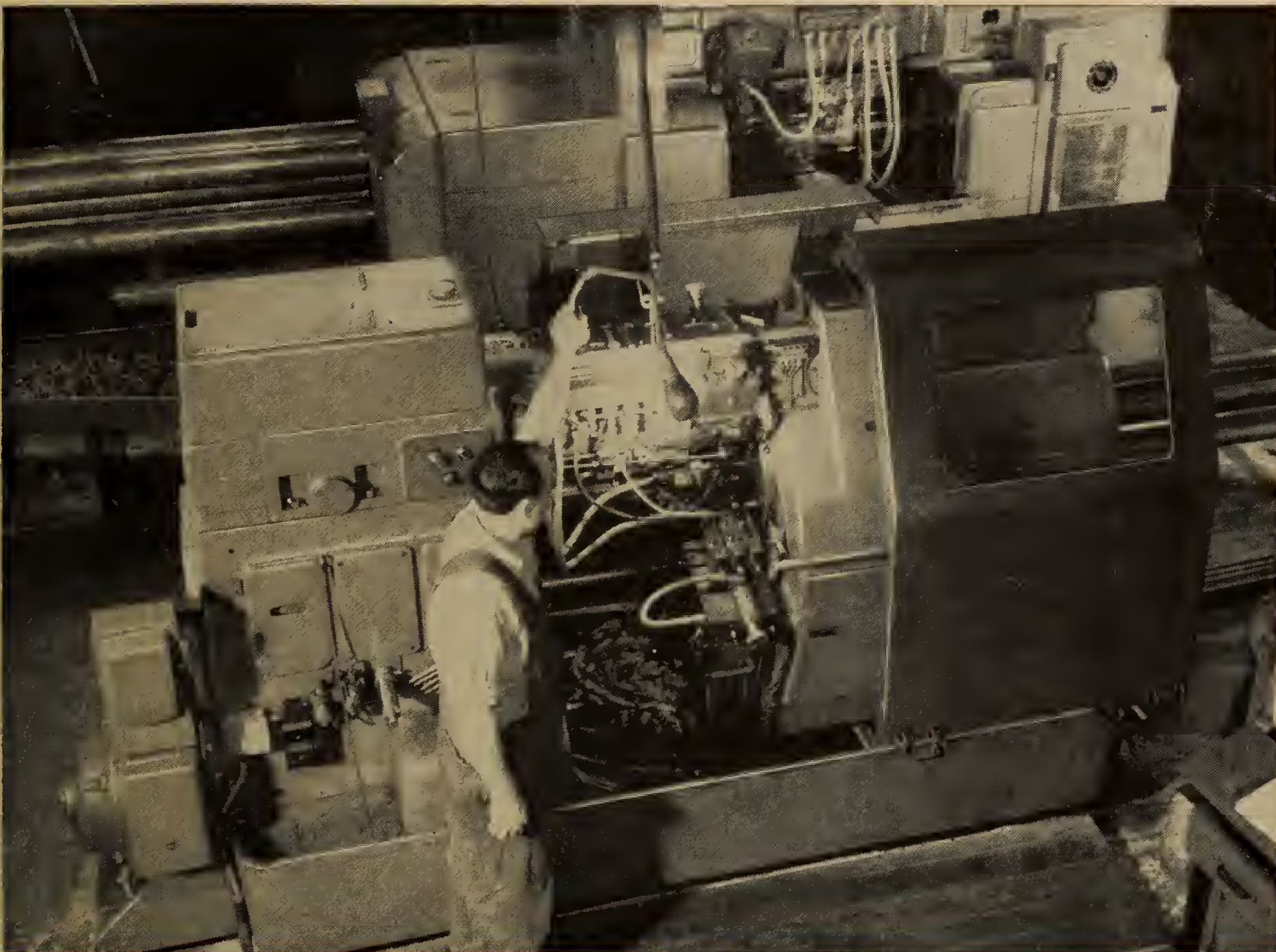

of the University of Toronto, class of 1952.

**W. J. Bell,** JR.E.I.C., a 1952 graduate in mechanical engineering of McGill University, is field engineer with Fischer & Porter (Canada) Ltd.

**R. L. Raskin,** JR.E.I.C., who graduated in 1952 in electrical engineering from the University of Alberta is now employed on the staff of the special contract division of the Bell Telephone Company of Canada.

He was formerly associated with Alberta Government Telephones in Edmonton.

**Yves Hamel,** JR.E.I.C., of the engineering staff of the Canadian Broadcasting Corporation, has been transferred as electrical engineer from Quebec to Montreal.

Mr. Hamel is a 1952 graduate in electrical engineering of Laval University.

**F/O P. J. H. Sheasby, R.C.A.F.,** JR. E.I.C., previously telecommunications officer at the R.C.A.F. Station in Clinton, Ont., is now located at Keesler Air Force Base in Mississippi.

F/O Sheasby is an electrical engineering graduate of the University of Manitoba, class of 1952.

**B. I. Maduke,** JR.E.I.C., a graduate of the University of Saskatchewan in agricultural engineering, class of 1948, and of civil engineering, class of 1952, is employed as soils engineer with the Geotechnical Services in Montreal.

He was formerly resources engineer with the Canadian Department of Resources and Development in Vancouver.

**H. W. Russell Smith,** JR.E.I.C., is junior engineer in the air services branch of the Department of Transport's Winnipeg division.

A graduate of Glasgow University in civil engineering, class of 1953, Mr. Smith was previously associated as construction inspector with the corps of engineers at Goose Bay Airport, Labrador.

A prize of $50.00 and an Engineer's Handbook were recently awarded by the Canadian Construction Association to each of the following in the fourth annual competition for theses on construction subjects: to **N. Cressey,** S.E.I.C., and **H. Sejbjerg** of the University of Saskatchewan for the paper "Modified Soil-Cement Base Course for Rosetown Streets"; to **Eric C. Garland,** S.E.I.C., of the University of New Brunswick for "Precast Concrete Buildings"; to **G. V. Roney,** JR.E.I.C., of Queen's University, for "Combined Cantilever and Simple Beam Design"; and to **R. L. Waddell,** S.E.I.C., of the University of Toronto, for "Factors in the Design of Earthquake-Resistant Structures".

The purpose of the Association's thesis competition is to stimulate interest among engineering students on construction problems with a view to developing new job-site techniques.

**Norman Moysa,** S.E.I.C., a graduate of the University of British Columbia in mechanical engineering, class of 1953, is employed as junior engineer on construction of the Sir Adam Beck No. 2 Generating Station at Niagara Falls, Ont.

**Norman G. Needham,** S.E.I.C., is on the staff of the Yukon Consolidated Gold Corporation, which has seven dredges and one hydraulic operation for the recovery of alluvial gold.

Mr. Needham received his B.A.Sc. degree in mining engineering from the University of British Columbia in 1953.

**Gordon P. Luke,** S.E.I.C., has returned to Kingston to complete his course at the Royal Military College after spending his summer training on road and bridge work with the Highway Maintenance Establishment, Royal Canadian Engineers. His headquarters were at Fort Nelson, B.C., on the Northwest Highway.

**D. Paul Andrews,** S.E.I.C., a 1954 graduate of the Nova Scotia Technical College in civil engineering, is junior petroleum engineer trainee with Imperial Oil Limited in Calgary.

**W. E. Jubien,** S.E.I.C., a graduate this year in civil engineering of McGill University, is now attending the University of Alberta where he is taking his master's degree in soil mechanics and foundations.

**R. E. Hennigar, Jr.,** S.E.I.C., a graduate of the Nova Scotia Technical College in electrical engineering this year, is now junior engineer-in-training with the Hydro-Electric Power Commission in Toronto.

**F. J. Bollinger,** S.E.I.C., a civil engineering graduate of McGill University, class of 1954, is field engineer with the Canadian Kellogg Construction Company.

**F/O C. Fontyn, R.C.A.F.,** S.E.I.C., formerly stationed at the R.C.A.F. Station in Aylmer, Ont., has been transferred to the R.C.A.F. Station at Penhold, Alta.

He is a 1954 graduate of Queen's University in mechanical engineering.

**Brian P. Dowsley,** S.E.I.C., a graduate this year in civil engineering from the University of Toronto, is now employed as lecturer on the staff of the Royal Military College in Kingston.

**William A. Burgess,** S.E.I.C., a mechanical engineering graduate of the University of Saskatchewan, class of 1954, is employed as mechanical engineer at the Regina Refinery of Imperial Oil Limited.

**J. D. Kingston,** S.E.I.C., is employed as a computor on a geophysical survey with the Seismic Party No. 11 of the Socony-Vacuum Oil Co. of Canada Ltd., and is located at Grande Prairie, Alta.

Mr. Kingston graduated in civil engineering from Queen's University this year.

**Andre Hebert,** S.E.I.C., a graduate this year in electrical engineering of Laval University, is now on the staff of the Quebec Hydro Commission in Montreal.

**Peter T. Hodgkins,** S.E.I.C., a civil engineering graduate of Queen's University this year, has been appointed by the Board of Control as assistant engineer in the design branch of the City of Ottawa's engineering department.

**Fred Gane,** S.E.I.C., who graduated this year in mechanical engineering from the University of British Columbia, is on the plant maintenance department of the wire and cable plant of Northern Electric Company Limited in Montreal.

**T. H. Shepertycki,** S.E.I.C., who received his B.Sc. degree in electrical engineering from the University of Manitoba this year, is now attached to the Navy section of the radio and electrical engineering division of the National Research Council.

**S. A. Stone,** S.E.I.C., a mechanical engineering graduate of the University of Manitoba, 1954, is on the staff of the microwave section, radio and electrical engineering division of the National Research Council.

**F. A Villela,** S.E.I.C.. has been structural engineer with the Nova Scotia Department of Highways since graduation in civil engineering from the Nova Scotia Technical College this year.

**Gerald Gagnon,** S.E.I.C., has been employed as process metallurgist in the casting shop of Noranda Copper and Brass Co. Ltd. in Montreal since his graduation with first class honours in metallurgical engineering from Ecole Polytechnique this year.

**D. G. Riecken,** S.E.I.C., a graduate this year of the University of Saskatchewan in mechanical engineering, is employed on the staff of the construction and maintenance department of the North Star Oil Company in Winnipeg.

**Donald H. Pyne,** S.E.I.C., a graduate civil engineer of the University of New Brunswick this year, has accepted the position of junior engineer with the Ontario Hydro-Electric Power Commission.

**Yves Pelletier,** S.E.I.C., a 1952 graduate in chemical engineering of Laval University, is on the staff of the production department of Du Pont de Nemours of Canada Ltd. in Shawinigan Falls.

**Nicholas Lee,** S.E.I.C., who graduated in 1953 in engineering from King's College, London University, is now associated with Howard, Needles, Tammen & Bergendoff, consulting engineers in Kansas City, Mo.

He was previously at Purdue University where he undertook post-graduate work in civil engineering.

**E. F. Cook,** S.E.I.C., has been transferred to the switch-gear and industrial control marketing section of the Canadian General Electric Company in Peterborough. He was previously on the company's test course in Toronto.

Mr. Cook graduated in electrical engineering from the Nova Scotia Technical College in 1953.

**D. A. Pannabaker,** S.E.I.C., formerly of the Western Geophysical Company of Canada in Edson, Alta., is now on the staff of the City of Ottawa.

Mr. Pannabaker is a 1953 civil engineering graduate of Queen's University.

**R. P. Malis,** S.E.I.C., a 1954 graduate in civil engineering of the University of Manitoba, is park engineer for Kootenay National Park, Department of Northern Affairs and National Resources at Radium Hot Springs, B.C.

He was previously associated with the Department of Transport as inspector at Gimli, Man.

**Robert Roberge,** S.E.I.C., has been appointed municipal engineer by the Town of Mont-Laurier, Que. He was previously associated with Canadian National Railways, Levis division, at Quebec City.

Mr. Roberge is a graduate this year in civil engineering of Laval University.

**Jack H. Boyd,** S.E.I.C., is now equipment development engineer in the woodlands division of Marathon Paper Mills of Canada Ltd. in Caramat, Ont.

Mr. Boyd graduated this year in mechanical engineering from Queen's University.

**Tache Boisvert,** S.E.I.C., is on the staff of the Shell Oil Company in Calgary.

He is a geology graduate of Laval University, class of 1954.

**R. G. Nicholls,** S.E.I.C., a graduate this year in mechanical engineering of the University of Manitoba, is junior mechanical engineer with the gas division of the Shell Oil Company in Calgary.

**Frederic Cronn,** S.E.I.C., is junior instrumentman with the Ontario Department of Highways in Toronto. He was previously inspector with Lucas Rotax in Scarborough.

**Donald K. Turner,** S.E.I.C., who graduated this year in civil engineering from the University of Toronto, is on the staff of the City of Toronto.

**I. A. Gibbons,** S.E.I.C., a 1954 graduate in mechanical engineering of the University of Toronto, is on the staff of Imperial Oil Limited, in Sarnia.

**Fernand DeSerres,** S.E.I.C., is on the general engineering staff of Canit Construction Limited in Montreal.

He is a graduate of Ecole Polytechnique in civil engineering, class of 1954.

**K. R. Walker,** S.E.I.C., who graduated in civil engineering from the University of Alberta this year is resident highway engineer with the Department of Highways in Edmonton.

**Thomas Hugh Oxland,** S.E.I.C., a graduate of the University of British Columbia in civil engineering this year, is assistant resident engineer with the British Columbia Power Commission in Victoria.

**C. H. Stephens,** S.E.I.C., is assistant transmission and distribution engineer with the British Columbia Power Commission in Vancouver.

Mr. Stephens is a 1954 graduate of the University of British Columbia in electrical engineering.

**Rene Martel,** S.E.I.C., a graduate of Laval University in chemical engineering this year, is development engineer with Canadian Industries (1954) Limited at Shawinigan Falls, Que

# Obituaries

*The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.*

**Edward S. Holloway,** M.E.I.C., who was associated with O. J. McCullock and Company in Montreal West, passed away on July 23, 1954.

Mr. Holloway was born in Montreal on July 18, 1885. Upon receiving his general education there, he entered McGill University, graduating with a B.Sc. degree in civil engineering in 1908. While attending McGill, he was employed during the summers with the Canadian Pacific Railway, first as instrumentman on surveys and construction; then in charge of bridge substructures on the Severn River, Shaws Creek, Bala, Otter Creek, and Point Carling Road; and later as instrumentman on the construction of shops, round houses, track maintenance, and the elevation of track for the Union Station in Toronto.

In 1908 Mr. Holloway became engineer in charge of surveys and location for the Canada and Gulf Terminal Railway, and two years later was placed in charge of construction by the same company. During the winters of 1910 and 1911 he was responsible for the exploration for a 250-mile line to the Gaspé and for the design and construction of all bridge substructures.

In 1911 he was appointed locating engineer from Sherbrooke to Levis by the Quebec Eastern Railway, and the following year he was named chief engineer, and as such, was responsible for the design of all structures.

From 1912 until 1920, with the exception of a period of service with the Canadian Armed Forces, Mr. Holloway was chief engineer with the Canada and Gulf Terminal Railway, and at the same time was engaged in design and construction work.

From 1920 until 1927 he was associated with the Hammermill Paper Company as engineer in charge of Matane operations. During this period he was responsible for the design and construction of wharves, loading plants, piers and booms.

In the summer of 1927 he was employed by Kerry and Chace Co. Ltd. as engineer in charge of surveys for hydro-electric power on the Ottawa River. In 1932 he was on the staff of Canadian Sheet Piling Company. He was subsequently associated with F. A. Gaby, M.E.I.C., the Anglo Canadian Pulp and Paper Company, and the H. E. McKeen Company. In 1939 he served with the National Electricity Syndicate on Ottawa River power developments, and in 1943 he was placed in charge of plant maintenance, repairs and construction by the Commonwealth Plywood Company in Ste. Therese, Que. He opened offices as a consulting engineer in Ste. Therese in 1946, and in 1949 became consulting engineer and managing director for S. & H. Construction Co. Ltd. there. During recent years he was associated with O. J. McCullock and Company.

Mr. Holloway joined the Engineering Institute of Canada as a Student in 1905, transferring to Associate Member in 1910 and to Member in 1928. In January, 1947, he attained Life Membership in the Institute.

**Arthur Benjamin Normandin,** M.E.I.C., technical advisor for the Department of Hydraulic Resources of the Province of Quebec, and a past vice-president of the Engineering Institute, passed away in Quebec City on September 18, 1954.

Mr. Normandin was born at St. Constant, County of Laprairie, Que., on March 29, 1883. He received his general education at Jacques Cartier Normal School, and in 1903 entered Ecole Polytechnique, graduating in 1907 with a B.A.Sc. degree in civil engineering. Previous to graduation, he was employed during the summers with Consulting Engineer F. C. Laberge of Montreal, and with the Department of Public Works in Montreal.

Upon graduation he returned to the office of F. C. Laberge where he was employed for two years on survey and municipal work. In 1909 he was appointed city engineer for Three Rivers, Que., a position he occupied until 1911 when he became associated with Messrs. Grenon and Lavoie of Chicoutimi, engineers engaged in surveying, municipal works and in water power development.

In 1912 he was appointed assistant chief engineer of the hydraulic service of the Department of Lands and Forests for the Province of Quebec, serving as engineer in charge of the approval of

**Arthur Benjamin Normandin, M.E.I.C.**

plans for dams. He was appointed chief engineer of the Department in 1939.

He was named vice-president of the Public Services Board of the Province of Quebec in 1940 and held this position until 1945 when he was made vice-president of the Provincial Electricity Board of the Province.

Mr. Normandin was Canadian delegate at the World Power Conference in Berlin in 1930. He was also a member of the Canadian-American Commission on the study of the St. Lawrence Seaway project, and a member of the Canadian Commission on Marine Utilization, and of numerous other commissions concerned with the study of drainage and aqueduct systems in Quebec City.

Mr. Normandin was a member of the Corporation of Professional Engineers of the Province of Quebec for nearly 20 years, and served as a councillor. He was also a member of the Corporation of Quebec Land Surveyors.

He was very active in the affairs of the Engineering Institute of Canada, having served as vice-president representing Eastern Canada from 1932 until 1937 and as councillor representing the Quebec Branch in 1924 and from 1926 to 1929. He also served as chairman of the Quebec Branch from 1925 until 1929.

Mr. Normandin joined the Engineering Institute as a Student in 1907, transferring to Associate Member in 1912 and to Member in 1933. On January 1, 1948, he attained Life Membership in the Institute.

**Roy Henry Parsons,** M.E.I.C., city engineer of Peterborough for 33 years, passed away after a brief illness at the Civic Hospital on September 6, 1954.

Mr. Parsons was born at Grand Blanc, Mich. on March 7, 1875. He received his early education there and at the University of Michigan. From university he went to the Pennsylvania Railway as rodman and engineering assistant, and in 1900 became topographer with the Algoma Central and Hudson Bay Railway.

In 1901 Mr. Parsons was appointed assistant engineer with the City Engineer's Office of the City of Ottawa, remaining there four years until his appointment as superintendent of the Warren Bituminous Paving Company in Toronto, Ottawa and Regina. He returned to the City Engineer's Office in Ottawa in 1906 and continued in the position of assistant city engineer until 1913 when he was named city engineer of Peterborough, which position he held until his retirement in 1946.

Some of Mr. Parsons' major works in Peterborough were the planning of the Hunter Street bridge, the sewage disposal plant, the extension of the storm sewer system during the depression years as emergency employment, and the supervision of the planting of trees on and about Armour Hill. Mr. Parsons had a broad knowledge of trees, and for a considerable time as city engineer he carried on most of the details of tree planting and maintenance that are now assigned to the parks committee of the council.

Mr. Parsons was a member of the Old Nicholls Hospital board, the Chamber of Commerce and the Peterborough Horticultural Society. He was particularly interested in the Children's Aid Society, having served as secretary for a number of years. He was also active in securing the property for the Children's Shelter and establishing the home as one of the valuable community properties. He was named an honorary member in 1951.

He was a member of the Association of Professional Engineers of Ontario.

Mr. Parsons was one of the founders of the Peterborough Branch of the Engineering Institute and served as its first chairman. He joined the Institute as a Member in 1915, and attained Life Membership in 1947.

**Ashton Burton Cooper,** M.E.I.C., president of Ferranti Electric Limited in Toronto, passed away at his home on September 20, 1954.

He was born in Bloomfield, Ont., on December 31, 1883. He received his early education in Prince Edward County schools and in Boston, and graduated from Tufts College in electrical engineering in 1903.

After two years with the General Electric Company in the testing department in Schenectady, N.Y., and two years as resident engineer with the Westinghouse Company in Pittsburg, Penn., Mr. Cooper joined the Brazilian Traction Company as assistant electrical engineer in charge of power house electrical construction in Rio das Lages, Brazil. He returned to the General Electric Company in 1909 and until 1913 served as engineer in the transformer sales department in Schenectady.

Mr. Cooper came to Canada in 1913 to occupy the position of transformer engineer with Canadian General Electric Co. Ltd. in Toronto. In 1922 he joined Ferranti Electric Limited as general manager, serving subsequently as vice-president and president, which office he retained after retirement from active management in 1947.

He was active in the organization of the Canadian Electrical Manufacturers' Association, and served as its first president. He was a director of the Toronto Industrial Association from its incep-

**Ashton Burton Cooper, M.E.I.C.**

tion and served as president from 1951 until 1954. He was a past president of the Association of Professional Engineers of Ontario, a past vice-president and director at large of the American Institute of Electrical Engineers, and a former chairman of the Canadian Manufacturers' Association. He was also a director of the Canadian National Exhibition.

Mr. Cooper joined the Engineering Institute of Canada as a Member in 1921. In January of this year he attained Life Membership in the Institute.

**Ronald Burns Smith,** M.E.I.C., of the Department of Public Works of Canada in Charlottetown, and chairman of the Charlottetown Branch of the Engineering Institute, died as a result of poliomyelitis on August 18, 1954.

Mr. Smith was born in Saint John, N.B., on November 10, 1924. He received his general education at Victoria School and the Saint John High School.

In 1942 he enlisted in the Royal Canadian Air Force and received his wings and commission. Upon his discharge in 1945 he entered the University of New Brunswick, graduating with a B.Sc. degree in civil engineering in 1949.

During the summer months of his university training he was employed by the Department of Public Works, and upon graduation, continued with the Department until the time of his death.

Mr. Smith was a member of the Professional Institute of Public Service of Canada.

He was actively interested in the affairs of the Engineering Institute of Canada which he joined as a Student in 1947, transferred to Junior in 1951 and to Member in 1951. In 1951 he served as secretary-treasurer of the Prince Edward Island Branch, and in 1953 he was elected chairman of the Branch.

# Employment Service

**THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.**

**NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.**

**REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.**

**INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.**

## SITUATIONS VACANT

### CHEMICAL

GRADUATE CHEMIST, required to be trained as assistant to cnief chemist. Plant located at Cardinal in Ontario in one of Canada's oldest food industries. Forward all details of experience, education, with pictures, and anticipated salary to File No. 4837-V.

GRADUATE CHEMICAL ENGINEER from Canadian University required by manufacturer of organic chemical products. Attractive opening in new project located in Ontario. Seven years of practical experience production and process development is required. File No. 4930-V.

CHEMICAL ENGINEER or chemist, preferably with experience in paint, printing inks, rubber or plastic industries. To sell chemicals in Toronto district. Apply fully in writing to File No. 4960-V.

SALES ENGINEER required by progressive Vancouver company specializing in process equipment in Western Canada. Canadian graduate preferred with experience in chemical or petroleum industries. Excellent opportunity for man with initiative and personality. File No. 4961-V.

CHEMICAL SALES OPPORTUNITIES for engineering graduates. Young graduates to develop thru-on-the-job training within sales organization and graduates with sales experience in chemical or allied field. File No. 4964-V.

CHEMICAL ENGINEERS required for refinery located in South America. Must be experienced in process engineering including design, economic studies, and/or scheduling of operating programs. Write giving age, education, marital status and complete details of experience. File No. 4970-V.

CHEMIST OR CHEMICAL ENGINEER for control department of a newsprint and specialty mill in P.Q. Preferably some experience in pulp and paper. Duties to include development and mill investigations. Give details of experience and references in initial letter. File No. 4982-V.

### CIVIL

CIVIL ENGINEER required by established construction firm operating in the west suburbs of Toronto. Duties entail sewer, water and road layouts planning and general construction problems. Opportunity for a young man wanting to advance. Please reply stating age, education and experience. File No. 4939-V.

CIVIL ENGINEER required in a city in Western Canada to assist in the planning and designing and supervising of construction in extensions of sewers and also sewage treatment plant. File No. 4940-V.

OFFICE ENGINEER AND ESTIMATOR REQUIRED BY LARGE CONSTRUCTION organization opening new office in Montreal. Services of bilingual graduate engineer experienced in heavy construction. Duties involve quantity take-offs, estimating and design. Good opportunity with permanent position for right party. File No. 4945-V.

CIVIL ENGINEER or architect engineer to act as assistant to chief engineer with large organization in the flour, feed and associated industries. Ten years in civil engineering required. Five years of design, foundations, superstructures, steel and reinforced concrete, 3 years in construction, 2 years in project co-ordination and administration. $12,000. starting with annual improvements, benefits include health insurance, retirement plan, etc. File No. 4946-V.

GRADUATE CIVIL ENGINEERS required for specialized work in soil mechanics and foundation engineering. Post graduate study essential. Locations Montreal and Toronto with some travelling. File No. 4968-V.

APPLICATIONS WILL BE received by The Federal District Commission for the position of Junior Engineer on highway work in the Ottawa area. Duties would be to assist in design and supervision of highway location and construction. A recent graduate would be suitable preferably with experience on highway work. Salary will depend on qualifications and experience. Position may lead to permanent employment. File No. 4969-V.

AN OUTSTANDING OPPORTUNITY for a qualified graduate engineer. Applicants must have had extensive supervisory experience in the construction of highways, dams, tunnels, bridges and like projects, together with a thorough knowledge of estimating and the preparation of tenders. This is a permanent position with an established firm. Write giving full particulars. File No. 4975-V.

WORLD RENOWNED INSTITUTE requires immediately a research engineer to work full time in the materials field for a highway research project. Work includes as well as practical testing, emphasis at the present time on bituminous pavement problems. Young civil engineer with at least a bachelor's degree. He should be interested in research and be able to work on his own. Experience in the materials field will be helpful. The opportunity is given to take one course per term. The salary is in the range of about $350. to $450. per month depending upon education and experience. File No. 4984-V.

CIVIL ENGINEER required by a municipal corporation in Western Canada. Recent graduate having some experience in railroad maintenance preferred. Other duties will cover the design and construction of water and sewage works. This job offers a good variety of experience in the municipal engineering field. File No. 4991-V.

CIVIL ENGINEER required for power department of large industrial concern. Duties include office duties and occasionally field work not necessarily in Canada, in the field of hydro-electric power investigations and development. Applicants must have had fifteen years previous experience. Fluency in French or Spanish in addition to English essential. File No. 4997-V.

ASSISTANT MUNICIPAL engineer for the Town of Pointe Claire, P.Q. Population 12,000. Preferably with experience in maintenance and construction of streets surface water drainage, sewage and watermains. Applicants are required to state qualifications and salary expected. File No. 4999-V.

YOUNG CIVIL ENGINEER required with 3 years or so experience in construction to supervise service station construction Location Ontario. File No. 5003-V.

CONSTRUCTION ENGINEER to act as general superintendent for a rapidly expanding organization of general contractors in Toronto. Minimum 10 years outside experience as general superintendent. Main requisite practical experience. This position is that of assistant to general manager, and carries excellent salary and opportunity for right man. Please reply in confidence stating age, marital status, previous employer and references. File No. 5005-V.

PROFESSIONAL ENGINEER for position of manager of moderate sized construction company. Broad experience in estimating, construction and installation supervision essential. Age in mid forties to work from Toronto office serving mining and newsprint industries across Canada. File No. 5010-V.

RECENT GRADUATE CIVIL engineer required in the track section of a large transportation company in Montreal. File No. 5011-V.

GRADUATE CIVIL ENGINEER for responsible duties in connection with hydraulic research on a large, outdoor erodible-bed tidal river model of the Fraser River estuary on the campus of the University of British Columbia. Must be able to carry out tests, analyze results and prepare engineering reports. Problems deal mainly with river regulations and the maintenance of navigable channels. Reply stating age, experience, education, salary expected. File No. 5017-V.

### ELECTRICAL

TWO COMPETENT EXPERIENCED graduate electrical engineers, with approximately 10 years experience in design, operations and maintenance of distribu-

# WANTED

by the

## City of Hamilton

## ASSISTANT ENGINEER

**Must be a professional engineer holding a degree of Civil Engineer as recognized under the Professional Engineers' Act of Ontario. Applicant should have a minimum of ten years experience in the design, construction and supervision of engineering projects particularly as related to a large municipality. Will be required to assist and work in close co-ordination with the city engineer. This position offers an attractive salary, future security and an opportunity for advancement.**

**Reply stating age, experience, education and relevant information to**

**Personnel Director**
**Corporation of the**
**City of Hamilton**

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tion facilities in established rapidly growing utility located South America. Reply giving resume education, experience and personal data to File No. 4950-V.

A LARGE MANITOBA UTILITY requires a graduate electrical engineer to fill the position of assistant to the distribution engineer. Applicant should have at least three years experience in distribution practices, including layouts of large distribution areas; estimating of costs of distribution changes and extensions; improvement of voltage conditions and expansion of existing systems, basic economic studies and design of transformer and other special distribution system structure. Ability to write clear and concise reports to supervise one or more junior engineers and a group of draughtsmen and to deal with field staff is essential. A limited amount of travel within the province will be required. Location is in Winnipeg. Applicants should submit details of family status, age, educational background and experience. Applications will be treated confidentially. File No. 4948-V.

ELECTRICAL ENGINEER with at least five years experience on electrical maintenance and operating problems of generating stations and substations of public utility companies. Permanent positions with long established consulting organization New York. Some travel in Latin America. Spanish or Portuguese useful. Salary commensurate with experience. Reply stating age, education, experience and personal particulars. File No. 4950-V.

ELECTRICAL ENGINEER required as junior or assistant distribution engineer. Graduate with at least 3 years field experience operating utility company. Permanent position with long established consulting organization New York. Some travel Latin America necessary in future. Knowledge of Spanish or Portuguese useful. Salary commensurate with experience. Reply giving age, education, experience and personal particulars. File No. 4950-V.

CITY IN WESTERN CANADA requires an electrical engineer. Duties: to prepare reports on problems of electrical distribution and utilization; to consult with large wholesale power customers concerning their electrical supply; to maintain technical records and perform related engineering tasks as required. Salary $335 to $408 per month (graduated scale). Qualifications: graduation in electrical engineering from a recognized university with some experience preferably in electrical distribution system work. File No. 4976-V.

SENIOR DESIGN ENGINEER with a degree in electrical engineering is required for our rotating machines, direct current design section. Applicants should be between 30-45 years of age, with at least six years experience on design of rotating electrical direct current machines in all sizes, including motors, generators, convertors and rotating regulators. He must possess ability to organize, plan, schedule, promote cost reduction and product improvement in engineering. In addition, he must have a thorough knowledge of direct current machine application, and the ability to promote teamwork. This is a senior appointment with excellent opportunity for promotion. Reply in confidence, giving full personal resume, experience, salary expected. File No. 4980-V.

AN OTTAWA ORGANIZATION requires research engineers to investigate problems in the practical application of electro thermal aircraft de-icing. This will include tests in flight and in icing tunnels, and the development of heater pads, and control in co-operation with aircraft firms. University graduation in electrical engineering with experience in aeronautical engineering and preferably in aircraft electric design and development is required. Flying experience is desirable. Salary up to $5,750 per annum depending on qualifications.

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# Sales Engineer

**Location Montreal required by large Canadian manufacturer for technical sales promotion of building products. Applications are invited from graduate engineers with civil or mechanical background and an aptitude for sales work. Age preferred 30 to 45. Address full details of education and experience to File No. 5023-V.**

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Apply by letter and enclose resume of qualifications and experience. File No. 4996-V.

YOUNG ELECTRICAL MECHANICAL ENGINEER required for the position of cost estimator. This position offers wide scope for advancement and presents the opportunity for a young engineer to demonstrate his ability and initiative, and to grow with a young company. Location Montreal. File No. 5001-V.

ELECTRICAL ENGINEER required by an Eastern Township paper mill. Recent graduate for layout work, procurement and installation of apparatus for paper mill under supervision of superintendent, apply stating age, qualifications and experience. File No. 5019-V.

### MECHANICAL

TOOL DESIGNER REQUIRED, mechanical engineering graduate or equivalent in actual experience. Should have approximately five years experience in design of cutting tools, light, sheet dies, forging dies, fixtures, jigs and gauges. Canadian background required. Location in Montreal. Write giving full details of training experience and state salary desired. File No. 4884-V.

GRADUATE MECHANICAL ENGINEER required by Quebec (Eastern Townships) paper mill to act as assistant to mechanical superintendent. Some experience preferred but not essential. File No. 4944-V.

MECHANICAL PLANT ENGINEER required by operating division of service organization. University graduate preferred, having 5 to 10 years experience in operation and betterment of steam plants operated by public utilities. Location New York, some travel. Spanish desirable, but not essential. Reply by letter giving age, education, experience, personal data, and minimum salary acceptable. File No. 4950-V.

SENIOR TOOL DESIGNER required by high class tool and gauge manufacturer in Southern Ontario. Must be mechanical engineering graduate or equivalent in actual experience. Should have approximately five years experience in design of cutting tools screw thread systems, fixtures, jigs and fixed and indicating types of gauges. Position provides good prospects for the future. Salary will be commensurate with ability. Reply in writing, stating details of age, experience, education and salary desired. Applications will be kept confidential. File No. 4951-V.

YOUNG MECHANICAL ENGINEER required for sales work. Must be energetic, have a good personality and the ability or a real desire to sell. Some knowledge of heating and ventilating equipment and their applications is desirable. Good opportunity for ambitious man, with right future in a growing business. Location Montreal. Write giving full particulars including training, experience, age and marital status. File No. 4954-V.

GRADUATE MECHANICAL DESIGN ENGINEER experienced in heavy industry machine design. He should have three or more years of applicable experience. His general duties would include, supervision of work of several draughtsmen, stress analysis of structural steel machine frames and machine parts. Evaluation of new designs and improvements to existing designs. Good salary and opportunity for the right man with a well established medium sized manufacturer of pulp and paper-mill equipment. Location, northern New York State. Enclose full details as to qualifications, experience, salary expected, and recent photograph. File No. 4955-V.

MECHANICAL ENGINEER required in Regina, Sask., who is a graduate mechanical engineer and has at least five years practical experience in the design of heating, ventilating, air conditioning and refrigeration systems for buildings. Applicants reply giving full details and expected salary in first letter. File No. 4963-V.

PLANT MAINTENANCE ENGINEER, mechanical graduate with three to five years of applicable experience and the ability to supervise personnel for a chemical works engineering department located in the Province of Quebec. Please reply with full particulars to File No. 4967-V.

MECHANICAL ENGINEERS REQUIRED for refinery located in South America.

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## RESEARCH CHEMICAL

OR

## MECHANICAL ENGINEER

**Required by Pulp and Paper Research Institute of Canada for research in unit operations and chemical reactions involved in new processes for pulp and paper manufacture. Necessary qualifications include a Bachelor's (or higher) degree in chemical or mechanical engineering, and 1-5 years of pertinent experience.**

**This offers an opportunity to gain experience in the planning, executing and reporting of engineering research projects. Salary will be commensurate with previous training and experience. Applicants should address a comprehensive resume of qualifications and career to the Scientific Personnel Officer, 3420 University Street, Montreal, P.Q., Canada.**

## HOWARD SMITH PAPER MILLS
LIMITED

CORNWALL DIVISION • CORNWALL, ONT.

**Permanent staff positions are available for 3 graduate engineers in layout and design, maintenance and operating department.**

**Minimum qualifications include graduation from recognized university and 3-10 years experience preferably including alkaline pulping or paper mill design or maintenance.**

**Salary commensurate with experience.**

**Write giving full details of education, age, experience, marital status and references to:**

**E. N. Alquire, Personnel Supervisor, Howard Smith Paper Mills Ltd., Cornwall, Ontario.**

Must be thoroughly qualified and experienced in design of refinery or chemical plant equipment including piping, pressure vessels heat exchangers, etc. Write giving age, education, marital status and complete details of experience. File No. 4970-V.

MECHANICAL ENGINEER, required by paper mill located in Province of Quebec with head offices in Montreal. Applicant should have some paper mill experience or interest to be trained for such a position. File No. 4972-V.

YOUNG MECHANICAL ENGINEER required for sales work. Must be energetic with a good personality and the ability or a real desire to sell. Some knowledge of heating and pumping equipment and their applications desirable. Location, Toronto. Good opportunity with long established business concern. Write giving full particulars including training, experience, age and marital status. File No. 4981-V.

MECHANICAL ENGINEERS required for sales positions with prominent Canadian manufacturer. Experience in gear and mechanical power transmission field would be an asset. Will be located in Ontario or Quebec. Write giving full details of training, experience and salary desired. File No. 4988-V.

JUNIOR DESIGN ENGINEER to be a graduate mechanical engineer, required for designing and making layouts of piping and equipment installations in a chemical engineering plant. Two years experience essential. Location Ontario. File No. 4990-V.

## Engineering Opportunity

**Established Engineering Company in Montreal doing Civil, Mechanical and Electrical Engineering work would consider participation by individual or group of engineers. Some investment would be required. State full particulars to Box 893, Station "B", Montreal.**

SENIOR MECHANICAL ENGINEER. Salary up to $8,200. Department of Public Works Ottawa. Details and application forms at nearest Civil Service Commission Office, Post Office or National Employment Office. Quote No. 54-1211. File No. 4993-V.

RECENT MECHANICAL GRADUATE or one with evidence or interest in mechanical or technical problems and experience or aptitude for sales. He should be bilingual and able to deal with all levels of personnel and management. The work involves study of actual conditions related to the use of tires and formulation of procedure and policies which must be sold at the level of top management. This offers an excellent opportunity to develop a highly interesting field of customer contact and product research. For the right person a car will be provided. File No. 4995-V.

MECHANICAL ENGINEER required sales and outline schemes, for world famous mechanical handling company. Interesting position. Good prospects for right man. Apply with full details to File No. 5000-V.

GRADUATE MECHANICAL ENGINEER interested in a career in Latin America with a Canadian owned electric light and power utility company located Maracaibo, Venezuela. Age limit 30 years and should have 5 years experience in a steam electric generating station. Immediate prospects for promotion to assistant production superintendent and ultimately to executive position if qualified. File No. 5013-V.

SALES ENGINEER with steam plant experience wanted as executive of a new Canadian company to sell, service and assemble combustion controls and industrial instruments in Ontario and Quebec, for well known American manufacturer. Must be native Canadian and a graduate of a Canadian engineering university. File No. 5018-V.

GRADUATE MECHANICAL engineer to eventually take over as production manager. Company manufactures industrial and construction products from sheet metal, plate and light structurals, including material handling products, fluorescent fixtures, special fabricated sections and weldments, plus a full line of construction products. Due to rapid growth, unlimited opportunity offered. File No. 5021-V.

### MISCELLANEOUS

NATIONAL PARK ADMINISTRATIVE OFFICERS, $4,260.00-$4,860.00. National Parks and Historic Sites, Department of Northern Affairs and National Resources, Ottawa. Details and application forms at your nearest Civil Service Commission Office, Post Office or National Employment Office. Quote No. 54-652. File No. 4934-V.

SPECIALIST ON WEAPON Analysis. Salary up to $7,900.00 depending upon qualifications. Department of National Defence, Ottawa. Preferably graduation in mechanical or electrical engineering. Details and application forms at your nearest Civil Service Commission Office and National Employment Office. Quote No. 54-1205. File No. 4935-V.

TECHNICAL ASSISTANT to the Chief Cartographer. Department of Mines and Technical Surveys, Ottawa. Salary $5,760.00 to $6,480.00. Address all enquiries to the Civil Service Commission of Canada, Ottawa, and quote competition numbers 54-1707. File No. 4933-V.

ASSISTANT CHIEF ENGINEER. Salary $10,000.00 per annum. Harbours and Rivers Branch Department of Public Works, Ottawa. Details and application forms at your nearest office of the Civil Service Commission, Post Office and National Employment Office. Competition number 54-1258. File No. 4937-V.

DESIGN ENGINEER REQUIRED to undertake, under general supervision, the design and development of a wide range of mechanical products and devices. Preference given to applicants having higher N.C. and with design experience on aero engines or their accessories, alternatively to University graduates with post graduate experience in design of highly stressed light weight mechanical devices. Small engineering company located in Toronto Suburb. File No. 4941-V.

## THE DEFENCE RESEARCH BOARD

REQUIRES

# ELECTRONICS ENGINEERS

AND

# PHYSICISTS

FOR EMPLOYMENT IN OTTAWA, ONTARIO

***Duties:***

**For the electronics engineers the work will be in connection with the technical administration of a development programme. The duties will include liaison work, etc. There are secretarial committee work, contractual negotiations, vacancies for physicists interested in research and development on the more fundamental aspects of electronic components, e.g. dielectrics and magnetic materials.**

***Qualifications:***

**Electronics Engineers should have technical experience in the field of electronic components.**

***Salary:***

**Starting salaries will be in the range $3600 to $5750 depending upon qualifications and experience.**

***Employee Benefits:***

**There is generous provision for vacation and sick leave. Superannuation and group hospital-medical insurance plans, and a five day week.**

***How to Apply:***

**Application forms will be sent to qualified applicants on receipt of letters outlining qualifications and experience.**

**Please write, mentioning 54-DRP-4 to:**

**Director of Research Personnel, Defence Research Board, National Defence Headquarters, "A" Building, Cartier Square, Ottawa, Ontario.**

Reply giving full particulars including salary requirements. File No. 4993-V.

SENIOR GUN INSPECTOR with salary up to $6,500 per annum depending upon qualifications required by inspection service department of National Defence, Ottawa. To supervise inspection and proof of light and heavy ordnance equipment in Canada. Details and application forms at Post Office, National Employment Office or Civil Service Commission, Competition No. 54-1212. File No. 4994-V.

SALES ENGINEER wanted by established transformer manufacturer, for Montreal district. Bilingual preferred. Excellent future prospects. State age, education and experience. File No. 4999-V.

SENIOR ESTIMATOR WANTED. Experienced man with extensive heavy and medium construction experience. Must have good knowledge of estimating, and pricing. Apply with full details to File No. 5000-V.

ENGINEER WITH some heating experience to act as chief engineer required by manufacturer of automatic oil and gas burning heating units of several types. Prefer a young man who has from 2 to 8 years experience in heating and air conditioning and who is prepared to come in and grow with the company. The position is a senior one and would offer a very attractive future for the right man. File No. 5002-V.

ENGINEER REQUIRED FOR a metal working industry in the Ottawa valley to work on the design and maintenance of a variety of machines as well as do general plant engineering. Must have a good fundamental knowledge of machine shop practice and be able to direct the work of machinists through their foreman. Graduation from a recognized Canadian university and a few years experience in a machine shop are requisites for this position. Apply giving full particulars and recent photograph. File No. 5004-V.

AN OTTAWA ORGANIZATION requires hydraulic engineers to undertake in the hydraulics laboratory research work in either fundamental or applied studies. Fundamental work is in the field of open channel flow, wave motion, sediment transport and allied subjects. Applied studies include the development work of river regulation, harbour development and hydraulic structures — locks, dams, breakwaters and similar installations. A master of science degree with specialization in hydraulics of fluid mechanics, is required. Hydraulic laboratory work is desirable but not essential. Salary up to $5,750 per annum depending on qualifications. Apply by letter and enclose a resume of qualifications and experience. File No. 5006-V.

TWO GRADUATE MECHANICAL or electrical engineers. One as plant engineer in a small Ontario town. The other for technical and administrative work in the office of the chief engineer of the company in Montreal. File No. 5012-V.

FIRM IN MONTREAL requires high calibre personnel to fill the following executive positions. Sales manager with sound engineering background and experience in the conveyor industry. Ability to negotiate at high level. Chief engineer with wide experience on design and layout of all types of heavy material handling plant. First class knowledge of bulk handling necessary. Generous salary and commission in both cases. File No. 5020-V.

AGRICULTURAL FIRM Eastern Townships requires graduate and/or practical engineer to assume gradually responsibility for all plant mechanical, electrical, heating and construction problems. This is a good opportunity for a young man, preferably not over 35 years of age and which can lead to plant engineer within 3 years at a minimum salary of $5,000. The man we are looking for must have administrative ability and good personal characteristics to work up to management level. Starting salary commensurate with qualifications. File No. 5022-V.

WELL KNOWN MANUFACTURING firm requires the service of a fully qualified industrial engineer to survey and report on manufacturing processes. Must have knowledge and experience of production methods. Knowledge and experience of machines and tools with particular reference to low cost production. Knowledge and experience of the modern concept of quality control methods. Apply stating both qualifications and experience in full to file No. 5032-V.

# SITUATIONS WANTED

MECHANICAL ENGINEER age 32, Polytechnique 1945, bilingual. Employed as combustion engineer with large distributon of coal and fuel oil in Montreal. Extensive field experience on all aspects of fuel utilization, sales and service. Seeks employment with oil company or equipment manufacturers related to power engineering as combustion and/or sales engineer. File No. 2554-W.

ELECTRICAL ENGINEER, P.Eng., M.E.I.C., B.Sc. (U.N.B., 1927), age 42, married, 1 child, 7 years with large Canadian Electrical Manufacturer including test course, 2 years switchboard design and 3 years apparatus correspondence sales. Hold technical secondary school teacher's certificate with university and school teaching experience. Heating engineering experience (2 years) in the design of hot water heating systems and service of automatic steam generators. Am seeking a responsible position as industrial training supervisor, power plant engineer or other responsible position. Residing in Toronto and free to accept immediate employment anywhere. File No. 2878-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., (Ont.) B.Sc. (Queens) 1941, age 33, 13 years experience in manufacturing methods, process engineering, production engineering of high precision components, plant layout and engineering desires position as plant engineer or mechanical superintendent; available immediately. File No. 3272-W.

ELECTRICAL ENGINEER, B.Sc. (E.E.) 1950 Jr.E.I.C., age 33, married. Presently employed managerial capacity in sales and sales promotion, directing small sales staff. Present earnings in excess $5000.00. Varied experience in sales, sales promotion office management and with Public Utilities. Desires responsible position in sales, sales representative or in line with experience. Details of education, experience and reference upon request. File No. 3375-W.

CIVIL ENGINEER, Jr.E.I.C., Alberta 1951, Veteran, age 33, single. 3½ years experience in hydro-electric field, both in design and field work. Also experience in municipal engineering. Two years experience in airport construction with the Department of Transport. Location preference, Alberta or British Columbia. Desires position in hydro electric field, but will welcome offers from other civil engineering fields. Available on month's notice. File No. 3439-W.

CIVIL ENGINEER, M.E.I.C., 1944 graduate, now residing Toronto, desires position in commerce or industry. Experienced in heavy construction, consulting, contract negotiation, administration and personnel fields. File No. 3796-W.

ELECTRICAL ENGINEER, B.Eng., McGill, 1950, P.Eng., Jr.E.I.C., C.G.E. Test Course. Experience: design; polyphase motor design and application ½ to 600 H.P., industrial; design and construction of distribution, lighting and power installations, power factor correction, frequency conversion, system control, air conditioning and plant engineering work general; artillery officer overseas in World War II, working knowledge of French, age 35, married, three children. File No. 3859-W.

MECHANICAL ENGINEER, P.Eng., Jr.E.I.C., experienced in machine design and mechanical drafting seeks part time employment in Calgary, Alberta area. File No. 3902-W.

GRADUATE ENGINEER 1951 (Mining), age 30, is interested in position offering scope and responsibility where an engineering background is helpful (not necessarily in the mining field). Other training includes military engineering, RCAF service and business management course. Mining experience as miner, surveyor, layout engineer and mine engineer in base metal and industrial mineral operations. More recent duties have included engineering reports and studies and supervision of construction. Married, one child, available on reasonable notice. File No. 4000-W.

GRADUATE MECHANICAL ENGINEER, Jr.E.I.C., age 28, with four years experience in design and research in the hydraulic field is seeking position with a progressive company as designer and/or sales engineer. File No. 4102-W.

METALLURGICAL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (Chemistry), B.E. Nova Scotia T.C. 1952. Married, age 32. Experience includes one years as metallurgical chemist in a control lab., one year as assistant welding engineer with a steel fabricator and about one year with a research firm on ore preparation and reduction of ores. Desires technical position with firm located in Toronto area. Available on short notice. File No. 4128-W.

CIVIL ENGINEER, M.Sc., M.E.I.C., P.Eng. (Ont.), graduate 1947 is available. First class designer of all types of modern structures, inventive, enterprising and with flair for structures involving complex statistical problems. File No. 4173-W.

GRADUATE ENGINEER, B.Sc. 1951, Jr.E.I.C., P.Eng., married, 3 years varied experience in mechanical handling and municipal engineering desires position in plant, mechanical handling or industrial engineering. File No. 4207-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950 graduate, Toronto, veteran, 32, single; some research experience, over three years in chemical industry on project and design work, involving process and services, equipment and piping, instrumentation and building construction, including some estimating, purchasing, expediting and inspection. Desires position of greater responsibility in similar work or in maintenance work of a general nature. File No. 4418-W.

CIVIL AND STRUCTURAL ENGINEER, Jr.E.I.C., P.Ont. Cambridge University, 1947. 6½ years experience, civil and structural engineering in industry, consulting engineering and research. Expert knowledge in structural analysis, specialising in prestressed concrete. Presently employed in Toronto. Desires change of employment where experience could be best utilized. File No. 4467-W.

ELECTRICAL ENGINEER, B.A.Sc. Toronto, 1950, P.Eng. (Ont.), Jr.E.I.C., age 30, married, experience in industrial construction, field supervision, electrical generation and distribution, paper mill operation and maintenance. Desires position offering opportunity. Will locate anywhere. File No. 4545-W.

ELECTRICAL ENGINEER, Power, McGill 1953, S.E.I.C., age 26, married, presently employed. Experience includes Westinghouse Training Course; small motors, switchgear, household appliances. Interested in a permanent position with an opportunity for further professional development in electrical engineering field. Good references. Location Montreal only. File No. 4553-W.

CIVIL ENGINEER, McGill, 1951, Jr.E.I.C., P.E.Q., married. Presently employed as area field engineer, on large project. Experience—6 months drafting, 2½ years office engineer (quantities, costs, progress reports etc.) and 1½ years varied field engineering in heavy construction. Seeks responsible and permanent position in Montreal with firm requiring above experience, or in design office. File No. 4579-W.

CHEMICAL ENGINEER, M.E.I.C., 1937 graduate, married, Canadian, would like to locate in the Toronto area. Experienced in pilot plant design, production and management phases of organic chemical plants both in Canada and the U.S. Interested in production and in sales in the field of chemical plant equipment or engineering services. File No. 4530-W.

ENGINEERING AND BUSINESS graduate Jr.E.I.C., P.Eng. Ontario, B.A.Sc. Toronto (honours) 1953, age 24, single, C.G.E. test course, graduate tool design and sales experience. Desires position with small or medium sized company in Toronto or South Central Ontario area. Prefers manufacturing or industrial engineering position leading to supervision and management. File No. 4581-W.

A YOUNG CIVIL ENGINEER, 27, married, with Master's degree in hydro-electric structures from Columbia University, New York, and with 4½ years' practical experience in design and construction of hydro-electric projects and reinforced and steel structures in U.S.A., India, and Canada. Knows Eastern and Indian languages. Desires a suitable job with any concern working overseas in any part of the world, preferably in Eastern or Middle Eastern countries. Presently employed. File No. 4582-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng. (Que.) B.Eng. McGill 1951, single, age 26, 1½ years' experience technical assistant sales in rubber industry, assistant construction engineer for new pulp and paper mill in New Zealand, assistant power engineer pulp and paper mill in Australia. Desires position with small manufacturing company in Montreal. File No. 4584-W.

CIVIL ENGINEER, university graduate, P.Eng., age 38, married, one child, with practical experience in road construction, surveying, steel structures and reinforced concrete (industrial structures and heavy foundations for power stations steel mills etc.) both with contractors and with consulting engineers, used to work on own initiative and responsibility, attending to correspondence, site meetings and negotiations with clients, some knowledge of accounting and financial matters, at present with consulting firm, desires responsible position with construction company, consulting engineers or investment organization requiring the services of a competent engineer, preferably but not exclusively in Toronto. Apply File No. 4586-W.

MECHANICAL ENGINEER (Polish University College, London, 1951) specializing in aero and thermodynamics. Three years' experience as designer and draftsman in pneumatic and electric equipment. One year in Canada. Interested in position in research or development. Age 35. Will go anywhere File No. 4587-W.

CIVIL ENGINEER, McGILL 1950, with five years excellent construction experience (design, supervision of construction, costing). Two and a half years on construction with Canada's largest textile company. Recent overseas experience in pulp and paper mill construction, oil refinery construction, building design. Desires position with company allied with the construction industry where there is a chance for responsibility and advancement. Willing to work anywhere but preferably in the Toronto-Montreal area. File No. 4588-W.

DIPLOMA ENGINEER—CIVIL, age 41, with 10 years of varied continental and British experience on the design of concrete buttress, gravity and arch dams, weirs, sluices, tanks, fishpasses, large steel welded pipe lines, and structural steelwork, reinforced concrete and prestressed concrete bridges and industrial structures with shel. roofs. Seeks responsible position in British Columbia, Ontario or Quebec. File No. 4590-W.

MECHANICAL ENGINEER, London University 1948. Experience includes 6 years, project and plant engineering in chemical industry, U.K. and Argentina. Presently employed in Canada in non-technical capacity. Desire position in line with previous experience. Location immaterial. File No. 4596-W.

CIVIL ENGINEER, B.Sc. Manitoba, M.E.I.C., ten years varied experience as designer and field engineer on plant construction and maintenance. Supervised structural and mechanical installations in Canada's largest pulp and paper, foundry, and automotive industries. Seeks position as assistant to resident or plant engineer with progressive company. Highest references and executive evaluation reports. File No. 4597-W.

PROFESSIONAL ENGINEER with master's degree in business administration, bachelor's degree engineering, 3½ years utility, 6 years manufacturing and sales, test course. Author technical papers. Accustomed to responsibility. Age 30. Seeks position with future. File No. 4599-V.

MUNICIPAL ENGINEER, M.E.I.C., age 46, bilingual, seeks managerial or senior engineering position with an expanding municipality. Also would consider work for a consulting firm specialising in town planning, design of subdivisions and municipal services. The advertiser would require some 2 or 3 months notice from his present position of project engineer for a large urban subdivision. File No. 4600-W.

MECHANICAL ENGINEER Jr.E.I.C., P.Eng., married, 7 years design experience in pulp and paper equipment, heavy industrial and marine equipment. 4 years research and development in combustion engines mainly diesel. File No. 4601-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., grad. U. Riga, Latvia, age 43, family, 8 years preliminary and 14 years responsible practice. Latter includes: heating and plumbing, design and installation; industrial engineering, process, research, production, maintenance, design and supervising of plant expansions; construction engineering; roads—survey, design, construction. Four years of this experience in Canada and five under U.S. army in Germany. Available for an engineering appointment in Montreal area, end of April 1955. Interview—Jan. 1955. File No. 4602-W.

ELECTRICAL ENGINEER, B.Sc. E.E., Man. 1950, Jr.E.I.C., age 26, married, 1 child. Four years with public electric power utility, including supervision of transformer repair dept., supervision of recloser servicing, experience in metering installations and meter testing, and experience in various operational problems of power lines and associated equipment. Seeks position in work related to experience, preferably design, with manufacturer, power utility, or industrial concern where conscientious work and ability result in opportunity for advancement. Available on suitable notice to present employer. File No. 4603-W.

MECHANICAL ENGINEER, age 33, married, no children, University of Toronto 1943, veteran. Ten years industrial experience, four years design, engineering, manufacturing, production and purchasing, six years application, marketing, sales and service. Experience covers power plant equipment, pumps, feed water conditioning apparatus, boiler controls, materials handling equipment, electric, hydraulic and pneumatic control systems, petroleum products, mining machinery and power transmission machinery. Presently employed but desires challenging work for aggressive firm with opportunity for administrative and/or management career in sales, service or manufacturing. Would prefer Ontario, Alberta, or British Columbia. Particulars willingly supplied to interested emloyers. File No. 4604-W.

MECHANICAL ENGINEER, Australian. Graduated 1943. A.M.I.E. Australia, 32, married. No children. Experience includes field installation of mechanical or electrical plant, army workshop. Supervision large scale refrigeration unit. Design development and manufacture of welded steel pipe plant. Physical testing, instrument calibration, materials investigation, lecturing in mechanical engineering and laboratory supervision. Factory management. Consultant on steel fabrication factory design and layout. Recently arrived Canada. Desires position in or near Montreal. Available immediately. References. File No. 4605-W.

CIVIL ENGINEER, B.Sc., P.Eng., M.E.I.C., age 30, family. Desires to become permanently established in large city, preferably in Western Canada. Three years experience as city engineer in charge of public works and utilities. Experienced in sewer and water main installation, sidewalk and curb construction, drainage, paving. Four years experience as resident engineer on highway construction, four summers on federal government geodetic and irrigation surveys. Further particulars will gladly be forwarded to interested employers. File No. 4606-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., age 36, married, wide experience in plant engineering, maintenance, plant layout, design and development in industrial and aeronautical field. Proven executive ability. Presently employed in managerial capacity. Wishes permanent position in progressive organization requiring initiative and ability. Montreal area preferred. Resume on request. File No. 4607-W.

MECHANICAL ENGINEER, P.Eng., Jr. E.I.C., veteran 4 years R.C.N. B.Sc. mechanical engineering, Queen's 1950. Age 34, married, 2 children. Administrative experience obtained in a large chemical plant, engineering and maintenance department, which included 3 years supervising maintenance and 1½ years engineering work on material handling, corrosion piping, and packaging problems. Sound practical experience gained when obtaining machinist fitter's Journeyman's papers. Desires a challenging responsible position with good opportunities situated in Ontario. File No. 4613-W.

MECHANICAL AND INDUSTRIAL ENGINEER, Jr.E.I.C., P.Eng. (Ont.), 5 years experience in plant engineering and layout, structural steel design, foundations, buildings, heavy machinery installation, piping, and process investigations. Above included drafting, detailing, cost estimation, and construction supervision. Have also had 2 years experience in townsite engineering and development, lot surveys and related work. Desires part time work with construction or engineering firm or private individuals in Montreal, Ottawa, Cornwall area. Free to travel. File No. 4614-W.

ELECTRICAL ENGINEER, M.Sc., graduate Delft Technological University, Holland, 25 years old, married, specialised in the power side: electric and diesel electric traction, generators, motors, transformers, high and low tension cables and lines, control and protective equipment, experience 8 months. Fluent English, German, French and Dutch. Seeks position in line with his education. Available in 2 weeks anywhere. File No. 4615-W.

CIVIL ENGINEER, Jr.E.I.C., Polytechnique '51, 26, single, 4 years experience with the RCAF construction engineering branch, supervision of roads and runways construction, reconstruction of various buildings, experience with all construction trades, inspection of construction sites. One year as resident engineering officer at RCAF unit requiring knowledge of maintenance and operation of diesel engines, air conditioning equipment, refrigeration, municipal engineering and related subjects. Will be ready for employment in April '55. Administration experience, perfectly bilingual, would feel capable of handling assistant town engineer position for medium size community. Will travel if necessary. File No. 4616-W.

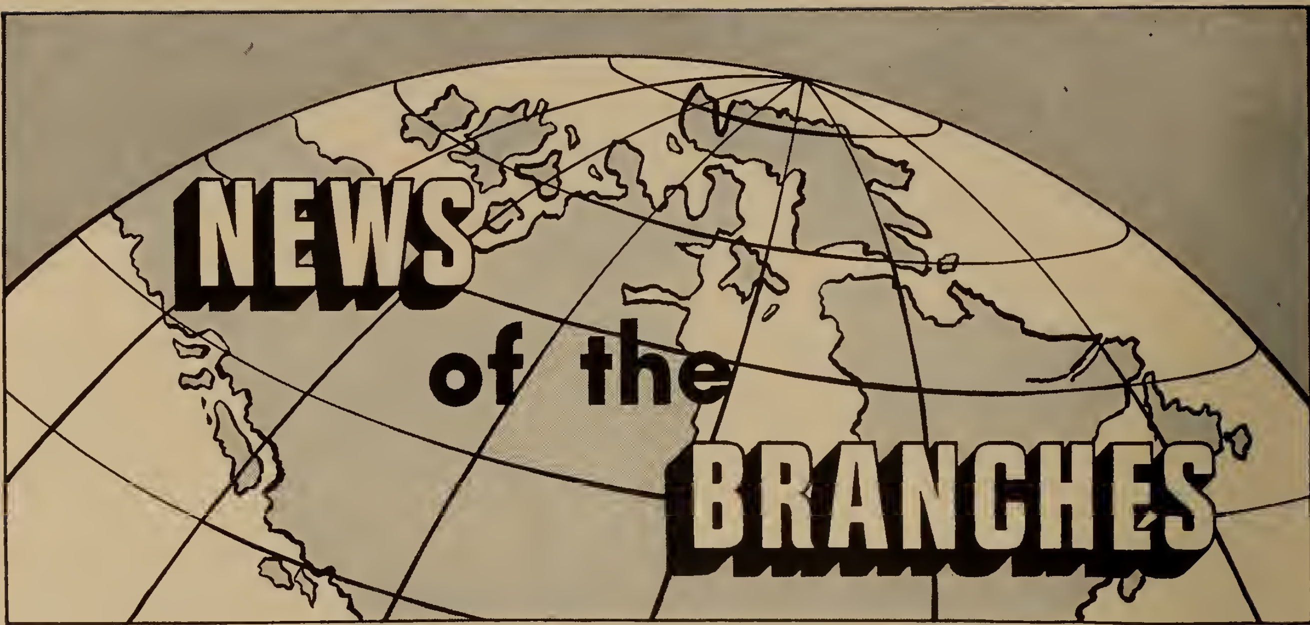
CIVIL ENGINEER, Jr.E.I.C., graduate N.S.T.C., 1952, age 31, married with children, desires position in maintenance with firm engaged in residential construction and/or community planning. Also interested in inspection services related to the above. Presently employed by research organization in Ontario. Available on reasonable notice to present employer. File No. 4617-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.A.Sc. (E.E.) U.B.C. 1950, married. C.G.E. Test course. 3 years experience with electrical manufacturer. Presently employed. Can arrange interview in Ontario or Quebec. Will accept opportunity anywhere in Canada. Public Utility or Industrial Plant maintenance preferred. File No. 4618-W.

ELECTRICAL ENGINEER, (Belfast, N. Ireland 1949), P.Eng., Jr.E.I.C., graduate I.E.E., age 25, married with 2 children desires position in Montreal. Experience includes 5 years indentured electrical engineering apprenticeship, 2 years test and inspection engineer, 2 years electrical machine design, 3 years Canadian experience in power lighting and distribution. Available on one months notice to present employer. File No. 4619-W.

MECHANICAL ENGINEER, M.E.I.C., age 36, British, 2½ years in Canada, seeks immediate employment. 12 years experience in the army and civilian life in mechanical handling and construction equipment. Since arrival in Canada employed as lubrication and maintenance engineer in the pulp and paper industry. Will consider work in any field of mechanical engineering. File No. 4620-W.

MECHANICAL ENGINEER Swedish Technical Institute, age 38, married. Experience includes 15 years in the oil industry, as project engineer and on the construction of oil plants which includes installation of pipelines, production and methods planning; design and service of burners and equipment for gasoline, fuel oil, butane-propane gas and petroleum industries. One and half years in Canada employed as oil burner mechanic and draughtsman. Seeks opportunity where former experience can be best utilized. Location immaterial. Available immediately. File No. 4625-W.




**Activities of the Forty-seven Branches of the Institute**
**and**
**abstracts of papers presented at their meetings**

## Belleville

J. G. Todds, M.E.I.C.,
*Secretary-Treasurer*

E. L. Littlejohn, M.E.I.C.,
*Branch News Editor*

***Hurricane Hazel Intervened***

The Belleville Branch of the Engineering Institute of Canada held its first meeting of the 1954-55 season on October 18 at the Masonic Temple. Approximately 35 members were present.

The chairman, Mr. Drysdale, opened the meeting. After a brief business discussion, Mr. Whittemore was called on to introduce the guest speaker. The speaker, R. J. Law, is corrosion engineer with the International Nickel Company of Canada, Ltd., at their development and research section in Toronto. Mr. Law had planned to present a film on corrosion, but Hurricane Hazel intervened and the film did not arrive in Belleville in time for the meeting. An expert on corrosion, this bothered Mr. Law not a bit and he went on to conduct a question and answer discussion on corrosion problems of general interest.

The speaker was thanked by S. Sillitoe.

## Eastern Townships

J. P. Champagne, Jr.E.I.C.,
*Secretary-Treasurer*

H. W. Percival, Jr.E.I.C.,
*Branch News Editor*

***President's Visit***

Some 100 members and their wives were present at the opening dinner meeting of the Eastern Townships Branch held at Hillcrest Lodge on Sept. 15.

President D. M. Stephens, was guest of honour and gave a short address to the members on the physical aspects of nation building. He outlined the part played by engineers in the development of Canada over the years, and particularly in the last decade since the development of the north has started. This has widened Canada's "economic ribbon". He attributed this development to sound investment policy on the part of the government, outstanding statesmanship and tremendous engineering competence.

Mr. Stephens, was paying one of his two official visits to Quebec Branches, and he thanked members of the Eastern Townships Branch, as well as officials of Sherbrooke, for their kind hospitality.

***More Engineers Needed***

In making an appeal to the group, Mr. Stephens told them that Canada, at the present time, is in need of more and more engineers to help speed up the economic growth of the country so it will coincide with Canada's geographic breadth.

Mr. Stephens was welcomed on behalf of the Provincial Minister of Lands and Resources, Hon. J. S. Bourque, by Gaetan Coté, and on behalf of the city by Pro-mayor Sylvio Rousseau, who also thanked the members of the Institute for their fine work on the study of Sherbrooke's water problems.

Said Mr. Rousseau, "The Institute decided one thing but the citizens decided another."

Chairman of the Eastern Townships Branch, Gaston Massé, officially welcomed all members and their wives and said that they should be honoured in receiving the visit of their newly-elected president, who was making only two visits to Quebec branches, one in Sherbrooke and the other in Montreal.

Mr. Massé urged members to keep their branch alive by attending the regular monthly meetings which will be held in the New Sherbrooke Hotel. He paid tribute to retiring chairman, J. C. Critchely, of Magog, and honorary Chairman George Dick, for the work they have done promoting the Eastern Townships Branch.

The general secretary, Austin Wright, delivered a short address and mentioned the tremendous expansion of the Institute over the past year. He mentioned that the budget this year has been set at a half a million dollars, and added that, to his knowledge, it was the largest budget of any professional group in Canada.

The speakers were introduced by Bruce Bradley, vice-chairman of the Eastern Townships Branch, and were thanked by J. H. Barnacal.

## Kitchener

J. F. Runge, Jr.E.I.C.,
*Secretary-Treasurer*

J. L. Fair, M.E.I.C.,
*Branch News Editor*

***Shell-moulded Castings***

The first technical meeting of the season was addressed by Robert Andrews of Shell Cast Alloys, of Guelph, Ontario. Mr. Andrews' paper was titled "Significance of Precision Shell-moulded Castings, and included a brief sketch of the history of the process, originating in Europe and being developed in Britain and America.

The paper described the precision obtained—generally about two thousands inch per inch of length; and the finish—frequently better than one hundred micro-inches, as well as the rela-

tive tool costs compared to conventional sand casting methods. Using samples of several castings now being produced Mr. Andrews illustrated his talk. He called attention to the economies effected by using the process, comparing it with other methods such as forging, permanent molding, die casting, and lost wax castings. Noting the great reduction in removal of metal to produce finished parts he ventured a prophecy that the trend in equipment used in metal working might be in the direction of substituting grinding for the heavy cutting work usual with conventional castings.

A lengthy discussion followed the presentation indicating a very lively interest among the members. A. J. Girdwood, past chairman thanked the speaker and the meeting was adjourned for refreshments.

The Branch Chairman James Todd has recently moved to Toronto, Vice-Chairman L. J. R. Sanders is therefore acting chairman.

## Nipissing and Upper Ottawa

E. A. Watson, M.E.I.C.,
*Secretary-Treasurer*

Allan T. McKerrall, M.E.I.C.,
*Branch News Editor*

#### Dinner Meeting

Twenty-eight members and guests of the Nipissing and Upper Ottawa Branch of the Engineering Institute of Canada assembled at the Marine Room, Trout Mills, Wednesday evening, September 15, for the first dinner meeting of the season.

J. W. Millar, chairman of the Branch for the current season, was in charge of the meeting. Following dinner and a short business session, a most informative talk on sign making was presented by Ced Price of Price Signs, North Bay, ably supported by demonstrations of the silk screen process and glass blowing by Emmett Rainville and A Blondin, respectively.

Mr. Price who was introduced by R. R. Prescott, briefly outlined his extensive background in the advertising field before becoming established in North Bay. He explained how advertising has grown from a comparatively simple beginning to a complicated business with unlimited power when properly interpreted and applied. The many regulations and restrictions governing the use of signs and displays are a constant problem for the advertising man though necessary for adequate control.

Mr. Rainville performed a demonstration of the silk screen process for reproducing coloured signs and displays in quantity, turning out a two-colour sketch graphically illustrating this method.

Mr. Blondin described the manufacture of illuminated tubular signs with particular reference to the cold cathode process now coming into prominence.

A question period followed the demonstrations after which a hearty vote of thanks was extended to Mr. Price and his associates on behalf of those present, by J. Chandler.

#### October Meeting

The October meeting of the Nipissing and Upper Ottawa Branch was held on Oct. 20 at the Manor Hotel. J. W Millar, Branch chairman was in charge of the dinner meeting which was attended by thirty-two professional engineers and guests from Sturgeon Falls, Temiskaming and North Bay.

#### Jet Age

A sound film entitled "Jet Age" was presented through the courtesy of the A. V. Roe Company of Canada. Flt. Lt. Paul Kent of the R.A.F. and Flt. Lt. W. J. Brown of the R.C.A.F. stationed at North Bay were present to take part in the discussion period following the film.

"Jet Age" was made to publicize the accomplishments of Canadians who have designed and built jet planes. Specifically the film deals with the manufacture and assembly of the CF-100 at the Avro plant at Malton. It shows the construction and explains the principle of operation of the famous Orenda turbo jet engine and follows the making of the component parts of the engine and body through to the assembling of the completed plane.

It was pointed out that the CF-100 is the most heavily gunned fighter in the world. Weighing 17 tons it has supersonic performance and is highly manoeuverable.

The enthusiastic discussion following the film indicated that the jet airplane has high local interest. Flt. Lt. Brown and Flt. Lt. Kent very capably an-

swered questions in an intelligent and interesting manner. Norm Burke expressed appreciation for their efforts on behalf of those present.

Frank Marshal outlined the plans being formulated for the annual Ladies' Night. It is to take the form of a buffet supper at the White Oaks Inn, Temiskaming on November 5. The Sophisticates will provide music.

## St. Maurice Valley

L. A. Pattison, Jr.E.I.C., *Secretary-Treasurer*

*Branch News Editors:*

C. Kerry, Jr.E.I.C., Shawinigan Falls

M. Wood, Jr.E.I.C., Trois-Rivieres

***Active Year Foreseen***

An extremely active year is foreseen by the St. Maurice Valley Branch. A new organizational set-up is being tried out with local group meetings in each of the cities of Shawinigan Falls and Trois-Rivieres and more comprehensive joint branch meetings are being planned.

***Woodlands Organization***

The Three-Rivers group opened their meetings with an interesting talk by L. L. Wetmore, manager of the woodlands division of the St. Lawrence Corporation on October 5, 1954, at the St. Maurice Hotel.

Mr. Wetmore's paper dealt with the organization necessary to keep a newsprint mill producing 200,000 tons per year supplied with sufficient wood. He pointed out that as much as 50 per cent of the cost of the finished product will be woodlands expense. The mill must have extensive cutting areas to insure a steady supply of wood—2,000 square miles in fact and this necessitates a huge capital outlay. Rights of tenure, obtained from the government, may cost upwards of $800.00 per square mile. In addition ground rentals, royalties on wood cut and education taxes must all be paid for and constitute a heavy base load of expense.

Although more mechanization of logging operations is being steadily carried out, Mr. Wetmore pointed out that much handling must still be done by horses, with tractors being used for heavy grades. This together with transportation of woods workers and the absolute necessity of access to fires requires an extensive system of roads in the forest. Not unusual is 200 miles of road costing $5,000 per mile to build. Winter upkeep is particularly arduous and expensive.

Base camps are built on which subsidiary camps depend. These must have supply depots, accommodations for personnel, and garages capable of handling everything from tractors to outboard motors. Such a base camp might cost around $200,000 and contain many thousands of dollars of supplies. Subsidiary camps might cost $10,000 and are now built to last 2 or 3 years. They are built with an eye to the comfort of the workers and have comfortable quarters and electricity.

Questions resulted in the interesting sidelight that the average worker consumes 6,000 calories compared with 2,500 for an office worker. His power saw cuts out the tedious task of sawing but his production is up and it takes brawn to tote the saw.

Construction of dams to control the waterways, booms to control the logs and tugs and other watercraft, make up another heavy expense which must be met by the woodlands division. Some of the larger dams might cost as much as $75,000. Many headaches exist for the drivemen, such as sudden freeze-ups and thaws with consequent risk of loss of a large part of the cut.

In addition to these more or less estimable operations, the woodlands division must spend much time and money for more indirect but essential services; fire prevention and detection, insect extermination and control, and protection against tree disease.

All these operations and services require a considerable amount of administration and control both in the woods and at central headquarters. Since man-

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agement must know what their raw material costs will be in order to predict selling prices, the woodlands division must predict events for a year ahead. It is a tribute to good administration and efficient operation to record that actual costs seldom vary by more than 2 or 3 per cent from estimates.

Mr. Wetmore's talk was very much appreciated and all agreed with his closing remark that woodlands operations affect every Canadian and should be of interest to everyone.

## Quebec

R. Desjardins, m.e.i.c.,
*Secretary-Treasurer*

The golf championship of the Quebec Branch again changed hands over the weekend of Sept. 11.

P. A. Dupuis, 1952 winner, chalked up a gross score of 87 in the annual tournament at the Royal Quebec Golf Club to oust last year's champion, C. E. Rochette, of Murray Bay by a two-stroke margin, and regain possession of the Davie Cup.

Emilien Dagenais of Montreal, placed third with 90.

Ludger Gagnon captured the Talbot Cup, awarded the player scoring the best net with a count of 71. Guy Archambault, of Montreal, placed second among the net scorers with 76, while Pierre Duchastel was third with 77.

Fifty-three men and 13 ladies took part in the tournament proper, with the ladies playing but nine holes. Mrs. Jean Proulx topped the ladies field with gross 48, followed by Mrs. Jachim Tessier with 55, Mrs. Paul Vincent had the best net, 42, followed by Mrs. A. E. Paré with 45.

Fred Cribb set the pace among the invited guests with a gross 91, while Daniel Noel chalked up the best net, 81.

A putting contest was held for men and ladies not taking part in the tournament. Mrs. Guillaume Piette led the ladies' section with 23 for the nine-hole round, with Mrs. Roger Desjardins and Mrs. René Rioux tied for second with 24. Mrs. Y. Jobin, Mrs. G. Sarault and Mrs. E. DesRivieres had 25. P. Langlais won the men's putting contest.

Charles E. Plamondon was chairman of the tournament, and carried out the prize presentation ceremonies, which followed the buffet. Roger Desjardins was the starter.

A dance at the Royal Quebec, topped off a lively day's activities.

## Sudbury

A. D. Finlayson Jr., e.i.c.,
*Secretary-Treasurer*

A. Eldridge, m.e.i.c.,
*Branch News Editor*

The first fall meeting of the Sudbury Branch of the Engineering Institute of Canada was held on Saturday, October 2. Forty-five members and visitors attended and were taken on a tour of the International Nickel Company's Copper Cliff plant. There was considerable interest shown in the various sections of the plant visited, which included the concentrator, roasters, reverberbatory furnaces and converters.

The field trip was followed by dinner at the Granite Club in Sudbury. During the business session, Frank Orange, Branch chairman, introduced the various committee chairmen to the gathering and they outlined their programs for the coming year.

It was announced that Bob Moore had been appointed for a two-year term as Branch councillor, succeeding Russ Eaton.

Several visitors from the Nipissing and Upper Ottawa Branch at North Bay were present and were welcomed by Bill Black. Jim Millar, chairman of the Nipissing Branch, expressed the thanks of the visitors.

## Toronto

L. F. Bresolin, Jr.e.i.c.,
*Secretary-Treasurer*

H. Fealdman, Jr.e.i.c.,
*Branch News Editor*

**Members' Social Evening**

As an "ice breaker" to the new season a members' social evening attended by about 100 members was held in the Prince George Hotel on September 30. After a buffet supper of gargantuan proportions, a "Gambling Casino" was

operated so that members could try their skill at such time honoured pastimes as "shooting crap," roulette, crown and anchor, etc.—all with phoney money, of course. At the end of the evening when prizes were to be awarded to the winner of the most phoney money, it was found that the piles had to be measured instead of counted! All those present voted it a most enjoyable evening and an excellent start to what is hoped will be a successful 1954-55 season.

#### The Engineer and the Contractor

G. W. Miller, president, American Railroad Engineering Association, and Engineer Maintenance of Way, Canadian Pacific Railroad, Toronto, addressed the Branch on October 7 on the complicated relationships between the engineer and the contractor. Mr. Miller spoke as an authority on the subject of the CPR and, indeed, has recently given evidence before the Select Committee of the Ontario Legislature, investigating the practices of the Department of Highways.

As an engineer for a privately owned concern Mr. Miller feels that an invitation to tender sent out to selected contractors is likely to result in more realistic and satisfactory bidding than the open invitation, although it is realized that this can not always be done in the case of public concerns. Mr. Miller felt, very strongly, that the engineer has responsibilities to the contractors, not only to the successful bidder but to the unsuccessful ones as well. The responsibilities include: ensuring that pre-engineering is adequately carried out before calling for tenders so that the contractors may know accurately on what they are bidding; setting the closing date for tenders so that contractors neither have to work over a weekend in figuring the bids nor wait more than a day in learning of the contract award; to ensure that any "extras" which might crop up are adequately authorized in writing by the engineer.

Mr. Miller is in favour of the "cost plus fixed fee" system in cases where there may be some doubt as to the extent of the work until it is actually carried out. However, he is insistent that a top figure for the cost of this work be agreed before commencement.

These and many other topics intimately connected with the whole subject of bidding and tendering were discussed in a most pleasant and interesting manner. Following the talk, a lively discussion ensued which, unfortunately, had to be cut off by the time limit. In all a most interesting evening was enjoyed by those present and a hearty vote of thanks was accorded to Mr. Miller by the chairman of the Toronto Branch of ASME since this had been a joint meeting.

### Lethbridge

R. D. Hall, Jr.E.I.C.
*Secretary-Treasurer*

P. Harding, Jr.E.I.C.
*Branch News Editor*

#### Joint Meeting with A.S.C.E. and Field Trip

A call for more engineers to enter the construction industry, and a visit to the mighty Tiber dam which is under construction in the valley of the Marias River about 50 miles southeast of Shelby, Mont., highlighted a joint meeting of more than 50 members of the Lethbridge Branch of the Engineering Institute of Canada, their wives and families, and members of the Montana section of the American Society of Civil Engineers Saturday, September 11, 1954.

The construction firm of James and Wunderlich began work on the $12,900,000 project in September 1952 and is expecting to complete the job during December 1955. At the present time the project is between 50 and 60 per cent completed, on a dollar basis.

#### The Tiber Dam

The immense dam, 38 feet higher and 900 feet longer than Niagara Falls, is the key structure of an undertaking to irrigate 127,000 acres of 990 farm units to the north and east of the Marias River, and is also integrated for flood control purposes with other dams in the


Aluminum Company of Canada officials inspect in transit an all-welded runner for an impulse type turbine installed at the Kemano Power Development. Operating under a 2,500 ft. head, this turbine generates up to 150,000 hp.

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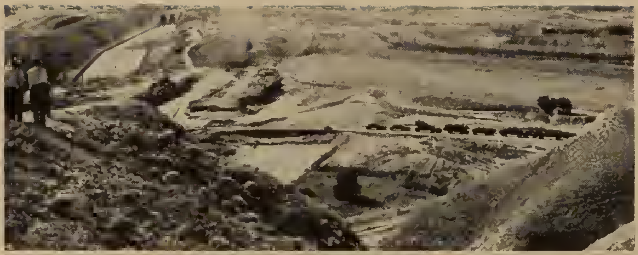

Left: A view of construction of the Tiber dam, Montana. Lower left: R. D. Hall, Jr.E.I.C., secretary-treasurer, Lethbridge Branch; A. E. Lawrence, M.E.I.C., chairman, Lethbridge Branch; J. G. Hoge, president, Montana Section A.S.C.E. Lower right: American and Canadian engineers in front of the U.S. Bureau of Reclamation office at the Tiber damsite.

Missouri River Basin. The work was engineered by, and is under the direction of the United States Bureau of Reclamation.

When completed the Tiber dam, named after a tiny railway siding 14 miles north, will have a crest length of 4,300 feet, be 205 feet high, and 1,300 feet wide at the base. Adjoining the western end of the dam is a 17,000-foot long dike which has a maximum height of 60 feet. Both dam and dike are of rolled-earth fill type construction.

The dam and dike will contain a grand total of 11,310,000 cubic yards of earth, sand, and gravel.

The reservoir will hold 1,337,000 acre-feet of storage extending 24 miles to the north-west with a maximum width of four miles, supplied from a drainage area of 4,375 square miles. The reservoir will have a surface area of 22,180 acres.

When fully completed the water will flow through a mile long tunnel into 77 miles of main canal and 140 miles of laterals. In some places the main canal will flow through cuts 80 feet deep.

The horseshoe-type canal outlet has a twin-tube inlet, with a capacity of 2,200 cubic feet per second. The length of the outlet structure is 600 feet under the present contract, and will be completed in the future under another contract.

To enable construction of the dam, the river is at present flowing through a 14-foot dia., 1,700 ft. long concrete diversion tunnel which has a capacity of 5,000 c.f.s. at 100 feet of head. Upon completion of the dam the diversion tunnel will serve as the river control outlet. However, the present entrance will be sealed and the water will flow into the tunnel through concrete trash racks constructed well above the reservoir bottom so as to permit the outlet to be above any sedimentation.

Saturday, following a welcome by W. A. Sanford, construction engineer of the U.S.B.R. and F. A. Bleeker, superintendent of the contracting firm, the Southern Alberta and Montana engineers drove to a vista point overlooking the project. They then moved on to the canal outlet-works, walked through the concrete tubes, and saw where the control gates will be placed.

Following this the tour drove over the dam to one of the borrow areas where gravel was being loaded into 30 yard bottom-dump Euclid earth-movers at a rate up to 30 yards per minute. The Euclid loader was pulled by two Allis-Chalmers crawler tractors—one a model five and the other a model 15. As the loader moved forward it cut into a bank of the borrow pit and loaded the Euclids by means of belt conveyors.

The borrow area is two and a half miles from the damsite with the earth carriers taking approximately 20 minutes per round trip. Powered by Cummins diesel engines, the giant movers are capable of speeds up to 40 miles per hour empty, and 25 miles per hour loaded.

Almost all of the 21,300-foot long dam and dike structures will be faced with riprap blasted from quarries in the Sweet Grass Hills, 40 miles from the dam, and only 10 miles south of the Canadian border. The riprap will vary from a minimum of half a cubic foot to half a cubic yard in size.

From the borrow area the tour drove to the dike, and along its crest to the spillway bridge. Here U.S.B.R. and com-



pany engineers explained the method of construction of the spillway and its design. Overflow will be controlled by three 32-foot by 20-foot gates, and the spillway will have a capacity of 51,700 c.f.s. The spillway varies in width from 100 feet at the crest to 200 feet in the stillbasin. The concrete structure is 1,336 feet long.

From the spillway bridge the tour was able to overlook the construction of the dam where the earth-movers dumped their loads which were pressed down into an impervious barrier with sheepfoot rollers. At the present time, 7,000,000 cubic yards of fill have been rolled into place. They try to move 50,000 yards every day, or 1,000,000 yards a month.

Immediately northwest of the spillway bridge the visitors were able to watch the aggregate processing plant in operation. The aggregate plant has a capacity of 100 tons per hour and the "Noble" concrete batch plant, with two 2.25 cubic yard mixers, has a capacity of 120 yards per hour.

The tour spent almost an hour on the spillway bridge watching the many operations of the project being carried out.

From the bridge the visitors drove back to the U.S.B.R. office where they looked over plans and maps of the project.

#### Dinner and Welcomes

At 7 p.m. the engineers and their wives were served dinner in the contractor's mess hall and heard short talks by Jim Hoge of Great Falls, president of the Montana section of the A.S.C.E., E. A. Lawrence of Lethbridge, chairman of the Lethbridge Branch and Mr. Bleeker.

Mr. Hoge welcomed the Canadians and introduced Dr. W. H. Fairfield of Lethbridge, and two East Asian engineers, Mr. William Chen of the Taiwan Power Co., Taipei, Formosa; and Mr. Uthai Charm Reon Prucksa of Thailand, who were visitors at the project.

Mr. Bleeker explained the set-up of the construction camp and described the $3,000,000 worth of machinery used on the project, and gave a brief outline of the problems of the construction industry.

#### More and Better Engineers Needed

Mr. Bleeker said that today the construction industry has outranked farming as being the leading industry in America. However, he added, the competition is steadily getting keener, and explained that last year construction firms averaged a two per cent profit.

He said that cost of labour and machines is steadily rising and the industry is beginning to look sick. One reason for the industry's present crisis, Mr. Bleeker said, was the lack of skilled and efficient personnel.

"We need more and better engineers. We have a good field for engineers in construction work," he said, and added that he thought the universities may be letting the industry down. He suggested more emphasis be placed on construction work, supervising construction work, estimates, machinery and its maintenance.

Mr. Bleeker, himself a graduate engineer, said he wished more young engineers would be willing to take advantage of the opportunities of the industry.

# For *positive* bearing protection on Military Jeeps-

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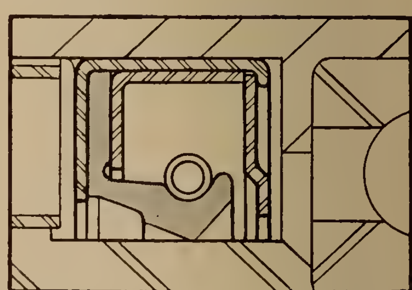

Installation of Model 65 KLOZURE Oil Seal on the output shaft bearing of the Spicer "transfer case."

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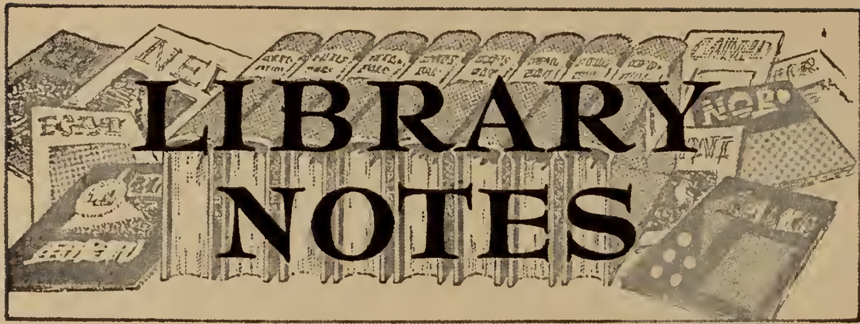


## Additions to the Institute Library

**Reviews — Book Notes — Abstracts**

### BOOK REVIEW

**Techniques of plant maintenance and engineering, 1954.** New York, Clapp and Poliak, 1954. 291 pp., $7.50 (U.S.).

This volume, the fifth in the series, contains the proceedings of the Fifth Plant Maintenance and Engineering Conference, held concurrently with the 1954 National Plant Maintenance and Engineering Show in Chicago. As in previous years, all the prepared papers delivered at the meeting are reprinted in this book, as are the questions and answers following them, and summaries of the twenty round table discussions, each of which lasted five hours.

The topics considered at the two general sessions were "planning and scheduling maintenance work", and "maintenance cost control and budgeting". At both sessions the presentation of papers on the topics was followed by question and answer periods.

The sectional conferences followed the same pattern, and dealt with a variety of topics; preventive maintenance, training for maintenance work, sanitation, work measurement, corrosion control, hospitals, medical departments and first aid rooms, and waste disposal.

Several of the round table discussions were devoted to specific industries, such as paper mills, steel mills, chemical plants, etc., whilst others covered a variety of topics involved in maintenance work.

Many of the papers are illustrated with charts and diagrams, and the inclusion of the questions prompted by the papers increases both the value and interest of the book. The editors estimate that the answers to thirteen hundred questions are given.

As in previous years this symposium will be of great interest to all maintenance engineers, and is a valuable addition to library. S.C.

### BOOK NOTES

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*Book notes marked by an asterisk have been provided through the courtesy of the Engineering Societies Library in New York.

**Bibliography of books and published reports on gas turbines, jet propulsion, and rocket power plants.** E. F. Fiock and Carl Halpern. Washington National bureau of standards, 1954. 110 pp., 50 cents (Suppl. to N.B.S. circular 509).

This bibliography covers publications issued from January 1950 to December 1953, and contains some five thousand references. Literature covered includes both books and periodicals and the references are arranged chronologically under subject, the subjects being listed in the table of contents. There is no author index.

**Chimie et structure cristalline.** R. C. Evans. Paris, Dunod, Montreal, Fomac, 1954. 331 pp., figs., $17.50.

The author's aim in this book, as stated in the preface, is to make a critical study of the results obtained from the X-ray analysis of crystals and to evolve several principles from these results. He has termed his study "crystallochemistry" and relates it to the fields of the chemist, physicist, metallurgist, geogolist and biologist. Only enough crystal structures are described to illustrate the theories presented. The first section of the treatise discusses the crystalline lattice; the different types of interatomic bonds and quantitative theory. The second section applies the theories of crystallochemistry (i.e. the relation between the internal structure of a body and its physical and chemical properties) to metals, alloys, ionic and molecular compounds.

**Comparative bridge designs.** J. G. Clark, ed. Toronto, Lincoln Electric Co., 1954. 211 pp., diagrs., $2.50 (U.S.).

Published in the United States by the James F. Lincoln Arc Welding Foundation, this book presents plans illustrating the advantages obtained by using welded bridges. All the material included was selected from the award program sponsored by the Foundation in 1952.

Various types of bridge are covered: continuous girder bridges, prestressed girder bridges, simple beam spans, simple trusses, continuous trusses, and arches. Reproductions of the original drawings are included, together with the designers' discussions and descriptions.

***Electrical transients.** L. A. Ware and G. R. Town. Toronto, Macmillan, 1954. 222 pp., $4.75.

This textbook, designed for junior and senior students, uses the Laplace transform freely in a quasi-rigorous manner suitable for students with no mathematics beyond differential equations. In the treatment of certain topics, classical methods are also employed. Material covered includes RL, RC, RLC, and vacuum tube circuits; compound, switching, and transition transients; non-sinusoidal applied emfs; and repeated and discontinuous functions.

**Electronics for everyone.** Monroe Upton. New York, Devin-Adair, 1954. 370 pp., illus., $6.00 (U.S.).

The author assumes no electrical knowledge on the part of his reader, but explains in simple language the discoveries and inventions of the past which have made possible the present day applications of electrical energy.

The workers whose names are associated with the early work on electricity are discussed, Faraday, Volta, Tesla, Ohm, Ampère and Franklin, as are Zworykin and Farnsworth of more recent date. The author also discusses radio, high-fidelity phonograph reproduction, radar, television, electronic cooking, etc.

This book should interest everyone from the high school student on, and the various diagrams and the index increase its value.

***Engineers' dreams.** Willy Ley. Toronto, Macmillan, 1954. 239 pp., illus., $4.25.

**Subscriptions**

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Nine projects that could be accomplished if it were not for political and economic difficulties are the subject of this book. These include a tunnel under the English Channel, "seadromes", harnessing volcanoes and hot springs, creating a lake in the Congo Basin, shrinking the Mediterranean by building a dam at the Strait of Gibraltar, and obtaining power from the sun, waves and wind.

**Flow properties of disperse systems.** J. J. Hermans, ed. New York, Interscience, 1953. 445 pp., illus., $9.90 (U.S.). (Deformation and flow, v. 5).

The dispersions treated here are protein and polymer solutions, suspensions, emulsions, liquid sprays, smoke, gels, foams and powders. The chapters on suspensions and emulsions cover the general rheological properties e.g., viscosity, Newtonian and non-Newtonian flow, thixotropy, etc. and include the entire field from coarse suspensions to dilute solutions of macromolecules. Modern concepts on gel structure are presented as well as recent theories of swelling and deformation. The ten authors are from various British and European universities and have wide background experience on which to base their views.

**Formal job evaluation and some of its economic implications.** L. G. Nicolopoulos. Montreal, McGill University. Industrial relations centre, 1954. 43 pp., $1.00.

This is a study of the relation between job evaluation as an administrative practice and labour market forces. The author, who was in direct contact with experienced practitioners in the field, discusses the development of formal job evaluation, administration and maintenance, union participation, labour relations, the advantages and disadvantages, and the economic implications of job evaluation. Included in the appendices are a salary evaluation and a case study of union-management co-operation.

**A glossary of terms in nuclear science and technology.** U.S., National research council, Conference on nuclear glossary. New York, American society of mechanical engineers, 1953. 9 sections, spiral binding, $7.00 (U.S.).

The nine sections of this preliminary edition cover general terms, reactor theory, reactor engineering, chemistry, chemical engineering, biophysics and radiobiology, instrumentation, isotopes separation, and metallurgy. Following these divisions there is an alphabetical arrangement of terms. Within the glossary the terms are well connected by cross references and liberal use is made of formulae.

***Hydraulic systems and equipment.** R. Hadekel. Toronto, Macmillan, 1954. 224 pp., figs., $3.00.

The concern in this book is with hydraulic circuits, control gear, and other equipment necessary for orthodox power equipment. Detailed information on control systems for aircraft, automatic machine tools, etc., and on power transmission in various types of machinery is included. Design, manufacture and installation of equipment — seals, valves, piping, and so on — are also dealt with. Much of the material was previously published in Machine Design, 1953.

***Linear transient analysis. Volume I: Lumped-parameter two terminal networks.** Ernst Weber. New York, Wiley, 1954. 348 pp., figs., $7.50.

This text for a basic graduate course emphasizes comparison of a variety of methods, offering a review of classical and operational methods of analysis as well as treatment of the Laplace transform and Fourier integral methods. Appendices review the mathematics needed for the various sections and provide a brief bibliography. A second volume will deal with the transform methods in the treatment of the more difficult network structures.

**Manual on cutting of metals with single-point tools,** 2nd ed. A.S.M.E. research committee on metal cutting data and bibliography. New York, American society of mechanical engineers, 1952. 546 pp., illus., $10.00 (U.S.).

As a result of much research and experimentation this volume presents metal cutting data in a form which can be directly used by the engineer, executive, designer, or shop mechanic. The chapters cover: types, uses and preparation of single-point tools; mechanical characteristics and structures of work material; cutting fluids; cutting forces; net unit power for machining a great number of metals using a single size of cut; economics of metal cutting; tabular data on cutting speeds and horsepower for various feeds and depths of cut when turning steel and cast iron. There is more descriptive presentation of tool materials and other subject matter than in the first edition.

**Metal industry handbook & directory, 1954 ed.** London, Cassier, 1954. 472 pp., 21/8.

This well-known reference book covers the general properties of metals and alloys, including British Standard specifications; the main metal finishing processes, and data regarding all the common rod, bar, sheet and strip products. The last section is a directory of associations and institutions as well as information for buyers.

**Model analysis of structures.** T. M. Charlton. Toronto, British Book Service, 1954, 142 pp., figs., $3.80.

In this book the methods of model analysis considered have been selected on the basis of being easy to use with speed and accuracy in the design office, without expensive tools and apparatus. It explains the theoretical principles and techniques of some of these methods of analyzing structures with linear load-deflection characteristics. The theories of the direct and indirect methods, with variations of the latter, are first considered with some attention being given to their commercial aspects. The author's original direct method, using an "isodynometer", is described, followed by detailed examples of the application of indirect and direct techniques of model analysis.

**The modulor; a harmonious measure to the human scale universally applicable to architecture and mechanics,** 2nd ed. Le Corbusier. Toronto, British Book Service, 1954. 243 pp., illus., $5.00.

The modulor is the name given to the new measuring tool evolved by the French architect, Le Corbusier, and is based upon the proportions of the human body and on mathematics. It is intended as an architectural reference to be applied to the problems of proportion, design, prefabrication and mass production. This book traces its developments and its origins in past architecture and sets forth its mathematical and philosophical bases. The position of the modulor in this day and age is outlined, as well as its application to several different buildings. This new and startling departure from ordinary units of measurement may provide some solution to the complexities of modern technology.

***Operations research — challenge to modern management.** Harvard University. Graduate school of business administration. Cambridge, Operations research group, 1954. 120 pp., spiral binding, $10.00 (U.S.).

This report, written to aid management in evaluating the possibilities of applying the methods of operations research to specific situations, discusses the need, historical development, and applications of the method in planning production, setting time standards, etc. Separate chapters describe the methodology, and the relation of computers to the subject. A selected bibliography is included.

**Paper chromatography,** 2nd rev. and enl. ed. Friedrich Cramer. Toronto, Macmillan, 1954. 124 pp., illus., $4.25.

This is principally a laboratory manual covering the microanalytical separation method known as paper chromatography. The first part deals with the theoretical background of partition methods and in the second part the operating methods are described: experimental technique, quantitative evaluation, and paper electrophoresis. The third, and largest, section covers the separation of particular substances, including amino-acids, sugars, alcohols, phenols, porphyrins, synthetic dyestuffs and optical isomers. Inorganic paper chromatograph is briefly discussed. Two charts are provided for the indentification of chromatograms and a nine-page bibliography is included.

**Physique nucléaire.** Théo. Kahan. Paris. Colin, 1954. 224 pp., figs., 250 fr.

In this book, the author who is a specialist in his subject, presents an outline of nuclear physics, reviewing the fundamentals of nucleonics, without ignoring more recent developments.

Topics covered include: detection of charged particles, natural radioactivity, $\alpha$, $\beta$ and $\gamma$ rays, nuclear structure and forces, nuclear reactions, and atomic reactors.

**Planning residential subdivisions.** V. J. Kostka. Foreword by J. A. Russell. Winnipeg, Manitoba. University. School of architecture, 1954. 127 pp., illus., $3.50.

This book, written in a practical and straightforward manner by a well qualified Canadian, will be enthusiastically received by civic administrators, planning consultants, architects and students. It is well illustrated by actual plans and examples of Western Canada subdivisions and contains an up-to-date bibliography.

The first part discusses site survey and in Part 2 the author co-ordinates site design and development from the viewpoints of planning, engineering, landscaping and architecture. A brief description is also given of the duties and professional services of those specialists who together plan and create residential subdivisions.

**Principles of geomorphology.** W. R. Thornbury. New York, Wiley, 1954. 618 pp., illus., $8.00.

Geologists and others interested in the subject will find this new text valuable because of the author's practical treatment of the concepts of geomorphology. He abandons the usual emphasis on comparative descriptions of landforms and geologic processes, concentrating instead on the historical development of geomorphic ideas, the tools of the geomorphologist, topography of the ocean floors, and soil characteristics with their geomorphic significance. More specifically he includes

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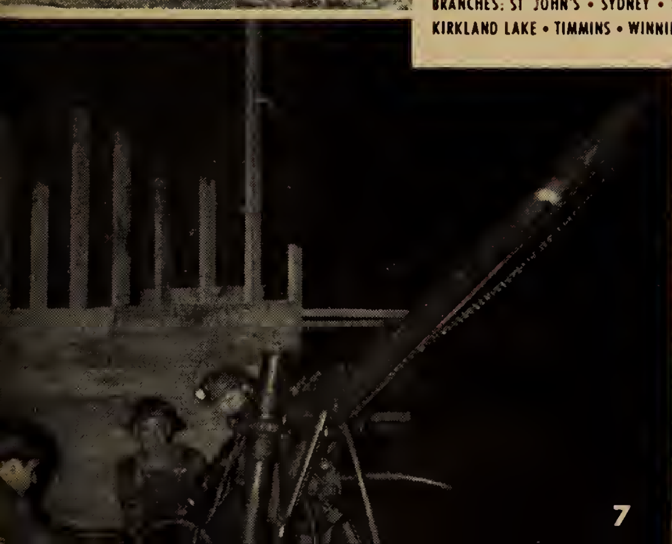

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chapters on the fluvial cycle, stream deposition, the peneplain concept, the arid cycle, Eolian land forms and karst topography. An outstanding feature of the book are the numerous illustrations.

**Principles of road engineering.** H. J. Collins and C. A. Hart. Toronto, Macmillan, 1936. 628 pp., illus., maps, $11.75.

This book could well be compared with another reviewed in this section, "Traité des routes" by J. L. Escario for a fairly complete picture of road engineering theories in Europe. While many modern techniques of road building and maintenance, brought into practice since its publication, are omitted, there is interesting material on the development of highway engineering in England from the earliest times, on the problem of accidents, the factor of cost, the use of photographic surveying from the air, surfacing, and legal questions.

***Proceedings of a conference on the utilization of scientific and professional manpower.** National Manpower Council. New York, Columbia University Press, 1954. 197 pp., $3.50 (U.S.).

This volume contains papers and discussion reports on the problem of the effective use of trained personnel, especially in engineering, medicine, and teaching. Aspects of the problem considered include the possible transfer of work to semi-professionals, incentives to prevent turnover, reassessment of the education and training of professionals, improved administration and leadership, and others. Throughout the volume, present utilization policies are critically examined.

***Les réseaux d'égouts.** Pierre Koch. Paris, Dunod, Montreal, Fomac, 1954. 348 pp., figs., $14.65.

A detailed treatment of the design of sewer systems of various types including all auxiliary equipment. Necessary calculations are carefully worked out, and a group of useful monograms is provided in an appendix. The final section deals with the preparation and presentation of reports concerning sanitary projects or programs.

**Statistical year-hook of the World power conference, no. 7, 1950-1952.** Frederick Brown, ed. London, Lund Humphries, Montreal, Engineering Institute of Canada, 1954. 160 pp., $6.50.

This new collection of annual statistics again relates to fuel and power production, distribution, and consumption and covers 1950, 1951, 1952 and 1953, where possible, with a few new or revised data for earlier years. Most statistics were especially reported according to standard definitions and some, which are usually approximately comparable, have been extracted from other publications.

All countries are listed alphabetically by continent in the present volume and are grouped under convenient headings such as "Iron Curtain" countries and the "Western World" for purposes of continental and world totals of fuel and power resources, the term "Western World" denoting those countries from which recent statistics are more readily available.

As in previous volumes, the chapters are divided into solid, liquid and gaseous fuels, and water power and electricity. For more detailed statistics, users of the Year-book are referred to a bibliography of publications which contain more complete information on fuel and power statistics of the various countries. The publications listed in this bibliography were submitted for inclusion by countries contributing to the Year-book.

**The technique of handling people,** rev. ed. D. A. Laird and E. C. Laird. Toronto, McGraw-Hill, 1954. 189 pp., $4.75.

It is doubtful whether the art of getting along with colleagues and employees in the business world can be condensed into eleven rules yet this book, which presents these rules, is interesting reading. The many illustrative stories will be useful to those who have similar problems in their personal relations and the authors, who have studied and analyzed these cases, offer some sound and valuable advice on winning co-operation, controlling others, arousing enthusiasm, overcoming opposition, uncovering ability, boosting loyalty and generating harmony.

**A text-book of metallurgy.** A. R. Bailey. Toronto, Macmillan, 1954. 560 pp., illus., $5.00.

This addition to the growing number of general metallurgical books appearing from time to time is written for the university student. It deals with the nature, structure and properties of metals and alloys, and the methods used for the examination of metallic structures, including an introduction to atomic theories. This is followed by sections on metal production, working processes, metals finishing and the testing of metals. Appendices include equilibrium diagrams of important binary alloy systems.

**A textbook of radar,** 2nd ed. E. G. Bowen, ed. Toronto, Macmillan, 1954. 617 pp., figs., $7.65.

Written by the staff of the Radiophysics Laboratory of the Commonwealth Scientific and Industrial Research Organisation, Australia, which was set up in 1939 as a centre of radar research and development, this edition is unchanged in the first part except for more up-to-date references. This section deals with the basic principles of radar and covers headings such as the magnetron, triode power oscillators, modulators, microwave transmission, aerials, receivers, convertors, amplifiers and circuits. The last three chapters concern the application of these principles to practical use and have been completely rewritten. The main types of military radar systems are described and a new account is given of the civil uses of radar e.g. in aerial and marine navigation and as aids to surveying. Finally, the applications of radar to physical science are discussed.

**Traité des routes.** J. L. Escario and B. Escario. Paris, Dunod, Montreal, Fomac, 1954. 1,119 pp., illus., $30.40.

The original edition, in Spanish, was published in 1951 and, because of the author's reputation as a road engineer, was translated into French. It is a large undertaking and extends in scope from the general questions of traffic, highway planning with its economic and political considerations, through the construction of the roadbed to the various surfacing materials. It includes discussions of road drainage, the difficulties of curves, tunnels and level crossings and also touches on the related questions of highway signs, lighting, obstruction by trees and the effect of weather on roads. An interesting section shows the cost of tar and asphalt materials in France, Great Britain, the United States, Germany and Spain. In his preface the author lauds the highway system of the United States and urges European engineers, whose problems are much the same, to follow its lead. Road-building machinery is fully described, with illustrations, and methods of construction in various countries are noted.

**Transient analysis of alternating-current machinery: an application**

**of the method of symmetrical components.** W. V. Lyon. New York, Wiley, 1954. 310 pp., figs., $7.00.

The author of this book claims that it presents the first systematic application of Fortescue's method of symmetrical components to the solution of transient conditions in a-c. machinery. It shows how this method can be used to determine the transient behavior of polyphase machines under different operating conditions. The analysis is founded on the Kirchhoff differential equations that apply to the machine and connected system. Because the analysis is rigorous the reader may have a clearer perception of the accuracy of other simpler, though approximate, methods of solution. The equations are generalized by using the per unit system, and all results are in terms of measurable quantities.

An important section contains the general analyses of sixty typical problems and a chronological bibliography is included.

**V-2.** Walter Dornberger. Toronto, Macmillan, 1954. 281 pp., illus., $5.95.

This memoir by one of the world's leading engineers will be fascinating reading for anyone whose imagination is fired by the words 'rockets' and 'space travel'. It is a well-written, factual and dramatic account of ten years of experiments and labour to develop the weapon which shook Great Britain and the world in the last stages of the war. General Dornberger is first and foremost a scientist and, as such, his sense of perspective rises above political levels. His story traces the development of the liquid-fuel V-2 rocket by his army of qualified men at Peenemunde to that day in September, 1944, when the first one fell on English soil, and describes the crippling British bombing raid on the project, its recovery and the later production of rockets.

This is more than a technical book, however, as it gives an inside account of a German army establishment, the bitter political rivalry then rampant and provides glimpses of Hitler and his right hand men. Students of history and politics will find as much to interest them as will engineers and scientists.

The introduction written by Willy Ley is a vital addition and the group of photographs are an added appeal.

**Welding processes and procedures.** J. L. Morris. New York, Prentice-Hall, 1954. 255 pp., illus., $5.00.

This basic welding book is directed to college and technical students and also to the practising engineer and industrial worker. Included is information on electric arc, oxy-gas and electric resistance welding, welding of commercial metals, testing, welding design, metal spraying, braze welding and oxygen cutting. The history, description, details of use and applications and limitations of the more important welding processes are given in that order. The last chapter treats welding economy, and exercises to be used in the welding laboratory are found at the end of the book.

## BOOKS RECEIVED

**Bibliography on prestressed concrete.** American concrete institute. Detroit, The Institute, 1954. 83 pp., $2.00 (U.S.).

**Chemical engineering in practice.** J. I. Harper, ed. New York, Reinhold, 1954. 140 pp., $3.00 (U.S.).

**Chemical engineering materials.** Frank Rumford. Toronto, Longmans, Green, 1954. 380 pp., illus., $5.75.

**The dam.** Murray Morgan. Toronto, Macmillan, 1954. 162 pp., illus., $4.00.

**Design and use of instruments and accurate mechanism.** T. N. Whitehead. New York, Dover, c.1934. 283 pp., illus., pa. $1.95 (U.S.).

**Dielectric materials and applications.** A. R. von Hippel, ed. New York, Wiley, 1954. 438 pp., illus., $17.50.

**Dielectrics and waves.** A. R. von Hippel. New York, Wiley, 1954. 284 pp., illus., $16.00.

**Electroacoustics.** F. V. Hunt. New York, Wiley, 1954. 260 pp., diagrs., $6.00.

**Elements of number theory.** I. M. Vinogradov. New York, Dover, 1954. 227 pp., pa. $1.75 (U.S.).

**Farm buildings,** 4th ed. D. G. Carter. New York, Wiley, 1954. 291 pp., illus., $5.50.



## E.I.C. Technical Papers

The Institute maintains a fund for the separate publication of high-calibre original technical papers. Interest in such papers is limited to a relatively small audience of specialists in the subjects to which the papers relate, and it is not economically sound to publish them in the *Journal* which aims at the interest of some 15,000 engineers in all branches of the profession.

It is an obligation of the Institute to publish original works which contribute to the reference literature of the profession. The Technical Papers are distributed to the world's major engineering societies and technical libraries. Similarly it is an obligation of those engineers qualified to write these papers to submit them for possible inclusion in the literature. The publications committee invites authors to present such manuscripts for submission to qualified reviewers and publication if warranted. Written discussion will be accepted and published as supplements.

**Technical papers issued to date are:—**

**No. 1—Flow in Conduits and Canals:** *French and Wood.* Comprises tables and diagrams for the solution of problems of flow in open and closed channels. Price . . . . . . . . . . . . $1.50

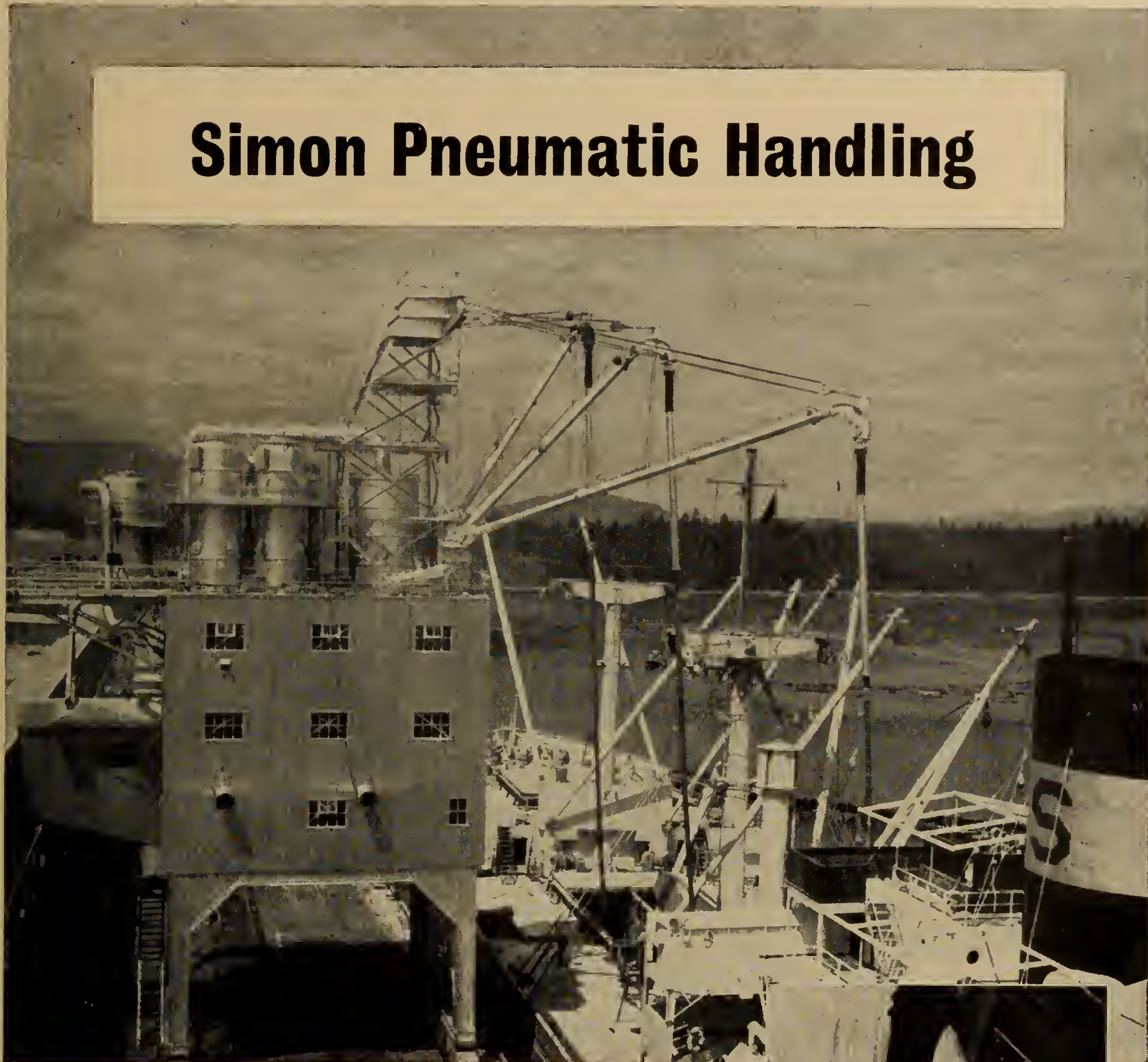
**No. 2—A Revised Manning Flow Formula:—***Blench.* A discussion of the various hydraulic flow formulae in use or proposed. The author, formerly Director of Irrigation Research, Punjab, Pakistan, and now on the staff of the University of Alberta, concludes that the Manning formula, with modifications, is the best now available. Price . . . . . . . . . . . . . . .$1.00

**No. 3—Air Entrainment by Water in Steep Open Channels:—** *Priest.* A theoretical solution of a problem of interest to hydraulic engineers. Price . . . . . . . . . . . . .$1.00

**No. 4—Graphical Solution of Partial Differential Equations with Engineering Applications:—***Wood.* Solution by simple, almost automatic, methods, of equations arising from the study of water hammer phenomena, impact, and other common engineering problems. This paper will be of particular value to hydraulic engineers and structural and machine designers. Price . . . . . . . . . . . . . . . . . . . . . . . . $3.00

**No. 5—Economy in Rigid Frames:—***Monti.* Charts and diagrams to facilitate rapid preliminary design of the common types of rigid frames, eliminating the cut-and-try methods previously necessary before a final analysis could be attempted. This paper belongs in the library of every structural designer. Price .. $1.00

**N.B.—Remittance with order please, payable at par in Montreal.**

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**Geometry of René Descartes.** New York, Dover, 1954. 243 pp., pa. $1.50 (U.S.).

**Guide for safety in the chemical laboratory.** General safety committee of the Manufacturing chemist's association. Toronto, Van Nostrand, 1954. 234 pp., illus., $4.75.

**Highway engineering.** L. I. Hewes and C. H. Oglesby. New York, Wiley, 1954. 628 pp., illus., $8.00.

**How to service tape recorders.** C. A. Tuthill. New York, Rider, 1954. 160 pp., $2.90 (U.S.).

**Inventories of apparatus and materials for teaching purposes. v. 3, part 4, Electrical engineering.** Paris, United Nations educational, scientific and cultural organization, 1954. 147 pp.

**Manual of British water supply practice,** 2nd ed. A. T. Hobbs, ed. London, Institution of water engineers, 1954. 963 pp., illus., 55/–.

**Materials of construction,** 2nd ed. M. O. Withey and G. W. Washa. New York, Wiley, 1954. irreg. paging, illus., $9.00.

**Microscopical techniques in metallurgy.** Henry Thompson. Toronto, Pitman, 1954. 146 pp., illus., $3.50.

**Molesworth's handbook of engineering formulae and data,** 34th ed. A. P. Thurston, ed. Toronto, British book service, 1953. 1,674 pp., diagrs., tables, $5.60.

**Noise and stochastic processes; selected papers.** Nelson Wax, ed. New York, Dover, 1954. 337 pp., figs., pa. $2.00 (U.S.).

**On the sensations of tone as a physiological base for the theory of music.** Hermann Helmholtz. New York, Dover, c.1954. 576 pp., illus., $4.95 (U.S.).

**Principles of engineering thermodynamics,** 2nd ed. P. J. Kiefer, G. F. Kinney and M. C. Stuart. New York, Wiley, 1954. 539 pp., figs., $7.75.

**Pulp and paper manual of Canada, 1954.** Gardenvale, National business publications, 1954. 446 pp., charts.

**Rocket propulsion,** 2nd ed. Eric Burgess. Toronto, British book service, 1953. 235 pp., illus., $3.60.

**Simplified site engineering for architects and builders.** Harry Parker and J. W. MacGuire. New York, Wiley, 1954. 250 pp., illus., $5.00.

**Specialized auto radio manual, v. 5-A.** New York, Rider, 1954. 208 pp., $3.00 (U.S.).

**Strategy for the West.** John Slessor. Toronto, British book service, 1954. 162 pp., $2.25.

**Successful commercial chemical development.** H. M. Corley, ed. New York, Wiley, 1954. 374 pp., $7.75.

**TV field service manual, v. 2.** Harold Alsberg, ed. New York, Rider, 1954. 160 pp., spiral binding, $2.40 (U.S.).

**Television,** 2nd ed. V. K. Zworykin and G. A. Morton. New York, Wiley, 1954. 1,037 pp., illus., $17.50.

**Textbook of servomechanisms.** J. C. West. London, English Universities press, Toronto, Musson, 1953. 238 pp., diagrs., 25/–.

**Twinning and diffusionless transformations in metals.** E. O. Hall. Toronto, Butterworth, 1954. 181 pp., illus., $5.00.

**Water supply and wastewater disposal.** G. M. Fair and J. C. Geyer. New York, Wiley, 1954. 973 pp., diagrs., $15.00.



**What every engineer should know about rubber.** W. J. S. Naunton. Washington, Natural rubber bureau, 1954. 128 pp., illus., 50c.

**Yearbook of the heating and ventilating industry, 1954.** London, Technitrade journals, 1954. 329 pp., 8/4.



## TECHNICAL BULLETINS AND PAMPHLETS RECEIVED

**British electrical and allied industries research association. Technical reports:**

B/T118 — H.V. D.C. inverter stations: comparison of cost of supplying reactive volt-amperes by various methods, by F. Busemann. F/T179 — Calculation of transient heating in the dielectric of single core cables, by H. Goldenberg. G/T286 — Flameproof electrical apparatus: flanged joints, one-half inch in radial breadth in mixtures of ethylene oxide and air, by T. J. A. Brown and N. Simpson. G/T290 — Present and prospective restriking voltage conditions on the British 132 kV and 275 kV networks, by L. Gosland and J. S. Vosper. N/T66 — The effects of inclusions or imperfections on magnetization processes in silicon-iron, by L. F. Bates and D. H. Martin. W/T28 — The operation of a barn hay drying installation, by P. Finn-Kelcey.

**British electricity authority:**
Power and prosperity. 1/–.

**Canada. National research council. Government specifications board. Specifications:**
22-GP-38 — Mop; flat head, string. 22-GP-40 — Mop; dusting dry or oiling. 39-GP-11 — Wrenches; open end and box, bolt and nut, non-adjustable. 39-GP-12 — Wrenches, handles and attachments; bolt and nut, socket. 39-GP-13 — Wrenches; bolt and nut, adjustable.

**Edison electric institute:**
TD-14 — 1954 — Specification for moulding staples.

**Institute of metals. Journal. Reprints:**
1547 — Metals and marine engineering, by S. F. Dorey (Presidential address).

**United Kingdom information office:**
Building research, 1953. 90 cents. Fire research, 1953. 65 cents. Fuel research. 1953. 65 cents.

**United States. Geological survey. Bulletin:**
1006 — Collected papers on methods of analysis for uranium and thorium.


giving substance to dreams
Installation of this English Electric 106,000 KVA generator at Kemano marks another step in translating the vision of the planners into reality. English Electric is proud to have shared in equipping another of the world's great projects.
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English Electric generator stator in transit from the service bay to its permanent location in unit No. 3 in the background. (Alcan B.C. project—photo courtesy Aluminum Co. of Canada Ltd.)

# Business & Industrial Briefs

## A Digest of Information received by The Editor

## Appointments and Transfers

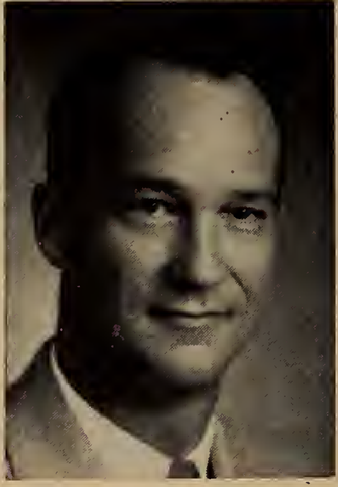
**C.G.E.'s Electrical Equipment Department.**—A realignment of responsibilities within Canadian General Electric Company's electronic equipment department has been announced by W. D. Schofield, department manager.

Mr. Schofield announced the following new appointments: Henry S. Dawson, manager-engineering; David H. Johnston, manager-manufacturing; James R Warren, manager-marketing.

In his new position, Mr. Dawson is responsible for advanced, system, and product engineering, installation and maintenance.

Mr. Johnston is responsible for material control, production control, planning and wage rate, assembly and test quality control and works facilities.

As manager-marketing, Mr. Warren is responsible for marketing research, marketing administration, product planning, product service, sales, and advertising and sales promotion.



J. R. Warren

H. S. Dawson

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**Quebec Power Company.**—Charles F. Scribner has recently been appointed director of supplies by J. N. Sicard, vice-president and general manager of Quebec Power Company.

He entered the service of the Quebec Power Company in 1928 and worked in the payroll, accounting and purchasing departments. During the war years, he was on active service with the Royal Canadian Air Force. At the end of hostilities he returned to the company and was later named chief of the supply division.

Mr. Scribner is a member of the Canadian Electrical Association, the Canadian Transit Association and the Canadian Manufacturers Association.

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**Shawinigan Water and Power Company.**—The formation of an engineering division of Shawinigan's generation and transmission department was recently announced by W. R. Wray, vice-president of the company. In addition to the changes noted in Personals, T. S. Dutton until now superintendent of the communication division, is appointed superintendent of communication in the new division. The newly formed engineering division combines the former communication division and the system planning division.

The appointment of Keevin Burnham as purchasing agent for The Shawinigan Water and Power Company, succeeding H. A. Elliott who retired September 1 after almost 40 years' service, was also announced.

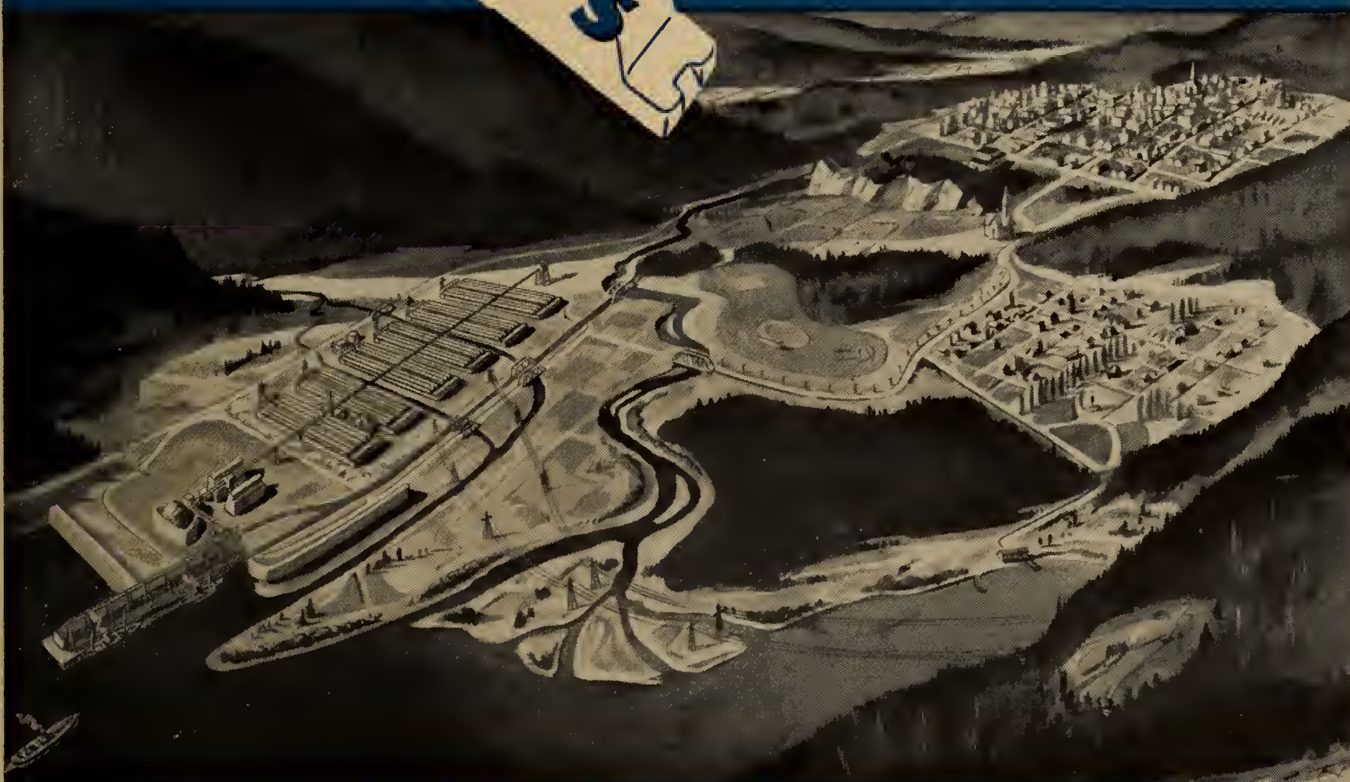
Mr. Burnham, who has been with the Shawinigan company since 1926, was formerly purchasing agent for The Shawinigan Engineering Company Limited.

Three other appointments in the purchasing department were also announced—they are:

David M. Yule, since 1952 assistant purchasing agent responsible for purchases on behalf of B. A. Shawinigan Limited and St. Maurice Chemicals Limited, who now takes charge of purchases for The Shawinigan Engineering Company as assistant purchasing agent.

W. E. R. Jones, formerly staff assistant, who has been promoted to assistant purchasing agent with responsibility for purchases on behalf of St. Maurice Chemicals and for liaison with the Department of National Revenue on matters relating to federal sales tax, customs and duties.

*(Continued on page 1582)*



Donal A. Aitken, to be attached to the purchasing department as engineer and standards co-ordinator and continuing his work on standards as well as taking responsibility for inspection service and technical matters as required.

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**Crosley's Electronics Dept.**—A British trained electronics specialist who participated in the development of radar during World War II has been named manager of Crosley Radio and Television's newly established industrial electronics department.

Appointment of Dennis W. Holdsworth to the new Crosley position was announced this month by Ivor M. Leslie, vice-president and general manager, Crosley Radio and Television Division, Avco of Canada, Ltd.

The company's new industrial electronics department will engage in design, development and production of electronic equipment for industry, aviation and other fields.

●

**Dow's Plastic Sales Division.** — Appointment of G. H. Laird to the plastics sales division is announced by R. H. Wright, sales manager of Dow Chemical of Canada, Limited, Mr. Laird will specialize in sales development work on styrofoam (Dow's expanded polystyrene).

Mr. Laird has been with the Dow organization for eight years in Sarnia and Toronto, and most recently was associated with the coatings and solvents sales division. He will continue to reside in Toronto.

The transfer of D. T. Jager from Montreal to Toronto and his appointment as assistant manager of the heavy chemicals sales division is also announced. Mr. Jager was formerly sales supervisor of the eastern district sales office at Montreal. In taking over his new duties, Mr. Jager will specialize in market study and development for such Dow products as ammonia and hydrochloric acid.

●

**James E. Kelley, Jr.**—Formerly of Stone and Webster Engineering Corp., New York City, has been appointed general manager of Don Mills Developments Limited and Greater Hamilton Shopping Centre Limited.

As general manager of Don Mills Developments, Mr. Kelley supervises installation of municipal services in the $200,000,000 development under construction at Don Mills, Ont. He also assumes the job of detailing construction of the $15,000,000 shopping centre at Don Mills.

As general manager of Greater Hamilton Shopping Centre Ltd., he is responsible for the construction engineering of the $18,000,000 shopping centre on a 71-acre site in the heart of downtown Hamilton, Ontario.

●

**Thomas A. Edison of Canada Limited.** — The Thomas A. Edison Company Limited announces the appointment of Lieutenant Colonel K. R. Swinton to be general manager for Canada.

Col. Swinton, a native of Vienna, Austria, graduated with the degree of Master of Science in radio and television engineering. Following a period of research work for the British Admiralty in England, Col. Swinton came to Canada in 1940. During the last war he served with the Royal Canadian Corps of Signals until the termination of hostilities when he retired as assistant director of radio design.

After the war, Col. Swinton, for a period of four years, was with the R.C.A. Victor Company as manager of the electronics division. Previous to his present appointment he was for five years the vice-president and general manager of Sonograph Ltd.

●

**Garlock Packing Company.**—Edwin W. Reese of Montreal has been elected vice-president of The Garlock Packing Company of Canada Limited, effective October 1. He succeeds J. P. Sewell, new general sales manager for Garlock in Canada and the United States.

●

(*Continued on page 1585*)

K. R. Swinton

**Robertson-Irwin Moves Offices.** — Robertson-Irwin Limited, makers of industrial steel products and building materials, have announced that their sales offices in Montreal and Hamilton have moved to new addresses.

The Montreal sales office is now located at 5165 Sherbrooke Street West, Montreal 29, P.Q., and the Hamilton office is now in the Hamilton Harbour Commission Building, 605 James Street North, Hamilton. The new Hamilton telephone number is JA. 8-8481.

•

**Canadian Electrical Manufacturers Association.**—Kenneth V. Farmer of Niagara Falls, Ont., was elected president of the Canadian Electrical Manufacturers Association at the group's tenth annual meeting. Mr. Farmer is vice-president and general manager of the Canadian Ohio Brass Co. Ltd. C.E. M.A. represents Canada's third largest manufacturing industry which had a gross national product of close to a billion dollars for 1953.

Vice-presidents elected for the new term of office include: H. M. Turner, president, Canadian General Electric Co. Ltd., Toronto; R. D. Harkness, M.E.I.C., president Northern Electric Co. Ltd., Montreal; and T. J. Bell, vice-president and general manager, Federal Wire & Cable Co. Ltd., Guelph.

Other officers are: treasurer, Thos. Edmondston, president Packard Electric Co. Ltd., St. Catharines; secretary, Keith H. Rapsey, vice-president and general manager, Allen-Bradley Canada Ltd., Galt.

•

**Canadian Ingersoll Rand.**—M. S. (Merck) Lothrop has been appointed manager of the Montreal branch of the Canadian Ingersoll-Rand Company Limited.

Mr. Lothrop joined the company in 1924. Working for many years with customers in the Montreal area, he has acquired a broad knowledge of the equipment field and its problems. He is a member of the Canadian Institute of Mining and Metallurgy.

•

**Canadian Zurn Engineering.** — The appointment of John Shreve as sales manager of the Canadian Zurn Engineering Limited has recently been announced. Mr. Shreve has been associated with the Zurn Company in the U.S.A. for many years and more recently has been in charge of the Toronto sales office. District sales offices are located in Montreal, Quebec City, London, and Vancouver.

•

**Public Works.**—Works Minister Winters recently announced changes in senior personnel of the Harbours and Rivers Engineering Branch of the Department of Public Works.

J. M. Vogin, Ottawa district engineer, has been appointed to a senior position in the Harbours and Rivers Engineering Branch at Ottawa under chief engineer A. A. Anderson. Appointed temporarily to replace Mr. Vogin is C. W. Morgan, district engineer at Toronto.

During Mr. Morgan's temporary absence, C. A. Stocking will be acting district engineer in Toronto.

•

**Changes at MacDonald Bros. Aircraft.** —Following the recent acquisition of Macdonald Bros. Aircraft Limited of Winnipeg by The Bristol Aeroplane Company Limited, the following executive appointments become effective October 1: general manager, W. S. Haggett; secretary, R. G. Small; treasurer, W. Dunbar; assistant general manager, Wm. Auld; and contracts administrator, D. A. Newey.

•

## New Equipment and Developments

**Canada Cement Company's New Plant.** —Canada Cement Company's new cement grinding plant now being planned will be completed in 1955. This plant will have facilities for shipping cement in both bags and bulk by motor trucks or on cars of either the Canadian Pacific or Canadian National Railways. The mill will have a capacity to grind over 7,000,000 bags of cement per year and sufficient storage will be provided for 800,000 bags of finished cement. The heavy machinery has been ordered and engineering plans are now being prepared so that construction work may be commenced at an early date. The plant will be located in the Municipality of Strathcona, about six miles from the center of the City of Edmonton. While the first installation is for grinding cement only, it is being designed so that it could become an integral part of a complete portland cement manufacturing plant, to be

# E.I.C. Annual Meeting

## May 11-12-13, 1955

### Royal York Hotel,
### Toronto, Ont.

## May 23-24-25, 1956

### Montreal, Que.

built later if it is required. The purpose in building this plant is to extend the company's service to its customers and also reduce the cost of the product to them.

●

**Iron Deposit in Northwest Territories.**—What may possibly prove to be a sizable iron deposit has been brought to light in Northwest Territories just north of the Saskatchewan boundary by the Geological Survey of Canada, George Prudham, Minister of Mines and Technical Surveys, announced recently.

The discovery, believed to be a body of magnetite iron, was made at latitude 60° 16′ and longitude 102° 53′, late in August by a field party of the Geological Survey while carrying out an aeromagnetic survey of a 15,000-mile area in the Territories. This disclosed an anomaly of exceptional intensity, indicating a high concentration of magnetic iron in the deposit. At a height of 1,000 feet it registered 7,000 gammas. Its intensity is better seen when compared with that of the Marmora magnetite deposit about 35 miles east of Peterborough in southern Ontario, which is being brought into production next month by Bethlehem Mines Corporation, and which when flown at a height of 500 feet registered 6,800 gammas.

The anomaly has an areal extent of four square miles. It will have to be further investigated by ground work, however, to ascertain whether or not it has economic possibilities.

It is off the beaten trail being about 8 miles southeast of Lake Atzinging, 200 air miles from Beaverlodge north of Lake Athabasca in Saskatchewan, and 300 miles west of Hudson Bay.

The surrounding country is flat and sandy with muskeg, although there are outcroppings nearby.

●

**Ceramic-Coated Aluminum.**—Ceramic-coated aluminum is now available from The Bettinger Corporation, Waltham, Massachusetts, porcelain enamel manufacturers, it was announced by Nathaniel Cannistraro, general sales manager.

Through the signing of a ten-year sales agreement with The Halrick Company, Danbury, Connecticut, which has facilities for the ceramic coating of aluminum, The Bettinger Corporation will be responsible for 100 per cent of Halrick's sales.

Ceramic-coated aluminum will be widely used in industry, and particularly in the aviation field, where the metal's light weight is desired and the porcelain coating's protection against fire, corrosive gases, moisture, steam, smoke and salt air, is an important factor.

●

**Canadian Westinghouse Expands.**—Electrical apparatus service facilities of the Canadian Westinghouse Company have undergone further expansion with the building of a large new repair centre in Moncton, N.B. Opening of the new building October 1 marked the second time in the past seven years that the increased volume of repair business handled by Westinghouse in the Maritimes has called for a doubling of service space.

The modern structure in the geographical heart of the city will handle repairs to all types of power and electrical equipment throughout the Maritimes. In 1947, when the company added a Moncton branch to its Canada-wide chain of service shops, the existing business outlook suggested a structure containing some 5000 square feet of floor space as adequate for both repair operations and warehousing. A short time later, however, it became necessary to devote the entire building to repair work.

Continued increase in business volume has now necessitated this latest increase in the Westinghouse service chain. The 10,000 square feet of space will also house offices and a small stock of fast-moving electrical equipment products. A high crane bay has been included in the building to conveniently handle transformer and large motor repairs.

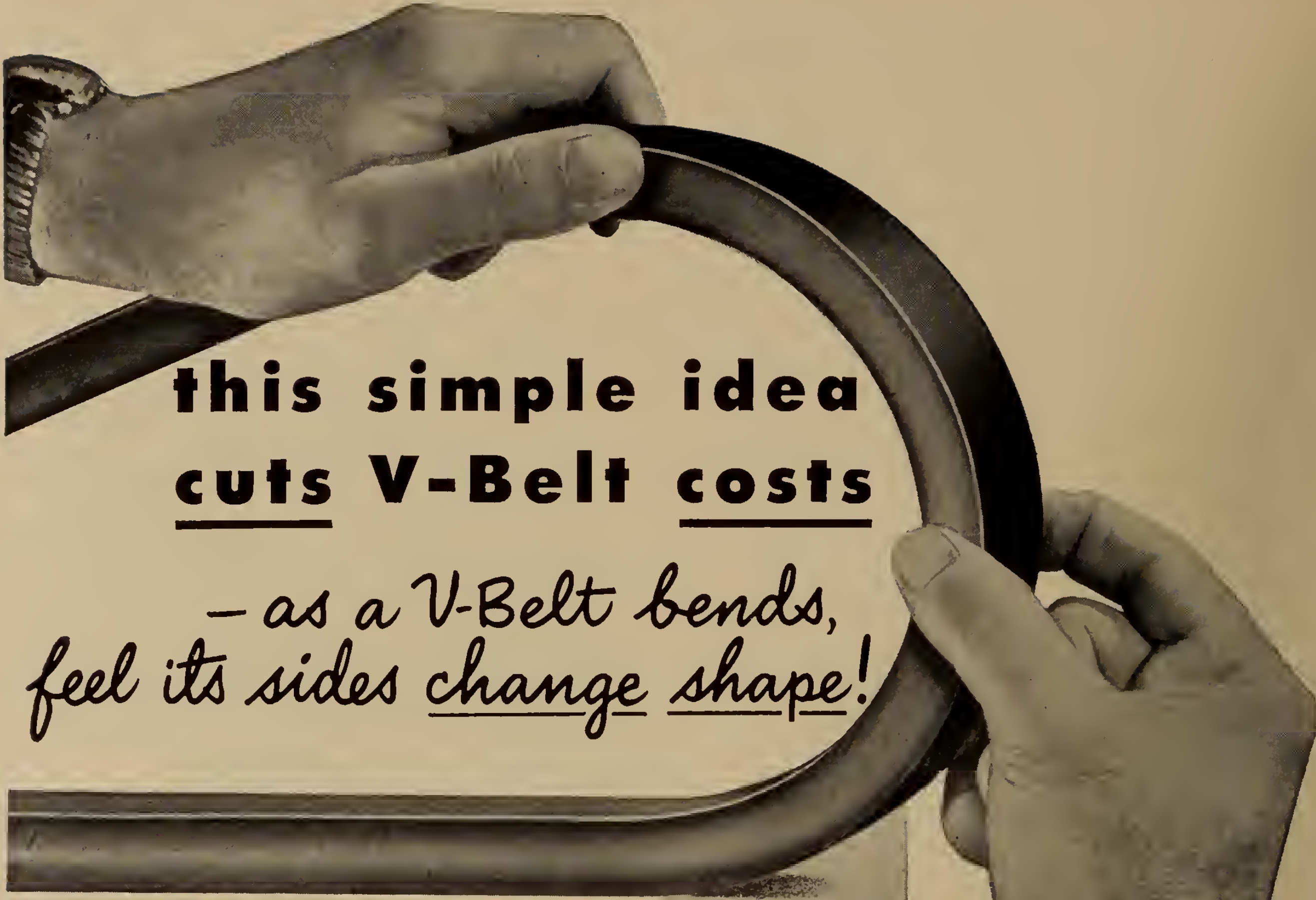
●

**New Plant of Automatic Electric.**—At an impressive ceremony on September 22, before a large gathering of invited guests, employees and citizens, the Honourable Lionel Chevrier, President of the St. Lawrence Seaway Authority, officially opened the new plant of Automatic Electric (Canada) 1953 Limited at Brockville, Ontario. This modern building is indicative of Canadian progress in communications.

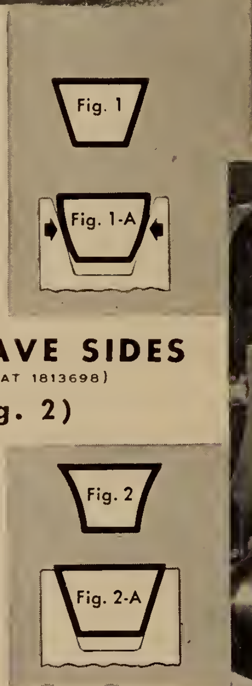
With an initial floor area of 125,000 sq. ft. and a present staff of 550 employees, automatic telephone equipment, electrical control apparatus and allied communication products are being manufactured, backed by the 60 years of experience of the world-wide Automatic Electric group, originators of the automatic telephone.

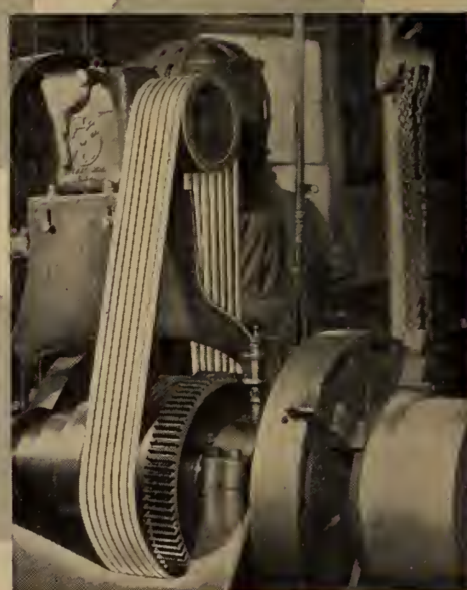
●

(*Continued on page 1592*)





Typical Gates Vulco Rope Drive

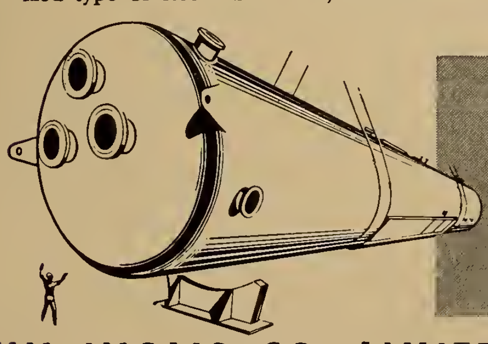

# **Inglis** pressure vessels

## SWELLING THE SURGE OF OIL

New oilfields and more production call for greater refinery capacity. As the industry expands Inglis is called on to make more steel or alloy vessels. Already many of the big refineries are equipped with Inglis pressure vessels.

With a plant ideally equipped for this specialized type of steel fabrication, and with a staff familiar with the problems involved, no manufacturer is better equipped to build pressure vessels for the oil, or any other industry.

In addition, as manufacturers in Canada of Worthington Pumps and Compressors, Inglis offers the most advanced designs available anywhere.



Inglis CANADA

**JOHN INGLIS CO. LIMITED · TORONTO · CANADA**

GENERAL ENGINEERING DIVISION

7-200-54

MONTREAL WINNIPEG CALGARY EDMONTON VANCOUVER

*Associated in the world wide English Electric Group with English Electric Company of Canada Limited*

**Three-Phase Distribution Transformers.**—A new line of three-phase, oil-insulated, self-cooled distribution transformers in sizes from 9 to 225 kva is announced by Reliance Electric & Engineering (Canada) Limited, Welland, Ontario.

These transformers have been designed for use in locations where transformation of three-phase power is required and where up to now three separate single-phase transformers have been installed in preference to a three-phase unit. The new Reliance transformer is said to have the reliability and flexibility of the conventional bank of three, single-phase transformers with the advantage that only one transformer need be installed instead of three.

The unique feature of this transformer is that the core and coil unit is constructed using three separate single phase components so that any one phase component can be readily replaced if necessary. If one phase fails for any reason, the transformer can remain in service by re-connecting the other two phase components in "open-delta". This is not possible with the conventional three-phase transformer having the core and coils assembled as a single unit.

Other features of the new transformer that make it comparable with three—single phase units are as follows: Easy connection of the windings above the oil level for either star or delta operation. Taps can be readily changed by means of tap switches with handles above the oil level. Sizes up to 75 kva can now be mounted on pole cross arms. Higher ratings can be platform mounted on poles.

Known as the Reliance 3-phase E☆L☆S CORE Transformer, the new transformer will have the exclusive construction introduced by Reliance in Canada earlier this year.

●



# Publications

**For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.**

**Please mention *The Engineering Journal* when writing.**

**Air Pollution Corrected by Sonic Energy.**—The American Institute of Chemical Engineers got technical about agglomeration, "the process of making big ones out of little ones" during the second day of the National Meeting at the resort Hotel Colorado in Glenwood Springs.

The effects of agglomeration have been apparent to the housewife in the form of anti-sneeze and dustless soap powders and detergents. However, this art is being widely applied in fertilizers, steel manufacturing, carbon black collection and coal briquettes.

Robert S. Boyd research engineer, Godfrey L. Cabot, Inc., described a new agglomeration operation which consists of utilizing sound energy to collect microscopic carbon particles being lost in waste gas of carbon black manufacturing plants. Areas surrounding carbon plants are continually being harassed by this nuisance problem. This system not only corrects the air polution but saves the valuable product.

The rapid depletion of the reserves of high grade iron ore is causing the steel companies deep concern. Agglomeration is being used to produce steel from taconite, an abundant source of low grade iron ore. Several pilot plants are operating on this low grade ore and Strathmore R. B. Cooke, Professor of Metallurgy and Mineral Dressing, School of Mines and Metallurgy, University of Minnesota, predicts that by 1958 commercial plants will be using 20 million tons of this processed concentrated ore.

Other papers were as follows: The technical aspects of agglomeration in the chemical process industries by Cecil H. Chilton, associate editor of Chemical Engineering; "Granulation of Mixed Fertilizers by Agglomeration" by John O. Hardesty, fertilizer and agricultural lime section, soil and water conservation research branch, Agricultural Research Service, U.S. Department of Agriculture; "Snowball Pelletizing" by H. E. Rowen, vice-president, Dwight-Lloyd, Inc., Division of Sintering Machinery Corp.

●

**Die Casting.**—A new 28-page, two-color, illustrated booklet describing the die casting process and its application is now available from the American Zinc Institute, Inc., 60 East 42nd Street, New York 17, N.Y.

The booklet, entitled "Die Casting — Molten Metal to Finished Part — Direct," discusses this important production method as it affects product design, machining requirements and surface finish. The basic steps of the die casting process itself are shown pictorially. Also included are concise descriptions of the dies and machines used to produce uniform parts of complex shape within close dimensional limits.

Zinc, aluminum, magnesium and copper base die casting alloys are discussed. A section on each alloy outlines its advantages and limitations with regard to cost, dimensional accuracy, surface finish, strength and machinability. Each of these sections also includes a chart which lists for each alloy: ASTM and SAE designations, composition by weight, mechanical properties and other properties and constants of each alloy in the as-cast condition.

Four pages of photographs illustrate 15 examples of typical die-cast products using the four alloy types. Each case history is accompanied by an explanation of the basic considerations that led to the selection of die casting for that particular application.

●

**Nickel Alloyed Cast Irons.**—Recently issued by The Inernational Nickel Company of Canada, Limited is a bulletin for design engineers called: "Nickel Alloyed Cast Irons — Guide to the Selection of Engineering Irons".

The bulletin describes the many valuable characteristics of modern alloyed cast irons and illustrates their broad acceptance throughout industry.

A complimentary copy may be obtained by writing, on company letterhead, to The International Nickel Company of Canada, Limited, 25 King Street West, Toronto 1.

●

**Crane For Many Uses.**—An 8-page illustrated bulletin (AD-2253) describing its indoor-outdoor hydraulic crane has just been issued by Austin-Western Company, 601 Farnsworth Avenue, Aurora, Ill. Included with specifications and performance data are diagrams on working ranges, manual boom extensions, minimum aisle widths for turns, etc. Also described are attachments and special equipment. The Austin-Western hydraulic crane is setting a revolutionary new standard for versatility and work capacity.

●

**Woods.** — The following booklets are available from Western Woods, 550 Burrard St., Vancouver 1, B.C. **Trends in Timber Construction.**—A 20-page illustrative booklet depicting new uses of B.C. Coast Woods in assembly, commercial and residential buildings as well as in industrial, marine, utility and recreational structures. **Ten Canadian Trend Houses.** — Canada's famous Trend Houses have received a great deal of attention in the past few months. The 32-page booklet illustrates how Western woods have been used to advantage in these outstanding, contemporary houses. **Handsplit Red Cedar Shakes.**—This 6-page folder on Canada's "luxury" roofing material will provide you with factual information on its manufacture and application. It is a valuable supplement to the Certigrade Handbook on red cedar shingles.

●

# THE ENGINEERING JOURNAL

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"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

*16,600 copies of this issue printed*

# CONTENTS



*Indexed in The Engineering Index*

# Photography

# in

# Armament Development

*by*

E. W. Greenwood

*Superintendent, Ballistics Wing,*
*Canadian Armament Research*
*and*
*Development Establishment*
*Val Cartier, Que.*

Although this paper, presented at the Quebec Annual Meeting, deals with a special application of photography, its contents offer many suggestions for its use in industry. The admittedly high cost of the equipment required would no doubt be a deterrent to such use. In any event, one cannot but respect the ingenuity of the physicists and engineers who made such apparatus practicable.

The applications of photography to armament development are so many and the variety of instruments and techniques so great, that only a brief outline can be presented in a short paper. Even this outline is incomplete; however, the main features of photography for weapon studies have been included and those whose interest is aroused are referred to the sources of information listed at the end of the paper.

Indirect applications of photography to armament work such as photomicrography and oscillography have been omitted in the interests of brevity. These techniques are already well documented. Attention is concentrated on methods for the direct observation of weapon phenomena, and in particular on methods and equipment for high speed photography, which is of major importance in armament development work.

Photographic recording extends visual observational methods far beyond the normal range of the human eye. In armament development, distortion of the observational time scale is the most important single feature of photography. Events taking seconds or minutes, may be recorded in a single exposure and the resulting picture seen at a glance, or an exposure of a fraction of a microsecond may be viewed for as long as desired. Motion pictures projected at the same frame rate used in the camera give zero time scale distortion; by taking motion pictures at frame rates lower or higher than the projection rate, events may be observed speeded up or slowed down by very large factors. Since many weapon functioning phenomena are extremely rapid, high speed photography is widely used to extend the time available for observation.

### Record Photography

By far the largest volume of photographic work for armament studies consists of ordinary record photography. Photographs of weapons, ammunition, trial set-ups and results such as recovered rounds, fired targets and damage to equipment are required every day to supplement written records. This is an extremely valuable service, quite aside from the more technical types of photography.

There are many applications of ordinary photographic methods to weapon trials: a good example is the use of a 35-mm. camera and colour film to record the colour and size of smoke clouds from coloured smoke grenades.

One of the most interesting techniques employed for special purposes is an extremely simple one. The camera shutter is opened, the event caused to occur in the field of view and the shutter closed. A complete record is obtained of all events occurring during the time the shutter was open. Naturally, this method is best suited to observing self-luminous phenomena in the dark, such as the flight of a tracer (Fig. 1), the overall flash of a gun or the flash produced by a shot striking armour (Fig. 2). There are, however, other applications which will be described later.

In direct contrast to the open shutter technique, which compresses what may be long duration events into a single composite photograph, high speed still photography freezes a single instant in the history of an event for study at leisure. A common application of the method is the photography of projectiles in flight with exposures of one or two millionths of a second. This application will be discussed in some detail later, because of its great importance.

One way of controlling the exposure time for high speed photography is by using a high speed shutter. The term "high speed" is flexible, and is perhaps best defined in terms of the action being observed. In ballistics work shutters with exposure times of less than a millionth of a second are commonly employed.

### Shutter Types

The rather wide variety of shutter types is broken down in some detail, with particular attention to microsecond shutters. Mechanical shutters are used with almost all cameras in ballistics work, either to control

**Fig. 1. Open-shutter photograph of an anti-tank gun firing tracer shot.**

the exposure by themselves or as capping shutters for shutters of much higher speed. These shutters may again be subdivided into several major groups, according to their fastest exposure ratings and the kind of camera with which they are used.

Diaphragm shutters (speeds up to 1/400 second) are used with ordinary still cameras. They are situated inside the lens and open and close in the manner of an iris diaphragm, hence the name.

Curtain shutters (speeds up to 1/2,000 second) are used chiefly in miniature, press and aerial cameras. This shutter resembles a curtain or roller blind with a transverse slot, the exposure being made by causing the slot to traverse the light path between lens and film. The exposure time is controlled by the width of the slot and the speed of the curtain. Usually, such shutters are installed very close to the film plane, and are then called "focal plane" shutters.

A very important feature of focal plane shutters is that, unlike the diaphragm shutters, the instant at which a particular point on the film is exposed is a function of shutter travel. In other words, one end of the film is exposed before the other, and if positions of objects are to be measured on the film this time difference must be known very precisely.

Rotating disc shutters (speeds up to 1/10,000 second) are found mostly in motion picture cameras, in highly specialized sequence cameras such as the Hulcher, or in ballistic phototheodolites. This type consists essentially of a disc with a pie-shaped cut-out which produces an exposure each time the open sector passes the lens. Other versions may use two synchronized discs to control the sequence rate, which is achieved by rotating the two discs at different speeds, exposure occurring only when both open sectors are in line with the lens.

This class is the rotating version of the curtain shutter and like it has no theoretical limit to the exposure time which can be obtained. The rotating disc shutter is best suited for rapid sequence exposures, as in motion picture work.

Slotted cylinder shutters (speeds up to 1/50,000 second) are used in a few highly specialized rapid sequence cameras, notably in the Bowen ribbon-frame camera. The shutter is a simple cylinder of metal with slots parallel to its axis and the film feed and transport mechanism is placed entirely within the cylinder. The action of the shutter is exactly the same in principle as that of the curtain shutter.

### Kerr Cell Shutters

For the photography of really rapid events, such as the motion of the jet from a shaped charge at a velocity of the order of 25,000 feet per second, mechanical shutters are far too slow. Kerr cell shutters have been made to give exposures as short as 0.004 microseconds.

The Kerr cell shutter is based on the property shown by some substances of becoming doubly refracting when placed in an electrostatic field. This property is known as the "Kerr effect" after its discoverer.

A Kerr cell camera comprises the following elements in the order given: a plane polarizer (sheet of Polaroid), an optical glass tank containing nitrobenzene between two sheet metal electrodes parallel to the light path, a second plane polarizer with its polarization direction at 90° to that of the first polarizer and a camera equipped with a mechanical shutter. Light passing through the first polarizer traverses the nitrobenzene and is stopped by the second polarizer. However, when high voltage d-c potentials are applied to the electrodes, the nitrobenzene becomes doubly refracting (it has the highest Kerr constant of any common substance), the plane of polarization of the light is rotated 90°, and the light therefore passes through the second polariod into the camera. Actual cell design is complex, since field intensity and path length in the nitrobenzene must be accurately controlled.

It will be noted that the open time of the cell is controlled by the duration of the electric pulse. With good circuit technique it is relatively simple to obtain exposure times shorter than one microsecond. A commercially available unit has a fixed exposure time of 1/10 microsecond.

It must not be imagined that this shutter has no defects. First of all, the d-c potentials used are as high as 40,000 volts, creating a real handling hazard and leading to operating difficulties in conditions of high humidity. Secondly, the very pure nitrobenzene employed freezes above the freezing point of water, making cold weather operation troublesome. Perhaps the worst fault is that at full opening the cell transmits less than 20 per cent of the light falling on it, because of absorption in the polaroids and in the nitrobenzene. In the closed condition the cell transmits some light, principally red, due to the characteristics of the polaroid. The mechanical shutter is synchronized with the event to prevent exposure of the film to this "leakage" light.

In common with all really high speed shutters, the Kerr cell can be used only for intensely self-luminous events, such as detonations, unless extra high-intensity lighting is supplied.

The magneto-optic (Faraday) shutter is another very high speed shutter for exposures at speeds up to a millionth of a second. Generally similar to the Kerr cell, it uses a block of special glass to replace the nitrobenzene and a coil of a few turns of heavy wire, with the helix parallel to and surrounding the glass, to replace the electrodes. The Faraday effect on which this shutter is based is that double refraction occurs in some substances placed in a very strong magnetic field.

The Faraday shutter avoids the low temperature difficulties encountered with the Kerr cell, although it is not possible to design useful magneto-optic shutters with the extreme speeds provided by Kerr cells.

The wide open transmission of this shutter is only about 4 per cent, even lower than the Kerr cell, but its closed transmission is only about one part in ten million, making it very well suited indeed for photography of intensely brilliant, long duration phenomena. ("Long" is here relative to the exposure duration of one-millionth-second).

Explosive shutters are used in a few instances where the camera may be open up to the time an event occurs, but must be closed afterwards at an extremely high speed. They are essentially capping shutters and have been used as such with Kerr cells and high-speed rotating mirror cameras for the observation of explosive phenomena. Two common types of explosive shutter are described below.

Putty shutters consist of a mass of putty or grease surrounding an opening in the optical path. The opening is usually covered with a tough glass plate which is shielded from the explosion. The operating power is supplied by a loop of cordtex surrounding the plastic mass and connected by suitable explosive links to the explosive system being studied. The explosion is initiated and, after the desired interval, the cordtex loop detonates, smearing the putty over the glass plate and closing the shutter. The whole closing action requires only a few microseconds.

Glass explosive shutters depend on the fracturing of glass to reduce the light transmission very greatly. A glass plate mounted in a heavy metal holder is shattered by the explosion of a detonator placed at one edge of the glass and initiated at the proper moment. Under concentrated explosive attack, a compression wave traverses the glass followed by a very intense rarefaction wave. The tensile stresses set up by the latter smash the glass practically to powder, reducing its transmission to a small fraction compared with the transmission of solid glass. Since there is still some transmission of light, an auxiliary capping shutter may be employed.

**Fig. 2. Open-shutter picture of the flash produced by a high velocity shot striking thin armour.**

### Subject Illumination

The alternative to controlling exposure time by means of a shutter is to control the time during which the subject is illuminated. If no shutter is used, all other light must be excluded; however, from a practical point of view it may not be necessary to work in the dark. It is necessary only that, except for the controlled illumination, the total exposure must not be sufficient to register on the film. Some slight exposure of the background may actually be useful in helping to locate the subject in space.

Very high-speed light sources may have extremely high intensity. They are therefore used with very high-speed shutters to provide sufficient light for good exposures. In these cases either the light source or the shutter may control the exposure time, depending on which is the faster.

### High Speed Light Sources

Several types of high-speed light sources are employed for different purposes. The most important types are described below.

Explosive flash lamps are used only for the study of explosive phenomena, since they are highly damaging in themselves. However, they are relatively cheap, completely non-electronic (a very real advantage) and produce extremely bright flashes of light of very short duration. They are usually used for auxiliary lighting with a high-speed shutter, such as a Kerr cell.

The explosive flash lamp is based on the extremely high luminosity of an intense shock wave in argon. A spherical charge of high explosive (usually pentolite), with a detonator at the centre, is mounted in a glass container (made by sawing a florence flask in half) so that there is a uniform air gap between the explosive and the glass. The joint in the glass is sealed with scotch tape and the air flushed out with argon. Upon detonation of the charge, an extremely high pressure shock wave emerges from the charge surface quite symmetrically and traverses the argon in the gap. During this passage very brilliant light is emitted. The flash duration is controlled by the thickness of the argon layer.

Although the explosion products themselves and the shock wave in air produce bright illumination, the amount is small compared with that which persists only for the very few microseconds in which the shock wave exists in the argon. A high-speed shutter blocks the unwanted light effectively.

Synchronization of the flash and the explosion to be studied is achieved by using primacord leads for timing, and Kerr cell synchronization is secured usually by an ionization pick-up in the explosive train and an electronic timer, although the ionization pick-up alone may suffice, if an extra detonation train is used as a "primacord clock".

Exploding wires provide extremely high intensity light sources. The wires to be exploded are clamped between heavy electrodes and shorted across a high voltage, high capacitance condenser by spark gap or thyratron switching. The wire vapourizes almost instantly (Kerr cells have been used to study the process) and produces very bright light which fades slowly, that is, in 10 or 20 microseconds. A Kerr cell or Faraday shutter is used to control the exposure time.

One important advantage in the observation of detonations is common to the exploding wire and explosive flash lamp. Both require only completely expendable and cheap components at the flash source and hence may be used where they will be destroyed by the experiment.

Open spark gaps can produce flashes of light of extremely short duration, but ordinarily of low intensity, and are therefore used only for shadow photography, which is discussed later.

### Guided Sparks

Guided sparks are sometimes used for reflected light photography of high-speed objects. Ordinary spark gaps are erratic light sources if high light output is required, since the spark path through air is not repeated from one flash to the next. If the spark gap is bridged by an insulating rod of glass or plastic, the spark will span the gap along the surface of the insulator; if a groove is made along the rod, the spark will almost invariably occur along the groove. With this device very high voltages and power capacitors can be used, giving sufficient light output for reflected light photography. The only commercially available apparatus of this type is the French "Defatron".

Enclosed sparks are used where the light source must be as small as possible in size. This requirement arises in shadowgraph and schlieren photography, which is discussed later. An enclosed spark gap is made by surrounding the two electrodes with an insulating tube and by drilling a hole lengthwise through one electrode. The spark is therefore seen end-on with the smallest possible presented area. The enclosure also confines the air heated by the spark, causing a local rise in pressure which increases the light intensity. The best-known example of the enclosed spark is the Libessart spark gap.

Electronic flash tubes are essentially developments of the enclosed spark gap designed for reflected light work. The electrodes are enclosed in a sealed glass tube containing a rare gas such as xenon (for a white light) at atmospheric pressure. A mixture of xenon with about 20 per cent hydrogen gives a brighter flash of somewhat shorter duration. The flash is powered as in the spark gap types by a capacitor connected across the tube and charged to several thousand volts. The flash is initiated by applying a high voltage pulse to a third electrode in the tube or to a wire wrapped around the tube. This pulse can be obtained from a spark coil or other high-voltage source, controlled by a switch or a thyratron operated by a suitable trigger circuit. A typical commercial flash unit is the General Radio "Microflash", which produces a single flash lasting approximately two microseconds.

Some lamps of this type may be flashed in sequence to give a series of exposures for motion picture work. In this application the total light output of each flash is usually much reduced.

### Photographing Gun Projectiles

The method of photographing gun projectiles in flight used at CARDE is simple and highly satisfactory. Permanent photographic installations are used and the gun brought to them for firing, since this is far easier than making temporary photographic set-ups.

The gun is arranged to fire through a small building about 50 feet from the muzzle. A heavy blast wall with an escape hole plate absorbs the main shock from the gun and protects the photographic equipment, some of which is not very rugged. The photographic shelter proper is a frame structure about 12 feet wide, 20 feet long and 9 feet high, without windows, but with small apertures in each end through which the projectiles enter and leave. Before a round is fired, these openings are covered with black paper.

Ordinary 4 x 5-inch press cameras are set up and focussed on the point in space at which it is desired to photograph the projectile. The microflash equipment is arranged so that its beam will illuminate the desired area. From the ceiling a simple optical system illuminated by an automobile headlight projects a parallel beam of light about ½ x 9 inches in cross-section vertically downward to the floor, where a similar system focusses the light on the cathode of a photocell. The photocell is connected to an amplifier which is designed to produce a large voltage pulse to operate the microflash trigger circuit. An electronic shutter synchronizer is normally used, connected to a mercury inertia switch fastened to the breech ring of the gun.

The sequence of events which results when the gun is fired is as follows:—

1. The gun begins to recoil, closing the mercury switch.
2. The mercury switch operates the shutter synchronizer.
3. The shutter opens.
4. The projectile moves into the photographic shelter and noses into the light beam.
5. The change in photocell current caused by the shadow of the projectile is amplified and passed to the microflash trigger.
6. The microflash lamp flashes, lighting the projectile for two-millionths of a second.
7. The projectile moves on out of the shelter.
8. The shutter closes.

With this method, extremely sharp photographs are obtained of even very fast projectiles. The motion of a shell travelling 2,500 feet per second is about 6/100 of an inch during the exposure. A typical photograph is reproduced as Fig. 3.

### The Shadowgraph

For many purposes a "picture" of an object is not required. The methods of reflected light photography may, in fact, obscure the very fine points of greatest interest. A major phenomenon of this nature is the air flow pattern around rapidly moving objects, for which there are several observational methods in common use.

The shadowgraph is the simplest of all the shadow methods and may be used for determining the position of an object in space and the air-flow around it. No optical apparatus whatever is used. Instead, the projectile is fired so that it passes between a photographic film and a light source of extremely small physical size, such as a Libessart spark. When the spark occurs in synchronism with the passage of the projectile, the latter throws its shadow on the film. Upon development, the film shows the shadow as a clear area on a darkened background. Fig. 4 is a shadowgraph of a rifle bullet in flight. If the space positions of the spark and photographic plate are accurately surveyed, the position of the projectile at the time the spark flashed can be computed in two dimensions. If three-dimensional co-ordinates are required, two spark-film systems at right angles to each other are used. Because of the long time required for surveying, plate measuring and computation, the method is employed only when the extreme precision attainable is worth the cost in man-hours.

The sharpness of the shadow is determined by three factors. The spark size must be small, the flash duration must be short and the ratio of the distances from film to spark and from film to projectile must be large. The last factor also reduces geometric distortion to a minimum.

The air-flow pattern around a projectile is visible in a shadowgraph. Motion of the projectile through the air produces various compressions and expansions, including shock waves, if the projectile velocity exceeds that of sound in air. There are pressure gradients, therefore, in the neighbourhood of the projectile and as a result there are local changes in the index of refraction of the air. This causes small zones to act as lenses bending the light towards the higher pressure side. If the pressure differences are sufficiently large and abrupt, the differences in light intensity which they cause will be seen on the film as shadows, giving a clear picture of the local non-uniformities in the airflow around the projectile. That these differences need not be large can be observed by watching the air shimmering above the hot surface of a stove. Such "heat waves" are gentle indeed compared with those caused by a supersonic projectile; nonetheless if a beam of sunlight falls through them onto a plain surface the wavy shadows are easily visible.

Parallel-beam shadowgraphs are much the same in principle as ordinary shadowgraphs. However, a large lens or concave mirror is used to make the light from the spark parallel before it strikes the film. This method has two advantages. First, it eliminates geometric distortion and, second, it permits removing the film to a greater distance from the object being observed without greatly reducing sharpness. Diffraction effects limit the second advantage.

The main drawback of the method is the cost of the lens or mirror, which is high for a large diameter field of view. For this and the preceding method the film must be at least as large as the field of view required, which sets practical limits of operating size.

### Schlieren Systems

Schlieren systems are also based on changes of refraction in air caused by pressure differences. Their principle of operation is best illustrated by an example.

Accompanying a projectile moving at supersonic speed is a system of shock waves, of which the nose shock is the strongest. In still air this shock wave is conical in shape, with the projectile at its point and the axis of the cone lying along the direction of motion of the projectile. This is termed the "Mach cone" after its discoverer, Ernst Mach.

If the shock front is examined in minute detail, it will be found to consist of an extremely thin surface of air at a pressure and temperature much above normal. The front of the shock wave—the side towards which the wave is moving—is marked by an extremely abrupt change in pressure and temperature, while the changes in the other direction are more gradual.

Considering now a parallel beam of light which passes through the shock cone surface in a tangential direction, it will be readily apparent that the light which just misses the edge of the wave and travels in undisturbed air will not be deflected. If the light passes just inside the shock front it will, n accord with usual optical principles, be bent slightly towards the region of greater density, that is, towards the shock front. At some little distance past the point of passage through the edge of the shock wave, the light beam will no longer be of uniform brightness. Instead, the light which passed behind the shock front will have been bent towards the front, leaving a zone of lower light intensity, and the undisturbed light which just missed the shock will have this deflected light added to it, increasing its intensity. If one simply recorded this directly on a film a shadowgraph would result, the shock wave being shown as a discontinuity between a bright zone and a dark zone, both zones fading out to background intensity at some little distance from the shock.

The schlieren system employs optical methods of amplifying the contrast between light and shadow and is therefore capable of detecting

**Fig. 3. Microflash photograph of a 6-pounder shot in flight at 2,800 ft. per second.**

disturbances too weak for direct shadowgraph methods. Obviously, it will thus enhance the sensitivity of the system for detecting flow disturbances of any kind.

A simple schlieren system is composed of a spark light source or small area flash tube and a large lens or mirror, which forms a very sharp image of the source. At the image is placed a "knife-edge", a very sharp-edged strip of blackened metal which is carefully positioned so that part of the light is stopped by the knife-edge and the light forming the rest of the image is permitted to pass by. A camera is placed behind the knife-edge and focussed on the plane occupied by the object to be observed. This plane may be almost anywhere between light source and knife-edge, but is usually near the large lens or mirror in order to give the largest field of view.

Considering the discussion of the effect on a tangent beam of light by a shock wave, it will be seen that the light arriving at the knife-edge when a shock wave or other disturbance is present will be non-uniform in brightness. If the shock wave image is parallel to the knife-edge, the change in uniformity of the beam will cause a large portion of the light to be either stopped or passed, depending on whether the knife-edge is on one side or the other of the beam. This effect provides the amplification of contrast essential for the detection of weak disturbances.

The sensitivity of a schlieren system of the type described is highly directional. A disturbance occurring in the proper orientation is emphasized; those oriented differently may be discriminated against. For special purposes, knife-edges may be formed as sharp-edged holes or opaque circular dots, both non-directional. It is more usual to rotate a straight knife-edge to the angle required to examine a particular disturbance.

Variations in the major optical arrangements are sometimes made. The most common is the use of two mirrors to produce a parallel beam through the region of space to be observed. This set-up is extremely useful where the distance along the beam to the disturbance is not exactly predictable, since the camera need only be focussed on the plane of the nearer mirror; all positions lying between the two mirrors are then in focus. This is the usual method used for wind tunnel observations. A sample wind tunnel schlieren photograph is shown in Fig. 5.

Schlieren systems have one important advantage over simple shadowgraph equipment. The film size depends not on the schlieren system, but on the camera lens and may be small. On the other hand, the lenses and mirrors are very costly in large sizes.

Multiple schlieren systems consist of a number of light sources and knife-edges with one camera for each pair. They are arranged at conjugate focal points on the opposite sides of a large lens. A mirror could be used, but since the disturbance to be investigated can be permitted to occur only in one of the light paths to the mirror to avoid great confusion in the record, a mirror must be very much larger than a lens to cover the same field of view. Exposures are made by flashing the lamps in sequence to give observations throughout a short period. It should be noted that each picture is made from a slightly different point of view, although this feature is of little consequence for many purposes.

These systems have been used for such widely varying purposes as study of gas flow from gun muzzles, of scale model projectiles attacking armour and of the velocity of shock waves from a shell exploded in flight.

#### Interferometers

Interferometers are extremely precise, delicate and costly devices if large in size, but provide direct measurements of the densities and density gradients in the air volume within their field of view, which is usually the test section of a wind tunnel or ballistic range.

Although the precision of optical finish and alignment of components needed for satisfactory operation of an interferometer are extremely difficult to achieve, the principle of their operation is quite simple.

A parallel beam of light is split into two beams by a semi-transparent mirror. One of the beams is

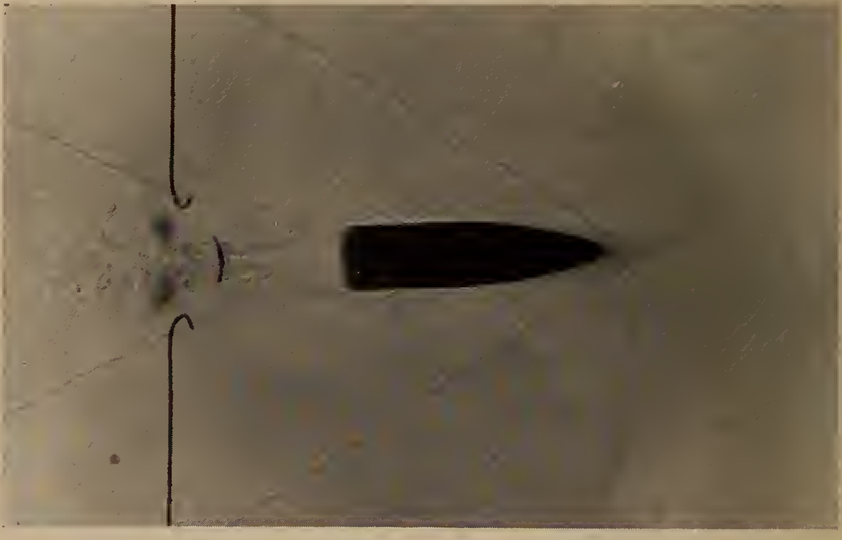

**Fig. 4. Spark shadowgraph of a service rifle bullet in flight.**

directed through the system to be observed and the other is passed around the system and re-combined with the first beam by another semi-transparent mirror. Now comes the most difficult structural and alignment problem: the path lengths of the two beams are adjusted so that, first of all, the wave-fronts of light exactly match each other over the entire area of the beams, and then put out of adjustment so that across the beam the light waves alternately are in and out of phase, producing a pattern of parallel interference fringes. To be really useful, the resultant fringes must be exactly parallel and of exactly even spacing, although corrections can be applied if this condition is not quite obtained. The minimum acceptable optical finish of the components is about one-twentieth wavelength of light for producing such high quality fringes and the adjustments in angle and spacing of the components must be of the same order of accuracy.

The fringe pattern is usually set up normal to the direction of air flow or projectile motion being observed. Variations in the direction and spacing of the fringes caused by differences in air density are determined by precision measurements on camera plates. These measurements and the ensuing computations are laborious and time consuming if carried out to produce a complete density plot. Because of this and their great cost, large interferometers are rare.

### Motion Pictures

Motion pictures are employed to record trains of events in time. They are used to display sequences of events which are in actual fact incoherent, using selective photography and editing procedures to eliminate unimportant items and to emphasize the continuity of processes and the relationships between them.

The availability of a motion picture record makes possible the repeated examination of a complex event with attention to one particular aspect at a time, providing observational data which it might not be possible to obtain with observers actually on the spot.

Normal speed cameras cover the range of frame rates up to 64 frames per second. This is an arbitrary limit set by the camera manufacturing industry and provides frame rates high enough for ordinary "slow motion" photography without raising too many difficulties in the design of camera mechanisms.

Cameras in this class are used in 16-mm. or 35-mm. film sizes for general recording work. They have been used for such technical jobs as measuring the oscillation frequency and damping time of gun mountings, the position of the barrel against a fixed scale being read off each frame and plotted on a graph.

High-speed, intermittent cameras move their film through the exposure gate intermittently as do those of the preceding group. The

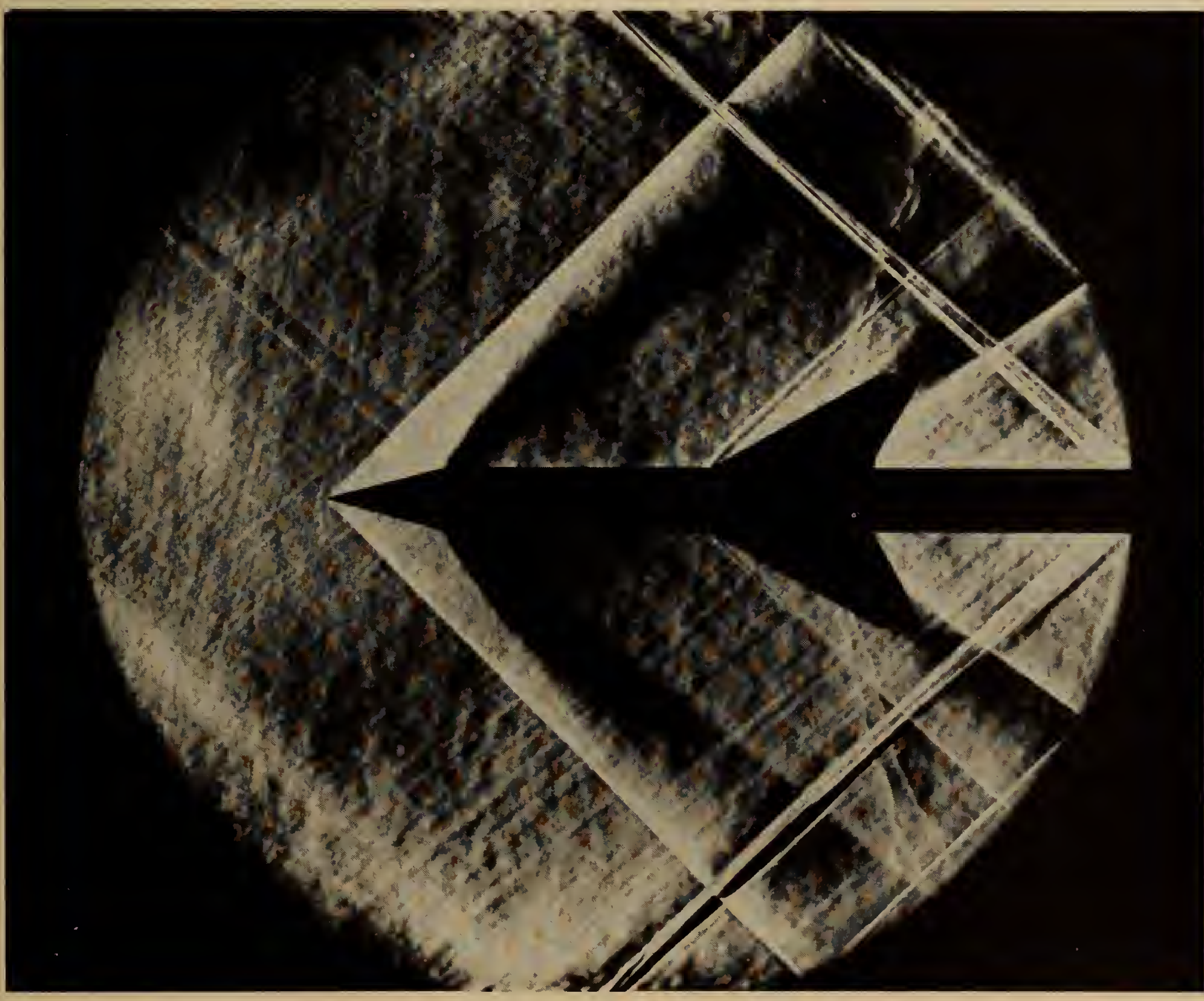

**Fig. 5. Schlieren photograph of air flow around a model in a supersonic wind tunnel.**

film is stationary during exposure and is moved to the next frame position during the time the shutter is closed.

The maximum frame rate of existing high-speed cameras is low, of the order of 200 to 275 frames per second. A special-purpose, single-speed Bell and Howell 16-mm. camera runs at 200 frames per second and the Vinten HS 300 35-mm. camera can run at speeds from 40 to 275 frames per second.

The design limits for intermittent cameras are set by the physical strength of the photographic film. Obviously, careful design and construction can do no more than make the load on the film uniform and smooth in application. It is still necessary to have the mechanism engage the film perforations, accelerate the film to speed, decelerate it to stop and hold it fixed during the exposure. Ordinary plastic-base film can endure only a limited load; what it can stand is indicated by the Vinten HS 300 camera, possibly the camera most nearly approaching the physical limits of design, which requires a 5 hp. electric motor for high-speed runs.

Cameras in this class are used similarly to ordinary cameras, but for more rapid events. They have been used for measuring gun buffer velocities in recoil and run-out, and are widely used as tracking cameras for observing the flight of guided missiles.

The frame rates available with intermittent film motion are much too low for observing really fast action. The limiting factor in their design is the loading placed on the film by starting and stopping it many times a second. This limitation is by-passed completely by having the film run continuously for a full magazine load. Even if several feet of film is used up during acceleration to speed, many events of extreme interest have durations of a few milliseconds, so that the event may be timed to occur after the film is up to speed.

The upper limit of film speed for continuous film cameras is well over 100 feet per second. A typical camera of this class, the 16-mm. Fastax, runs through a 100-foot-long spool of film in 0.9 second at top speed, including starting from zero and an acceleration period lasting about 0.5 second.

With continuously moving film the obvious difficulty is the production of a sharp picture. This problem has been solved in several ways, for example, by using high-speed repetitive flash lamps without a shutter. The individual flash duration of about one millionth second or less is too short to cause appreciable blurring and the repetition rate is synchronized with the film speed by contacts on the film drive sprocket, in order to produce frames at the correct spacing along the film for projection in standard projectors.

Commercially available flash apparatus provides frame rates up to 7,000 frames per second. The picture quality is high, because of the extremely short exposure time of each frame.

At the higher speeds, this arrangement can be used in a normally lighted room without fogging the film. The limited light output of the flash lamps restricts its use to small area photography, the limit of the usable field of view being of the order of 3 x 4 feet.

High-speed shutters of the types previously discussed can be used if sufficient illumination is provided. One shutter, not yet generally available, which is ideally adapted for this application is the image converter.

#### Image Converter

The image converter is a highly specialized vacuum tube with a photosensitive cathode. If an image is formed on the cathode by a lens, electrons are emitted from the back of the cathode proportionately to the intensities of the light image. The light image is thus converted into an electron image. A suitable array of electrodes inside the tube form an electrical lens for producing a second image on a fluorescent screen which can be photographed by a camera lens. However, the transferred image is formed only if a potential is applied between cathode and fluorescent anode to drive the electrons from one to the other. By applying voltage pulses to the tube the image can be made to pass only for definitely controlled times at a controlled repetition rate. The exposure time can be as short as the minimum pulse width obtainable (of the order of a millimicrosecond), and the repetition rate up to several million frames per second, far beyond the capacity of a continuously moving film camera. If pulsed once, it is of course a still shutter.

A major advantage of the image converter is that it can be a light amplifier, yielding an image brighter than the original, a characteristic of great promise for extremely high-speed work. However, image resolution is not high with existing image converters.

#### Image Movement Compensators

Image movement compensators are by far the most widely used devices for obtaining sharp pictures with continuously moving film cameras.

The principle of the image motion compensator is simple. The reader will be familiar with the experiment of holding a thick piece of glass between the eye and a distant object and rotating the glass about an axis in its own plane, producing apparent movement of the distant object.

The image movement compensator consists of a thick glass prism with four, eight or more sides placed between the camera lens and the moving film and rotating on an axis parallel to the plane of film motion. The rotation of the prism moves the image laterally without destroying its sharpness, and the speed and direction of rotation of the prism are controlled by gearing to the camera drive so that the image moves in the same direction as the film and at the same speed, giving a sharp picture.

The simple explanation given above is true within practical limits only for limited rotation of the prism. Exposure outside these limits is prevented by housing the prism in a metal cage which grips the corners of the prism, acting as a shutter when the prism is rotated at an unfavourable angle.

Typical commercial cameras in this class are the Acmade 35-mm. (2,000 f.p.s.), the Fastax 35-mm. full frame (2,500 f.p.s.), the Fastax 16-mm. (7,000 f.p.s.), the Kodak High Speed 16-mm. (3,000 f.p.s.) and the Fastax 8-mm. (14,000 f.p.s.).

Cameras of this type are widely used for the study of weapon functioning. A typical wartime investigation of repeated jamming of Oerlikon guns during proof firings was unsolved, until Fastax photographs showed that a minor and unnecessary bracket on the proof mounting interfered with case ejection, causing some cases to clear the gun and then bounce back in front of the breech-block, jamming it. A typical application as a measuring instrument is the determination of fragment velocities of detonating weapons. In grenade trials a Fastax may be set up to photograph both a target plate at a surveyed distance from the grenade and a mirror reflecting the grenade itself. Timing marks placed on the edge of the film by a flash lamp driven by a timing oscillator permit timing the flight of each fragment striking the plate by counting frames from the appearance of the grenade flash to the flash of each fragment on the plate.

Sequence cameras make a series of photographs of an action automatically. The dividing line between sequence cameras and motion picture cameras is indefinite; the difference may be considered to be in the method of examination of the final pictures, since sequence camera records are not usually projected as motion pictures. In many instances they cannot be so projected, because of lack of frame registration or differences in image orientation. However, even for the most intricate frame arrangements, special-purpose printing machines can provide prints for motion picture projection. Some of the specific features of these cameras are discussed below, the list being far from complete.

Slow-speed sequence cameras are employed to obtain pictorial records of slow events, or synchronized pictures of several repetitions of a repetitive cycle. In the latter application they are equivalent to automatic film changers.

Typical examples are ordinary aerial cameras, which may be operated in some cases up to two or three cycles per second, and the Robot 35-mm. camera which can run at up to six or eight frames per second. These speed ranges overlap those of motion picture cameras, which can, of course, be operated at one frame per day if anyone needs such a low rate. The sequence cameras often have larger film sizes, which may be of great importance for some work.

High-speed sequence cameras are best described as higher-frame-rate versions of the preceding class, differing from motion picture cameras in having larger frame size.

The Hulcher 70 camera is the most generally available machine in this class. The Hulcher camera uses 70-mm. perforated film to take pictures 2¼ x 2½ inches or 2¼ x 5 inches at rates of up to 50 or 25 frames per second respectively. A double-disc rotating shutter provides exposure times down to one thousandth second per frame.

#### Ultra-Speed Framing Cameras

Ultra-speed framing cameras operate on very different principles from those previously described. One type developed to a practical level at Los Alamos and now manufactured by Beckman and Whitley operates at up to 2,400,000 frames per second in the following manner.

An objective lens forms an image of the subject on a rotating mirror. The mirror sweeps the beam of light around, directing it into a series of lenses set around a circle centred on the rotational axis of the mirror. These lenses form secondary images on a strip of 35-mm. film placed in a suitable film holder behind them.

It should be carefully noted that the images on the film are not moving, since the "object" which the secondary framing lenses observe is the primary image positioned on the axis of rotation of the mirror. Rotation of the mirror acts only as a shutter controlling the time during which each secondary lens views the object.

This arrangement yields sharp pictures at high frame rates and short exposure times, at the cost of low optical speed, requiring extremely high intensity illumination. The major difficulty in the design of such cameras is the mirror drive. since rotational speeds of 100,000 revolutions per minute or higher are needed. Air turbines are often employed.

Usually either self-luminous subjects, such as detonations, are photographed, or explosive flash lamps are used for small-area observation of non-luminous objects. Since the camera must be open for only one revolution of the mirror to avoid double exposures, a high-speed shutter is required to close the camera. The Los Alamos camera uses an explosive/glass shutter for this purpose.

Examples of applications of this camera are the study of the motion of metal surfaces under explosive attack and the early stages of expansion of atomic explosions.

#### Image Dissectors

Image dissectors provide another method of obtaining high frame rates. An optical system is used to break up the original image into strips rather like the pattern of a venetian blind. These image elements are then placed end-to-end across the film. This permits the recording of a picture frame on much less than its normal length of film. As a result, the film need move only the height of an image element between frames. Using high-speed drums as film carriers, cameras of this type can reach frame rates of about 200,000 per second.

#### Grid Analyser

In a grid analyser, the original image is formed on a grid made by scribing parallel lines about 0.0005 inch wide on an opaque coating on glass, the lines being separated by a fairly large multiple of their width. A second lens is used to form a 1 : 1 image of the grid on a photographic plate, but a large area rotating mirror is inserted between the second lens and the final image, causing the latter to move across the film.

Considering a photograph taken with the mirror stationary, the resulting picture will consist of a series of lines separated by areas with no image. To the eye the picture will appear somewhat the same as a television picture, having a line pattern not too clearly resolved. Providing the size of the object in the picture is large compared with the line spacing, a fairly sharp picture is obtained.

Now if the mirror is rotating, there will be constant exposure of the film and the resulting picture will be a blur. However, if the original grid is placed in contact with the picture, the result is similar to the preceding case in that the appearance of the subject at the moment corresponding to the grid position used can be examined. If, then, the grid is moved normal to the line direction by one line width another stage of the process can be observed. In a similar manner, separate views of the event can be obtained by moving the grid until the whole space between grid lines has been traversed, line width by line width. Although the exposure is continuous, a "frame rate" can be defined as the reciprocal of the time taken for the image to move one slit width. By this definition the United States Ballistics Research Laboratories camera has a frame rate of 100,000,000 per second.

This is a decidedly special-purpose camera intended for the study of the motion of shock waves near small charges of explosive. For this purpose it is often convenient to permit multiple exposures to give a record of successive positions of the shock wave on the same frame.

Image converters have been used as high speed framing devices by adding magnetic deflection coils to the image converter shutter. Each image formed by a single exposure is deflected to a different position on the fluorescent screen. Commercially available equipment provides six pictures at a maximum repetition rate of about 1,000,000 per second.

For many purposes a pictorial image of an object or event is not necessary. For example, only in the time at which some event occurs may be of interest or the intervals between similar events, or, perhaps, a combination of the time and distance along a straight line, as in the measurement of the velocity of detonation of explosives, may be of interest.

### Streak Cameras

Applications of this nature are often best served by a method of continuous exposure, since the dark interval between exposures in a framing camera may obscure the most interesting portion of an event. Cameras designed to give continuous recording usually sweep the image along a film giving a picture which is composed of smears or streaks, and so they are often called "streak" cameras.

Moving film streak cameras use a fixed optical system and move the film past the point of exposure. To avoid inaccuracies due to image extension along the time axis of the film, a slit is used, either inside the camera or at the subject, to confine the field of view to as short a length as may be desired.

There is a very large number of cameras in this class differing in detail, but not in principle. The Hulcher 70 camera may be used as a streak camera by disengaging the intermittent drive and can give film speeds of up to 10 feet per second. The General Radio continuous film camera uses 35-mm. film at up to 100 feet per second.

A typical application of this class to armament work is the determination of fuze functioning time. The camera is set up to view the edge of a target from a point at right angles to the trajectory and has its slit oriented parallel to the trajectory. A burst of gunfire at the target results in streaks of light which originate at the burst point of the shell. If a light is mounted on the target, the distance between target and burst can be obtained, and the time computed from the observed velocity of the shell. In this particular case, a still camera might suffice, but the streak camera permits using automatic fire and also moves the image on the film so that if the explosion gases expand towards the target, they do not obscure the original point of burst.

### Drum Cameras

Drum cameras form another class of moving film cameras with higher film speed than can be obtained with continuous film cameras. They have been used for similar purposes, but with higher time resolution.

Rotating mirror streak cameras raise the limit of image velocity attainable to much higher levels than do the preceding types. Image speeds of 5mm. per microsecond are attained by commercially available cameras and this is by no means an upper limit.

Most cameras of this type have an objective lens which forms the primary image on a slit. A second lens transfers the image of the slit to a fixed film by way of a mirror which rotates on an axis parallel to the slit. This arrangement establishes a virtual slit at the object being photographed, which is frequently a most convenient feature.

The most common applications of this camera type are to the study of detonation phenomena. A stick of explosive oriented parallel to the slit and initiated at one end produces a streak image which can be analyzed to give the detonation velocity at all points along the stick, showing variations where the mechanism of detonation changes. If the end of such a charge is imaged on the slit, the resulting record shows the shape of the detonation wave traversing the explosive, since each portion of the detonation wave is recorded as it arrives at the free end of the charge. In this manner the effect of various systems of initiation and confinement on wave shape can be investigated, matters of considerable importance in, for example, shaped charge design.

### "Ballistic Camera"

The term "ballistic camera" is applied only to cameras used for the precision measurement of trajectories of projectiles, rockets and other free-flying objects. The major features of these cameras are the extreme precision of their construction and the provision of accurate methods of reading their position and orientation. There are two major subdivisions of the class, fixed and tracking cameras.

Fixed ballistic cameras are very precisely set up and fixed in position. They record the flight of objects across their fields of view and are the most accurate of all optical instruments used in ballistics work. Phototheodolites are the simplest in principle of all ballistic cameras. They consist of a precise lens, a light-tight box and a plate-holder, the whole assembly being mounted on horizontal and vertical bearings of extreme precision and rigidity.

These cameras are used in pairs on a long base line, and are equipped with rotating disc shutters accurately synchronized. Usually, they are used at night with projectiles fitted with tracers or other light sources, and record views of the trajectory interrupted at precisely determined intervals by the shutters. The three-dimensional trajectory is then computed by triangulation from the known survey positions of the cameras and their orientations.

For work of high precision the orientation of the cameras cannot be obtained with sufficient accuracy from any conceivable scales. In such cases, firings are carried out on clear nights and the photographic records are calibrated for each small part of their areas by measurements of the relative positions of the background star field, the positions of stars being known to great accuracy from astronomical observations.

This method avoids all mechanical errors and neutralizes the effects caused by slight dimensional changes in the emulsion during processing, as well as allowing for lens distortion. Position accuracies of the order of one inch at ranges of many miles can be achieved under the best conditions.

Ribbon-frame cameras are actually high-speed sequence cameras designed for precision position measurements. The CZR-1 Bowen camera may be taken as typical of the class. This camera uses 5¼-inch wide aerial camera film to make exposures of full film width, but as little as one-quarter inch high at rates up to 180 frames per second. A multiple-slot drum shutter produces exposures down to 25 microseconds at very precise intervals. The field of view includes an array of timing lights which record exact time of exposure and a series of reference crosses which are recorded on the film at each exposure and which are used to calibrate the field of view by making exposures of a precisely surveyed set of targets.

The camera includes a mounting which can be oriented around all three axes to about 0.002°. This allows the long axis of the camera frame to be oriented parallel to the missile trajectory, the position of the missile image in subsequent frames being measured with a travelling microscope and used to compute position, velocity and acceleration versus time.

This camera was originally designed for the observation of rocket trajectories during burning and still provides the most satisfactory method for this work.

Tracking cameras are used for determination of position versus time of larger missiles and aircraft and differ from the fixed cameras in two major respects; tracking cameras usually use motion picture film for sequence photographs and are equipped with long focus lenses. They must therefore be pointed at the missile at all times in order to keep it in the field of view.

Kinetheodolites are the tracking equivalents of phototheodolites, though of necessity of much lower precision. The Askania kinetheodolite is typical of the class. This instrument has a very rigid camera body with a long-focus, usually 24 inch, lens and an intermittent motion-picture film-feed mechanism. A moderately fast shutter is used with a synchronizing drive, which can be adjusted so that all cameras of a group can be made to expose at the same instant.

The camera body is mounted on horizontal and vertical bearings of high precision, both axes being equipped with precision calibrated circles. Lens and prism optical trains are used to transfer images of both circles into the field of view of the camera aperture, so that each exposure shows the target, fiducial marks indicating the centre of the field and two scale readings giving the azimuth and elevation of the optical axis for the particular frame.

At least two cameras must be used in a set-up. Operators track the target manually during a flight, and the position of the target at each exposure is computed from the time, scale readings, survey base and corrections for tracking error which are read off the individual frames.

Tracking cameras when used as ballistic cameras are similar to kinetheodolites in principle, but usually of somewhat lower precision. They may use lenses of focal lengths up to 20 feet or more and are primarily intended for obtaining measurements of pitch, roll and yaw of guided missiles at very long ranges. The great size of the optical systems usually requires the use of power-driven mountings.

The same equipment is frequently employed without any attempt at quantitative measurements, but with high frame rate cameras as a method of viewing the operation of external devices, such as moving wings or the separation of booster rockets.

Radiographic techniques are of wide application in armament work. Most applications can be classified as inspection, but there are purely ballistic uses as well.

Industrial radiography is carried out with commercial X-ray equipment or gamma radiation sources, such as radio-active cobalt.

Aside from applications to the inspection of items of equipment, perhaps the most important use of radiographic techniques is the examination of explosives and propellants for the detection and measurement of physical flaws. Cracks and voids in these substances cause irregularities in their performance and examination is used to determine whether the samples are usable and, if so, what irregularities may be attributed to flaws.

A very common use of radiography is the examination of fuses to determine whether they have been assembled correctly, or after recovery to investigate how they have operated.

Flash radiography is closely allied in principle to flash photography. X-rays are used where ordinary light photographs cannot give the required information. Examination of the discarding process of sabot projectiles in the muzzle smoke or flash can readily be accomplished by flash X-ray exposures lasting one or two millionths of a second. If the exposure time is reduced to one-tenth microsecond, detonation waves in explosives can be resolved and the structure and formation of jets from shaped charges, or the break-up of metals under explosive attack, can be observed.

#### References

Information on technical photography, particularly that concerning high speed methods is widely scattered in the literature and a complete or even comprehensive bibliography would be extremely bulky. For this reason only a few references are cited. Those who are interested enough to examine them will find copious references listed in all these sources.


***Periodicals***

Journal of the Society of Motion Picture and Television Engineers (monthly)—In recent years this journal included special issues on high-speed photography and yearly articles on progress in photography.

Photographic Engineering (monthly)—Official publication of the Society of Photographic Engineers; a valuable technical journal.

***Textbooks***

(i) Chesterman, W. Deryck, The photographic Study of Rapid Events, Clarendon Press, 1952.

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## Natural Gas Pipe Line System

The Government of Alberta has authorized Trans-Canada Pipe Lines Limited to export 4 trillion 350 million cubic feet of natural gas from the province. It may be taken from Alberta at the rate of 183 billion cubic feet per year, or 540 million cubic feet per day.

The Government of Canada, through the Board of Transport Commissioners, has granted the company a permit to construct a pipeline from a point in Alberta, near the Saskatchewan border, across Canada to Montreal; and to build a branch from the main line from Winnipeg to Emerson, on the Manitoba-Minnesota border, to carry gas, through a U.S. system, to the St. Paul-Minneapolis area. Other branches will serve south-western Ontario and the Ottawa-Hull district.

Federal approval of the $300 million, 2,200-mile project was granted on July 26, 1954. The final permit will be issued as soon as authorities are satisfied as to the adequacy of financing arrangements. The company was to report to the Transport Board on this, and several other points, prior to December 31, 1954.

***Niagara Falls—Toronto Branch***

Construction of this line, the first phase of the natural gas system, is well ahead of schedule. The line will serve the Toronto area which, originally, was promised natural gas by November, 1954.

Primary purpose of building the Niagara Falls-Toronto pipe line at this time is to develop the Toronto market area ahead of the arrival of Alberta gas. Under the permit issued by the Board of Transport Commissioners at Ottawa, this line will carry American natural gas to Toronto until November, 1956. The Board has ruled that, once Alberta natural gas shall be available to Toronto, surplus gas, after filling the needs of Eastern Canada, may be piped to the Buffalo-New York area.

Laying of pipe and negotiations for the right-of-way are proceeding simultaneously. At this time, three-quarters of the pipeline is already laid.

# Instrumentation in Armament Development

by

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**In this Quebec Annual Meeting paper, the author discusses in general terms the methods and instruments used in the collection of the data required in modern armament design. Some are adaptations of those developed for use in industry, but many are unique. The high cost of proper armament instrumentation will surprise those unfamiliar with it, which naturally includes most readers.**

All phases of armament development from early research to final acceptance trials involve special instrumentation to measure the many parameters which affect basic design or performance. Indeed, without proper instrumentation, it would be almost impossible to attempt a scientific approach to armament design, except possibly by trial and error, which would not only be time consuming, but fruitless and frustrating.

Regardless of the type of armament involved, it is often surprising to note that relatively few basic parameters need be measured. However, the method of measuring any particular phenomenon may be complicated by its nature and the location of its origin. The provision and subsequent application of proper instrumentation for evaluating the performance of an armament or parts thereof may often be the most expensive portion of the program, both in time and in money.

With respect to guns, rockets, guided missiles, aircraft, submarines torpedos, and other projectiles, bombs and associated devices of devastation, one may divide the instrumentation involved into two basic classes. Equipment used to evaluate the *effects* or *results* of a weapon, or its manoeuvre and external condition during flight, is classed as "external" instrumentation. "Internal" instrumentation, however, is concerned with the measurement of the various internal parameters which govern *causes* and is normally more basic in concept. For example, instrumentation to measure the velocity of a projectile is classed as external, whereas the instruments for measurement of the pressure-time curve in a gun barrel during firing are considered internal.

In any experimental analysis in which a measurement is required, there are several significant steps in setting up an instrumentation system:

a. Transforming the physical phenomenon into some measurable impulse by means of a suitable transducer.
b. Transmitting or telemetering this impulse to a recording unit.
c. Recording the signal on an instrument having the response and accuracy required by the experiment or trial.
d. Reducing the accumulated recorded data into some convenient form for analysis.

This paper describes some of the various methods used to accomplish the above steps and their relative importance with respect to armament design and development.

### External Instrumentation

External instrumentation is sometimes referred to as "range" instrumentation, because the equipment involved is normally permanent and is interconnected into a complicated system of facilities, which may extend over a large area. This is particularly true of external instrumentation required for guided missile or long range rocket tests.

The types of measurements involved with armaments include:

a. Space position vs. time.
b. Velocity vs. time.
c. Acceleration vs. time.
d. Altitude vs. time.
e. Miss distance of projectile with respect to a target.
f. Detailed behaviour of a missile or rocket in the early launching phase.
g. Effects or magnitude of blast of a bomb.
h. Shock wave patterns on aircraft, missile models or projectiles.
i. Meteorological data, such as temperature, humidity and pressure.
j. Spin, pitch and yaw of projectiles.

Perhaps the most common and useful type of instrument for external instrumentation is the photographic camera. Special tracking and viewing cameras, some with long telescopic lenses, others of the high speed, short focus type, combined in various ways and involving complicated electronic speed regulating and timing devices, are available on the market today. These, combined with high speed movie cameras and high speed microflash single frame cameras, constitute a special field of instrumentation itself and are covered in the paper "Photography in Armament Development."

Velocity, one of the measurements most commonly required for missiles or projectiles, may be determined by means of photoelectric screens, spaced a known distance apart, through which the projectile is fired. The time interval may be measured on a high accuracy chronograph or electronic timer. The latter are now made to enable accuracies of the order of at least one part in ten million. Among the newer devices for velocity measurements are single point and continuous doppler sets. The latter provide doppler frequencies which are proportional to the velocity during the complete trajectory of the projectile. The single point doppler set measures the velocity at only one point in the projectile's trajectory.

Pulse radar equipment, including beacons and chain radar systems with associated plotting boards and computers, are relatively common for obtaining range, azimuth and elevation data on an aircraft, missile rocket or projectile. These often replace the photographic kinetheodolites, which, although highly accurate, are too dependent upon weather conditions and require a large volume of data reduction to obtain trajectory information.

A large range, especially one concerned with guided missile development, is fully equipped with scores of the above instruments. In addition, complex chains of communications are required to synchronize all the instruments as a team during any single trial.

It may be interesting to note some of the costs involved with equipment of this type. A fully instrumented kinetheodolite station may cost as much as $60,000. At least three of these stations are required to provide useful trajectory information. A tracking radar set complete with computers and plotting boards may run as high as $350,000. Several of these, with their maintenance and operating crews, quickly bring the capital costs up to several millions of dollars.

Recent atomic explosions bring to mind the fact that blast and radiation measurements must be obtained for proper evaluation of such explosions. Special pressure-sensitive transducers, as well as simple interferometer devices, have been developed to measure blast intensity. Geiger counters, of course, are common in detecting and determining the intensity of radioactivity.

Meteorological measurements are important in the armament field. The measurement of temperature, pressure and humidity in the upper atmospheres is required in calculating the expected trajectory of a projectile. The use of special radiosonde equipment, combined with balloons, is the most common method of observing these parameters.

Some of the most difficult measurements involve the determination of yaw and spin of projectiles travelling at extremely high velocities. Spin sondes and similar electronic devices have been used but many of the problems involved remain unsolved.

Instrumentation incorporating electronic and photographic devices for determining the fragmentation pattern and velocities in warhead design is another special requirement.

These and many other requirements provide daily challenges to the ingenuity of the instrument engineer involved with armament development.

### Internal Instrumentation

The instrumentation problems involved in measuring the basic parameters which affect the performance and operational limits of an armament are usually the most interesting. In the field of ballistics experimental techniques must be worked out to measure quantities such as transient pressure, temperature, flash intensity, detonation and ignition time. Such measurements are increased in complexity because of the short duration or rapid transient nature of the events.

The design of suitable propellants and igniters for shells involves measurements of pressure, burning rate, rate of pressure change and similar quantities. Measurements of temperature in guns are important in determining whether the barrel will tolerate those involved.

The development of new aircraft and guided missiles involves measurements of strains, pressure, accelerations, positions of various actuators, pitch or roll angles, fuel flow, skin temperatures, altitudes, vibrations and many other quantities. In most cases, the space and weight problem necessitates the development and design of reliable miniature transducers and recording systems.

Perhaps the greatest accession to instrumentation in the past ten years has been the development of special telemetering techniques, which make it possible to record and measure on elaborate ground-based equipment the behaviour of an aircraft, missile or rocket while in full flight. Engineering personnel, who only a few years ago were loath to look at telemetered results, are now quite willing to accept them as an excellent substitute for data previously taken in test pits or wind tunnels. No longer is there any question whether or not telemetering methods provide good instrumentation; instead, the question is only what system will provide the best data.

Recent rapid advances in electronics, stimulated by the problems created and solved during the late war and those wars now being conducted on an experimental basis by the various nations, have almost completely revolutionized instrumentation systems. Virtually, every instrument at present involves applied electronics of one type or another, whereas twenty years ago optical and mechanical measuring systems were predominant. Future development will be speeded up by the great potentialities resulting from the intensive research programs being carried on in the solid state physics field.

### Transducers

The first step in any measurement problem after a study of the characteristic to be measured is to select a proper transducer, sometimes called "pickup," "sensing element," "command" or "monitoring device". Electronic measuring and indicating equipment, characterized by rapid response, high sensitivity and accurate control, are so commonly used that most transducers now are designed to convert a physical phenomenon into a suitable electrical signal.

Frequently, the nature of the experiment dictates the selection of a specific transducer. For instance, where long cables are necessary, piezo electric transducers may not perform satisfactorily; where temperatures are high, crystals may disintegrate with heat; capacitive devices, though relatively sensitive, usually require intervening electronic circuitry; magnetic transducers should not be used in the presence of strong magnetic fields.

In general all transducers providing electrical outputs operate on the following basic principles:

a. Resistance change—SR4 strain gauge thermisters.
b. Capacitive change—condenser microphone.
c. Magnetic changes—tachometers, saturable reactors and variable reluctance pressure gauges.

d. Piezoelectric phenomena—piezo pressure gauges, vibration pickups and phono pickups.
e. Photoelectric phenomena—photo cells.
f. Thermoelectric phenomena—thermocouples.
g. Electroic phenomena—vacuum tube accelerometers and ionization counters.
h. Radioactive phenomena—thickness gauges.

Transducers now available are far from optimum in versatility, size, weight, construction or cost. Manufacturers and users are beginning to realize that fancy machined surfaces, coupled with intricate electromechanical converters requiring multiple adjustments, are not necessarily of much advantage.

Many basic measurement problems are unsolved for lack of proper transducers or associated elements. For example, how can one measure the mass of a rocket or missile at any time during flight? Can the drag of a projectile or missile be measured within 0.1 ft. per sec.[2] Can continuous measurements of air density during flight be made?

#### Transmitting Systems

After the transducer has been chosen and located, the electrical output must be transmitted either by a wired or wireless link to a recorder. If several quantities are to be transmitted simultaneously, it is sometimes advantageous economically and electrically to use multi-plexing techniques. For static and dynamic measurements on guns wired links are predominant. However, the great interest in rockets and guided missiles has stimulated the growth and development of the radio telemetry link as a replacement for the on-board recording techniques commonly used in the development phase of aircraft work.

When the idea of radio telemetry was first considered, many organizations in Great Britain and the United States began independently to develop telemetering systems. This created complete chaos because of the numerous permutations and combinations of systems that can be made to function. A few survived to be extensively developed and, luckily for Canada, to be eventually available commercially. The drive toward standardization was sparked by the Telemetering Working Group of the Panel on Test Range Procedures and Instrumentation of the Research and Development Board in the United States. In 1948, the FM-FM, the most common telemetering system, was recognized and adopted as a standard. Since then the PWM-FM system has been added as a standard and the PTM-AM system is being encouraged.

All the above systems permit the transmittal of multi-channel measurements from numerous transducers in a test vehicle, missile, rocket or aircraft by a single wireless carrier signal in coded form. These are recorded in a central receiving station, where decoding and subsequent recording on paper may be accomplished automatically.

The factor which will most influence telemetering during the next few years will be the application of transistors. The advantages of decreased volume, weight and power requirements will be exploited for airborne applications. It is hoped that subsequent reduction in costs may follow. A single channel of information telemetered by the FM-FM principle, including the cost of a transducer, one amplifier and a sub-carrier oscillator, may run into six or seven hundred dollars or even higher. Multiplying this by ten channels, and including a four hundred dollar transmitter and a three hundred dollar commutating switch, brings up the total cost of a telemetering transmitting system to several thousands of dollars.

#### Recording Systems

The choice of a recording system depends upon many factors some of which are not dictated by technical reasons. These include the following considerations:

a. Nature of function to be recorded—duration, frequency, magnitude, independent variable.
b. Method of reducing and assessing data.
c. Location of recorders with respect to source of quantity to be measured.
d. Type of transmitting or receiving system.
e. Method of storing recorded data.
f. Number of channels required.
g. Telemetry system.
h. Environmental conditions.
i. Type of transducer.
j. Cost of equipment.
k. Type of maintenance and operating personnel.
l. Provision—by development, or by purchase from standard commercial sources.

In general, the oscilloscope with an associated single frame or moving frame camera is the most common and versatile recorder. This is available in single channel or multichannel form. Its wide frequency characteristics make it applicable to most recording problems. For lower frequency operation, pen type recorders closely followed by galvanometer-paper-record type systems may be found in most laboratories. The development of good magnetic tape recorders is now well enough advanced to make them applicable to many recording systems, especially to provide secondary coverage. Transmitting data by digital and pulse systems makes the tape recorder still more useful, especially since automatic data reduction equipment may be tied in with greater facility. The tape may be played back innumerable times to assure that the information is as accurate as possible.

The simplest and most basic recording unit is the recording pressure gauge, operating on the Bourdon tube or bellows principle, to which an inking pen is attached. Self balancing, potentiometer type recorders, in addition to such instruments have been used in pressure, thrust and force measurements in long burning rockets for many years. These are low frequency devices and are not applicable to guns, where the phenomena are of transient nature with high frequency components.

Measurements on aircraft have been normally made by pen type instruments or more commonly by the galvanometer-paper-record type machines. These are giving way to telemetering systems, especially on small, high speed fighter aircraft where space is at a premium.

#### Data Reduction and Analysis

The great demand for measurements during armament development programs has provided the designers with so much qualitative information that the task of reducing the data to quantitative values usually creates a bottleneck and consequently delays the application of the test results to design.

This may be exemplified in reviewing some of the assessments necessary in sample measurement systems. Consider the use of kinetheodolites to obtain trajectory information vs. time of a rocket in flight for 45 seconds.

Each camera station takes about five frames per second and on each frame the azimuth and elevation of the tracking camera appears with a photograph of the rocket at some distance from the centre cross hairs. A total of 45 by 5 by 3 or 675 frames

*(Continued on page 1609)*

# ARCTIC APPLICATION

of

# THE HEAT PUMP

*by*

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This paper was read at the Quebec annual meeting in May, 1954. It calls attention to the special advantages of the heat pump when used in hard-to-get-at locations, such as our Arctic and sub-Arctic defence installations. The particular pump described is a standard refrigerating unit driven by a diesel engine and with ingenious means for getting rid of the ice formed from the water used as a source of heat.

In the Arctic and sub-Arctic regions of North America there exist a number of installations which are manned by fewer than a dozen persons. The supply of food, fuel and equipment to these establishments is a costly undertaking. The inland posts are supplied by air or by winter caterpillar train, and the posts on the Arctic sea are usually supplied by ship during the brief summer season, or by air.

While little can be done to reduce the requirement for food and equipment, it is possible that some saving can be effected in fuel consumption. The saving in oil fuel is important during wartime since oil becomes a strategic material because it can be converted to higher grade fuels by improved cracking processes, because it is the base for various other products by the chemical industry and because of the scarcity of transport equipment.

Another problem associated with the supply of power and heating in the Arctic is the supply of water during the long winter period. The present answer is the melting of ice cut from nearby rivers and lakes, which also requires the consumption of fuel.

The solution to the problem then would seem to be the development of a device or devices which would perform three functions with the minimum fuel consumption. These functions would be to supply heat for dwellings, fresh water at such a temperature that it could be pumped from building to building without danger of freezing, and electrical power for the operation of various appliances and equipment.

The improvement of existing types of fuel oil heaters does not seem to offer much promise of large savings, so the heat pump was investigated on a theoretical basis to determine its possible application.

### Design and Operation

It should be emphasized at the outset that the design and operation of the pump itself is by no means complicated nor even new; its possible use was first pointed out by Lord Kelvin in 1854. We hear so much about it nowadays because there have been improvements in compressors, motors and heat exchangers in the past few years and because fuel and transportation costs have risen to a point where in some cases the heat pump now has an economic advantage over other methods of heating. The refrigerator in your kitchen is a heat pump. It extracts heat at a low temperature level from within the refrigerated enclosure and rejects it at a higher temperature level into the room. In that case we consider the extraction of heat to be the useful and desirable thing. In the case of the heat pump we consider the rejection of heat to be the useful and desirable thing. From a practical point of view this is the only difference between a refrigerating machine and a heat pump.

The heat pump is merely a means of recovering heat at a low temperature and raising the temperature of this heat so that it may be put to some useful work.

The first step in heat pump design is completed when the use to which the heat is to be put is decided and the temperature level of this heat is established. The important consideration with respect to the temperature level hinges on the theoretical coefficient of performance of the cycle.

### Coefficient of Performance

The coefficient of performance is the ratio of heat pumped to work expended. The theoretical coefficient of performance depends only on the temperatures of extraction and of rejection. If $T_s$ be the absolute temperature at which the heat is received and $T_d$ be the absolute temperature at which the heat is rejected, the theoretical coefficient of performance on the heating cycle is

$$\frac{T_d}{T_d - T_s}$$

Thus the smaller the difference between these temperatures and the higher they both are, the greater is the theoretical coefficient of performance.

It becomes obvious that we must use the heat at a temperature as near that of the source as possible and that the higher the source temperature, the greater the coefficient of performance. In heating of dwellings, it appears that the best method would be panel or radiant heating for which a temperature of 90°F. is sufficiently high for the heat transfer fluid. This temperature would also be sufficiently high for the circulation of water for drinking and washing purposes. The design temperature would have to be about 20°F. higher than this, or about 110°F., in order to deliver the heat to the heat transfer fluid through some type of heat exchanger. The working fluid would most naturally be water, since this is most readily available, or perhaps a water-glycol mixture to guard against freezing during shut downs.

### Heat Source

The second criterion of heat pump design is the selection of a suitable heat source. This source quite logically should be at the highest possible temperature and an economic method of heat extraction must be established. The normal heat sources, exclusive of industrial sources, are as follows:

1. Air.
2. Ground and/or ground water.
3. Water.

Using air as a source of heat is ruled out for several reasons. A finned coil type of heat exchanger would have to be employed and the incidence of blowing snow would cause a great deal of difficulty. The mean temperature during January and February for Fort Churchill at 58°N. latitude is about −15°F.; for Ennedai Lake at 61°N. latitude, about −20°F.; and at Resolute Bay at 75°N. latitude, about −30°F. The refrigerant temperature required to extract heat from air at −20°F., for example, would be about −40°F. and, aside from the low coefficient of performance incurred, the problems of defrosting iced-up coils would be extremely difficult to solve and costly from an operating standpoint.

Several installations have been made in Canada where the heat source used is the ground. These have operated fairly well, but in the Arctic and sub-Arctic regions, the incidence of permafrost and the complete freezing of the ground almost completely rules out this source. There are certain relatively small areas where the ground does not freeze completely, or where water is moving through sand and gravel strata throughout the year, but they occur so rarely that they cannot be taken into account in a general design problem. At any rate, heat recovery from the surface would be non-existent and we could expect rapid freezing of these areas if any sizeable heat extraction were attempted.

The water source seems to show the greatest promise. The northern lakes and rivers are not often very deep, but ice thicknesses of six to eight feet are about normal during the winter. The average water temperature below the ice is about 33½°F., and it is obvious that very little sensible heat can be removed. Any type of submerged coil would quickly acquire an ice cover which would seriously reduce the coefficient of heat transfer. The coil would also tend to float as the ice mass increased and the problem of anchoring it properly is almost insurmountable. Another drawback to this approach is the almost certain damaging of the coils during breakup in the spring.

The answer here is to pipe the water to a device which will then freeze it in such a form that it can be easily disposed of. Dr. Misener, now head of the Department of Physics of the University of Western Ontario, conceived such a device in 1950, and Mr. Hooper, of the Department of Mechanical Engineering of the University of Toronto, designed a machine which was built by the Canadian Ice Machine Company, Ltd. This machine has been installed at Fort Churchill for the past four winters. It employs a 15 hp. diesel engine driving a compressor which extracts the latent heat of fusion from water frozen on the horizontal stainless steel drum of a York DER Flakice machine.

This ice-making machine turns out about 7,500 lb. of ice per day in the form of flakes about 1/16 in. thick, 1 in. long and ⅜ in. wide. The ice flakes are carried by a screw conveyor to the inlet of a fan which breaks the ice up and discharges it from the building vertically through a stack. The ice is then dispersed by the wind.

This unit was primarily designed for water heating, and will heat about 35 g.p.m. from 33°F. to 90°F. The latent heat of fusion is extracted by the Freon-12 refrigerant at 0°F. and rejected to the water in the refrigerant condenser at about 120°F. The theoretical coefficient of performance of this refrigeration machine is

$$\frac{Td}{Td-Ts} \text{ or } \frac{580}{580-460} = 4.83,$$

which is, of course, unattainable and is based on the actual work done in the cylinder of the compressor. The losses between the shaft input and the cylinder work must be taken into account.

This figure is again materially reduced by the losses in the diesel engine and transmission system. The shaft output of the diesel engine is only about 30 per cent of the fuel potential. The heat in the diesel exhaust, however, is mostly recovered through an exhaust heat exchanger and the combustion products are exhausted at about 60°F., thus recovering the latent heat of vapourization of the water formed during the combustion process. The cylinder jacket heat is also recovered by direct circulation through the jacket.

### Overall Performance

The overall coefficient of performance by actual field test is 1.61, which means that the useful heat transferred to the water is 61 per cent greater than the higher calorific value of the fuel consumed. In reality the actual coefficient of performance is about 1.8, since the former figure does not take into account the fact that the building in which the machine is housed is heated by the heat losses from the machine, a useful function. This represents approximately three times as much heat as would be obtained from the burning of the fuel in the conventional type of oil burning space heater.

Another factor worth mentioning here is the ever-present wind of the Arctic and sub-Arctic. If a suitable system could be found for storing the output of wind-driven generators in some form readily accessible to the heat pump, it should be possible to increase the operating efficiency to a great extent and to reduce the cost and complexity of the equipment.

The greatest problem to be overcome with this system is in the supply of water. Very few of the northern waters drop off suddenly from shore to deep water. This necessitates long water lines. Near and at the shore a bottom laid pipeline must pass through areas whose temperatures are considerably below the freezing point. The flow rate required for this particular unit is about 0.6 g.p.m. and if the machine is shut down for any reason the water in the pipeline must be drained immediately. As an emergency measure a resistance wire must be run in the pipe to thaw the line when it freezes up. Flow in the pipe must be turbulent at all times, since laminar flow would be conducive to freezing. The line must be insulated from the point where it leaves the under surface of the ice to where it enters the building. If the run over the ground surface covers any distance, then a snow fence must be put up to build snow over it as added insulation. It may be advisable to build a pier or fill in a section of the lake or river so that the water line will be as short as possible.

The heat pump capacity is now matched to the load by manual control of the diesel engine speed. For a complete installation—one which supplied electrical power as well as drinking, washing, and cooking water and heat for dwellings—a slightly different approach would be used. Two diesel engines of equal power would be arranged so that one drives an alternating current generator at constant speed and the other, also at constant speed, transmits its power to a line shaft and then to the compressor through a variable speed transmission automatically controlled by the heat demand. The two engines would be arranged so that each could carry the load of the other should shut down occur. Each engine would have capacity adequate for the one load, either power supply or heat pump, whichever is the larger. This would make it possible for routine maintenance to be carried out and an annual overhaul completed in the summer with no discontinuity of service.

#### Design Comments

The design of the system as set forth here is for the usual type of Arctic station which consists of a number of detached buildings. This has been the rule of construction in order to minimize damage by fire. Once a fire has a good start it cannot be effectively fought at very low temperatures. One outstanding advantage of the heat pump system, aside from its economy, is the almost complete absence of fire hazard since the fuel is burned only within the cylinders of the diesel engine. A single building could therefore be constructed to house the entire installation, and the heat pump could then use an air-cooled condenser in place of the present water-cooled condenser and discharge its heat directly into the air circulating through the building. The fan circulating this air would be driven from the constant speed line shaft. The water supply would then take its heat from the jacket water and exhaust heat exchangers.

While this present system is not at the stage where it could be termed absolutely reliable, it should not take a great deal of effort to bring it to a high standard. It has proven its remarkable economy, and within the next several years should be in shape for an actual field installation. √

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## Instrumentation in Armament Development

(*Continued from page 1606*)

must be analyzed individually. Each azimuth and elevation reading must then be corrected for tracking errors and substituted into trigonometric equations to obtain the trajectory points in space with respect to the time axis. The work involved is considerable, so much so, that often this method of measurement is neglected because of the heavy effort involved in data reduction. Newer systems using automatic computers have eased the burden somewhat, but at the expense of added equipment which requires additional skilled personnel for maintenance and operation.

Analog and digital computers and automatic data reduction facilities, however, are decreasing considerably the time and effort formerly required to provide quantitative information from the recorded data.

#### Conclusions

Instrument engineering may be defined as the art and science by which the properties of matter and the laws of nature are made useful to man in the observation and control of physical processes. The ever-increasing pace in the race for new and better armament systems will create a greater demand for specialized instrumentation to provide high accuracy experimental evidence to the ballistician, the aerodynamacist, the structural and mechanical engineer, the electronic design engineer, the mathematician, the chemist and the physicist. Although the cost and effort of providing proper instrumentation may be heavy in armament development programs, one well-executed test is worth a thousand expert opinions. √

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THE NECHAKO-KEMANO-KITIMAT DEVELOPMENT

## Aluminum Towers on the Transmission Line

(Refer to Relative Weights, *The Engineering Journal*, November, 1954, p. 1442)

Dr. K. Sutter of the Aluminium Laboratories, Geneva, Switzerland, and a co-author of the paper "Aluminum Towers on the Transmission Line" wished to make the following addition. Unfortunately this was not received in time for inclusion in the November issue. The addendum is included here to avoid misinterpretation.—Editor.

"The above relative weights are, in reality, no measure of the efficiency of the aluminum design as they refer to towers of different heights and of different strengths in spite of identical basic loading conditions. The aluminum strain towers are designed to withstand 45 kips *P* loads as compared with only 25 kips for the corresponding steel towers. In addition, the aluminum towers include from 4.2 to 5.3 tons of steel which, in order to determine the efficiency of the aluminum used, must be deducted from both the steel and the aluminum tower weights."

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**The Editor invites discussion on papers appearing in the *Journal***

*A paper presented before the Belleville Branch of the Engineering Institute of Canada on March 30, 1954.*

# The Shell Moulding Process

*by*

W. A. Campbell

*Sales Development Manager.*
*Division of Union Carbide Canada Ltd.,*
*The Bakelite Co.,*
*Belleville, Ontario.*

**This paper gives an excellent description of the mechanics of the shell moulding process. Trade opinion however, appears to be somewhat divided on the advantages of the "shell moulding" process unless the shell moulded castings are cast to such fine tolerances as to make certain machining operations unnecessary. It is questionable if this can be done with castings for most applications.**

"Shell Moulding" is the current name applied to the process of casting metals, developed by Johannes Croning in Germany during the early years of World War II. From its originator it was first known as the "Croning Process" which later was shortened to the "C" process. Its current name derives from the thin shell-like moulds produced and employed in foundry casting.

The process was patented on February 1st, 1944 in Germany, and was used at Hamburg for the production of munitions. It was kept on the German secret list until May 30, 1947, when W. W. McCulloch of the U.S. Technical team revealed it in his final Fiat Report No. 1168.

During the seven years intervening, the use of the process has grown to such an extent that it is being used in the casting of practically all metals. The recognition of its place in the foundry industry is well summarized in the words of Bernard N. Ames, then supervising physical metallurgist, New York Naval Station, Brooklyn, New York in these words: "In the past few years shell moulding, sometimes referred to as the "C" process, has been recognized as one of the major technical advancements in the foundry industry. It is, perhaps, the first substantial change in the method of mould construction since the inception of the foundry art."

An equally strong endorsement was made by a small Ontario foundry-head in his statement "The hand-writing is on the wall for the small foundryman in competition with the big boys, unless he ean produce more economically with better finish to closer limits than he is now doing. This is only possible, in my opinion, through the use of shell moulding, where such moulding makes certain machining operations unnecessary."

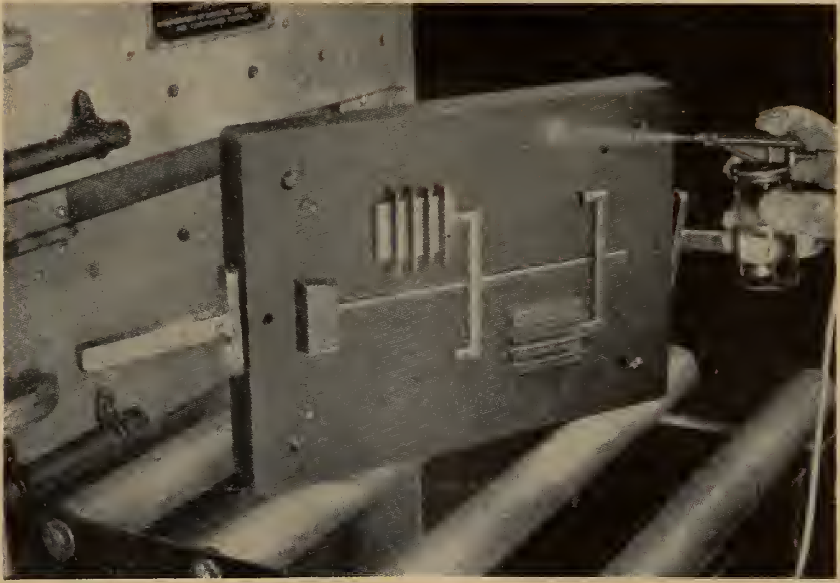

**Fig. 1. Application of parting agent to hot pattern plate.**

### Uses Metallic Pattern

To describe the process it may be said that it involves the use of a metallic pattern capable of withstanding cycles of heating to about 600° F. and cooling to about 400° F.

**Fig. 2. Oven-curing freshly formed mold half.**

repeatedly, and of a mixture of a synthetic resin and foundry sand in the approximate proportions of 5 per cent to 95 per cent.

The resin-sand mixture is thrown onto the surface of the pattern and allowed to rest there for a matter of seconds until a soft "tender" coating in the required thickness of melted resin and sand is formed. This skin is then baked for a few minutes until it is cured and hard enough to be handled.

When removed from the pattern this shell is a hard, porous and somewhat brittle structure. Possessing approximately 50 per cent voids, it has sufficient permeability to allow the free passage through it of air and combustion products. This porous property permits the elimination, normally, of air vents in the mould.

The pattern, as has been mentioned, is metal, to withstand warping under the strain of repeated heating and cooling. Cast gray iron for the base has been found most suitable. This base is provided with kick-out pins spring mounted, and equally spaced about the design pattern so that the hardened shell can be lifted off without strain. The design-pattern itself may be cast iron, wrought iron or other suitable metal while the pouring basin, the down sprues, the runners and gates may be aluminum or iron as convenient.

Since the tolerances and finish of the finished casting is a function of those of the pattern, it is obvious that the design-pattern must be carefully and accurately produced and mounted. The pattern is usually so designed that the cope is on one side and the drag on the other. Through the use of this device a pair of shells may be clamped together face to face to form the complete mould.

**Materials Used**

The raw materials for the production of shells consist of foundry sand, synthetic resin, wetting agent and parting or release agent. The sand is silica, either bank or synthetic, containing not more than 3 per cent clay or fusible oxides. The sand constitutes 96-90 per cent of the resin sand mix. The best resin is a finely ground phenolic resin which in the finished mix varies from 4 to 10 per cent. The usual proportion of resin in the mix is 5 to 6½ per cent for moulds with 4 per cent for cores.

The wetting agent is a mineral oil, commonly kerosene, mixed with the sand before the addition of the resin in the proportion of about one pound kerosene to one ton of sand. The parting agent is a silicone resin in either an emulsion form or in a solution. This is sprayed on the pattern at about 400° F. and baked to a hard film. (Fig. 1.)

The equipment by which the shells are formed is more or less conventional. The mixer is usually a muller found in almost any foundry, but may be a ball mill,

**Fig. 3. Mold backed up for pouring.**

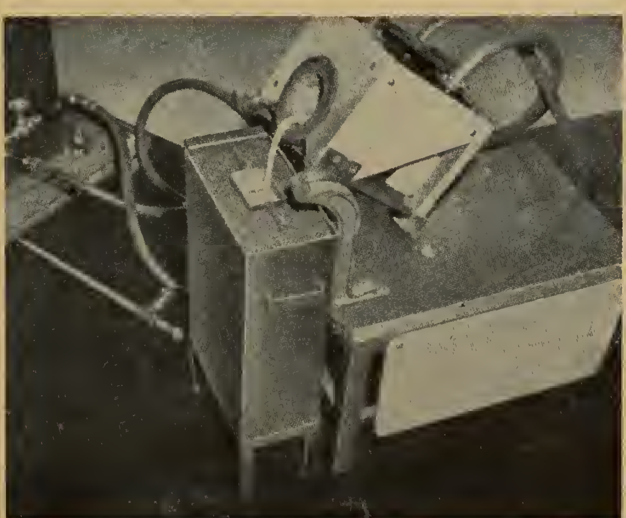

**Fig. 4. Pouring molten metal.**

a dough mixer, a blender or any other machine to produce efficiently uniform powder mixes.

**The Process**

A dump box whose top is the shape and size of the pattern is mounted on axles placed off-centre. The hot pattern is clamped face down on the open top of the box which contains a quantity of the sand-resin mix. The box is turned upside down so that the mix is thrown onto the face of the pattern. It is kept in this position for 1-1½ minutes depending on the thickness of shell desired. When righted, the unmelted loose mix falls back into the box, leaving a uniform coating of soft melted resin and sand adhering to the pattern.

The pattern with its coating of mix is then transferred to an oven, where it is cured at about 600° F. for long enough to harden the resin, usually 1½—3 minutes. (Fig. 2.) The hot pattern is then placed face up in a frame, so that the kick-out pins are forced up to raise the shell from the pattern. The shell is removed and the pattern recycled to the dump box.

In pouring, a pair of shells are clamped, bolted, or cemented face to face. In casting lighter metals they may be poured into without any backing. General practice, however, calls for the use of steel shot, or sometimes foundry or beach sand, to surround the shell mould and provide support during the pouring operation. (Figs. 3 and 4.) The shell receives the metal, usually in a vertical position, though this is not essential.

**Trade Comments**

The economics of the process have given rise to more discussion than probably any other feature. The cost of the pattern is very high. In order that this high cost can by amortized long runs have always been deemed essential. It was reported that at a meeting of the local chapter of The American Foundrymen's Society in Montreal, the contention was made that there were in Canada no jobs of a type and quantity where shell moulding would be economical. However, at the time the meeting was held a paper by C. R. Dutton, superintendent of foundries, Crane Limited, Montreal, was being published in the 1954 February issue of *The American Foundryman*. In it he described a method of producing patterns (not production) by the shell mould process. Mr. Dutton adopted shell moulding because he could produce pattern parts:

1. With almost no hand finishing before mounting.
2. With a saving of almost 30 per cent on the cost of producing pattern plates due to elimination of machining.
3. With castings from the shell mould requiring single contraction allowance similar to metal match plate patterns.
4. With castings requiring only surface grinding and polishing with emery cloth before mounting, and
5. From moulds which may be used immediately or stored indefinitely.

These five points have been listed from the paper because they summarize the main advantages of the process.

Another Canadian foundryman claims, because of close tolerances and consequent low finishing costs, he produces parts much cheaper than was formerly obtained in green sand. He claims that he gets tolerances down to .001″ per inch parallel to the parting line and almost as good across it, which appears unlikely in view of the tolerance of .005 to .010 usually obtained.

In addition, his melted metal efficiency is 70-75 per cent against 50-55 per cent in the foundry formerly making the part. This of course merely reflects more careful study of casting design, metal analysis and gate and riser design before making the shell moulds, than with the previous method.

**May Revolutionize Foundry Technique**

Costs vary in different foundries. No hard and fast rule can be formulated to guide anyone in his choice of method. Each job must be evaluated on its own merits. In general, only reasonably long production runs will absorb the high pattern cost.

It is certain that shell moulding has a very definite place in the foundry industry and, like any other engineering process, can occupy certain fields of operation better than other processes. The extent of this position in the industry has been perhaps prophesied by James H. Smith, general manager, General Motors Central Foundry Division at Saginaw Michigan in words quoted from his paper at the Chicago A.F.S. meeting in 1953:

> "I consider the shell process one of the greatest technical developments of our time in the foundry industry. In my estimation it may revolutionize foundry moulding technique to the point where it will be more economical to produce most small castings and some large castings by the shell mould process as compared with conventional green sand moulding.
>
> "At Central Foundry Division we are approaching the shell program from the standpoint of producing a better casting for less money and at the same time holding dimensional tolerances to closer limits than with our green sand casting." √

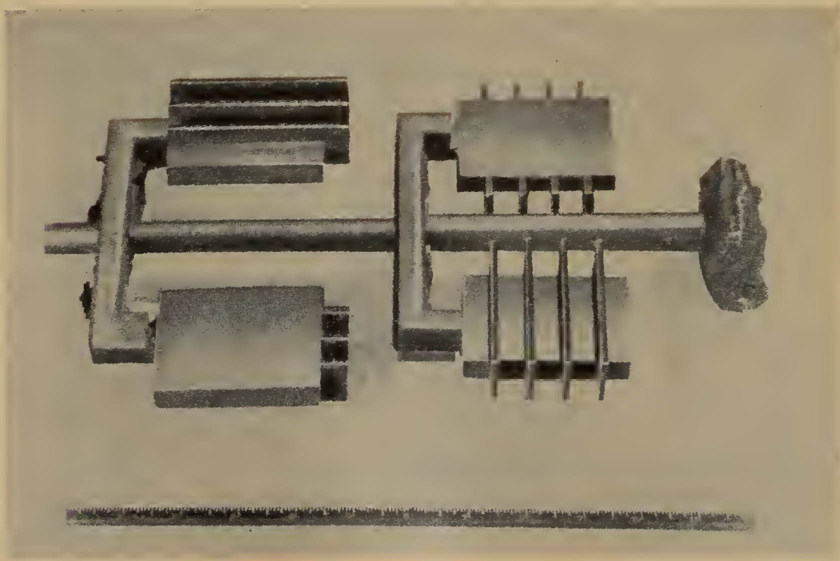

**Fig. 5. Finished piece as cast.**

# Air Pollution Control

*A panel discussion on the program of the Annual General and Professional Meeting of The Engineering Institute of Canada, Chateau Frontenac, Quebec, May 14, 1954.*


***Chairman:***

E. A. Allcut, M.E.I.C.

*Professor of Mechanical Engineering, University of Toronto.*

R. L. Broad, M.E.I.C.

*Manager, Combustion Engineering Dept., Rochester & Pittsburgh Coal Co. (Canada) Ltd.*

Dr. E. A. Watkinson

*Chief, Occupational Health Division, Department of National Health and Welfare.*

J. G. Hall, M.E.I.C.

*District Manager, Combustion Engineering Corp. Ltd.*

Dr. Morris Katz, M.E.I.C.

*Chairman, Canadian Section, Technical Advisory Board on Air Pollution, International Joint Commission, Defence Research Chemical Laboratories.*


*Prof. E. A. Allcut*—May I say, in introducing this very controversial subject, that there are many other factors in addition to smoke which can be of a more deleterious or harmful nature. We are therefore going to discuss today the question of air pollution control as it applies to the situation in general.

I propose to give each of the main speakers ten minutes. I know they will not tell all they have to say in that time, so I hope that each of the members will reserve some portions of their remarks for the discussion that will follow. After all, the success of a panel discussion depends mostly on audience participation.

As far as the members of the panel are concerned, we have on my right, Dr. Morris Katz, a Defence Research scientific officer and chairman of the Technical Advisory Board on Air Pollution of the International Joint Commission. Dr. Katz is a chemist and, I suppose, is one of our foremost experts on sulphur dioxide.

On my immediate right, we have Dr. E. A. Watkinson, chief of the Occupational Health Division, Department of National Health and Welfare, Ottawa. Dr. Watkinson is a medical man, with wide knowledge of this particular field. He can handle those aspects of atmospheric pollution that are related to health.

On the left we have Mr. Robert Broad, who is head of the Combustion Engineering Department of the Rochester and Pittsburgh Coal Company, and Mr. J. G. Hall, who is district manager of Combustion Engineering Corporation Limited. It is scarcely necessary to introduce Mr. Hall to an Engineering Institute audience, but his presence here on our panel is a source of satisfaction to me particularly. These two gentlemen will deal with combustion in its various aspects, but our discussion of this problem is not to be limited to combustion matters. As we know, there are many other things to consider, but in view of the fact that air pollution control has been closely linked with combustion processes, we thought it wise to start with that and then to have the other aspects of the subject introduced, as the panel or the audience may see fit.

I will now call on Dr. Katz to open the discussion by telling us something about the nature of the pollution; the various kinds of pollution and the consequences.

### The Nature of Air Pollution

*Dr. Morris Katz*—I am afraid ten minutes is an exceedingly short time in which to deal with some of the matters at issue here. However, if I can stimulate a few questions, there may be time later to go into the subject in more detail.

It is very true, that we take in much more air than we do food or water. The approximate proportion for the average adult is two to three quarter pounds of food, about four and a half pounds of water, and about thirty pounds of air. Ordinarily, we would not be too much concerned with the air we inhale and use in such large quantities, but the increasing growth of industry and population of large cities and communities has faced us with a considerable number of air pollution problems.

We are currently investigating an international problem in the Windsor-Detroit area, on the basis of complaints submitted to the governments of the United States and Canada in 1949. There is also a very familiar problem on this continent in connection with air pollution in the Los Angeles area. These two typical areas I am going to use as examples of certain types of pollution which may give rise to problems.

Ordinarily, air can be looked upon as a natural means for the disposal of waste products of industry and of the various activities of the public. There is no reason to question this practice, until the contamination becomes too great, or until we have a visible nuisance.

If we are confronted with an air pollution problem, the first thing we should do is to find out the nature of it. In some areas, particularly in urban areas, a lot of coal and other fuels are used and also there are a considerable number of traffic vehicles running about. Such areas also have a variety of industries, metallurgical, chemical, manufacturing, and others. The three simplest things that one can do in order to determine the nature of pollution is to measure, first of all, the dustfall rate; secondly, the suspended particulate pollution, and thirdly, the sulphur dioxide.

In connection with dustfall, we estimate that in heavily concentrated areas the dustfall rates run around 50, 60, 70, to upwards of 100 tons per square mile per month. By comparison, in semi-rural areas the dustfall, which is mainly that due to causes of natural origin—the wind blown dust, sand, particles of vegetation, top soil, etc.—will run around 10 to 15 tons per square mile per month. So you have a considerable spread.

Then, we have cities where the main source of fuel is not solid fuel, but either natural gas or oil, and there the dustfall may be lower than the figures quoted—say somewhere around 35 to 40 tons per square mile per month, because fly ash and other solids of that type are not a problem in that particular city.

These particles which contribute to dustfall are comparatively large in size and most of them will be over 44 microns in size, or greater than about 335 screen mesh size. In other words, the particle sizes range from about 40 microns to well over 100 microns, and only a minor fraction is less than 10 microns in size.

The suspended impurities which reduce visibility and result in the staining or soiling of surfaces are very much smaller in size. These consist of particles that range from less than 5 microns down to 1/100 of a micron; particles that you can never actually see but which obscure light, and coat walls and the surfaces of buildings with a somewhat sticky substance.

Then, there are gases. We have sulphur dioxide, hydrogen sulphide and fluoride in certain places; chlorine gas, chlorides, oxides of nitrogen and so on. Many hydrocarbon vapours and organic gases, including carbon monoxide, which is fairly abundant in certain localized areas of heavy traffic, are also present. I am not going to consider carbon dioxide which, in some respects, is actually beneficial to plant life or vegetation.

We find that these contaminants, if they are present together in city air and sufficiently concentrated, can produce very distinctive smogs, depending on the meteorological conditions. Normally, weather plays an important role in disseminating and diffusing these contaminants, so that they are scattered and dissipated into harmless proportions. But whenever special conditions prevail, such as temperature inversion, we can have a typical smog over a city, and if this is prolonged and is severe enough we can have disastrous effects.

A photograph taken to show "smog" over a city will show extremely low visibility near the ground. One taken from higher up will show clear sky above, then the inversion layer up to that level, and smog below. A photo taken in late morning in clear weather should show good visibility, but the air, in trying to disperse the contaminants may cause reduced visibility by breaking up the inversion layer and mixing it, thus bringing the contaminants down to ground level. This condition may persist for several hours until with increasing turbulence the pollutants are dispersed and visibility improved.

I hope that I may have, a little later, an opportunity to amplify some of my remarks, especially in this matter of the role of meteorology in dispersing contaminants.

*The Chairman:*—Having had a sketch of the atmospheric situation in a certain part of Canada, which is fairly representative, not only of Canada but also of the United States, I will now ask Mr. Broad to present his views on combustion or other similar operations.

## Scientific Selection of Fuel

*Mr. R. L. Broad*—Although my purpose here today is not to defend the coal industry, no matter how much coal has been blamed for atmospheric pollution for so long a time—I would feel remiss if I did not point out that the City of Los Angeles, which has had a very serious problem, burns no coal.

Any fuel can be burned improperly and can create atmospheric pollution, and I think that all of us are well aware that gasoline used in automobiles is responsible for the resulting contamination by carbon monoxide. We have all ridden behind Diesel busses and I am sure some of us live in oil-burning neighborhoods where, when we walk down a street on a quiet winter evening, we have smelled that old familiar Diesel odour and perhaps did not realize it might be coming from our own oil burner — or one of the neighbors'. These are problems which are becoming more and more important and problems that we really have not started to attack.

We, in the fuel industry, are able to do quite a bit and I think that we are just starting to think about doing our bit about alleviating some of these problems. Now, in the coal industry, we have been attempting to make a study of the problems of heating buildings, small industrial buildings, office buildings, larger industries, and so on, and we think that we are going to be able to help in this field.

We have several problems however. One of them is obsolete equipment. That is one area where I think we have a selling job to do with the equipment people, and we are attempting to do it. Poorly installed new equipment is another problem which should not occur, but it is one that we come across very often. Poorly trained operators also present a difficult problem, and we are able to help these men considerably, often giving them information or instruction—and of course, the most important problem is poor fuel application, and that sits right on our own doorstep.

It is not many years since the coal man sold mine-run or lump coal, whichever the plant required. We have moved a long way from that period, and today we have tried to approach the problem much more scientifically. I think most of you are familiar with the sources of coal, at least you have a rough idea of the sources, but it might be well just for a moment to discuss briefly its origin.

I think you all learned in school or since that coal originated from tropical swamps. Some 300 million years ago a very large swamp ran all the way from Nova Scotia and New Brunswick to Pennsylvania and West Virginia, through East Kentucky and down to Tennessee. That tropical swamp grew for several thousand years.

It was finally covered over with silt, due to flood conditions, and the resulting muskeg which had been formed lay buried there. After the flood subsided another tropical swamp grew on top of the covering material. That cycle continued until there was material for as many as 120 seams of coal, one above the other, perhaps separated only by a few feet, perhaps separated by several hundred feet of clay and silt.

In West Virginia, there is a 250

foot total thickness of coal produced in that way. The time interval involved might be of interest. One thousand years of tropical growth will produce enough material to form seven inches of coal. So we can see 250 feet of coal represent a terrific time interval.

After those beds had been formed, a tremendous folding took place, and that folding centered east of the City of Altoona in Pennsylvania. The pressures and temperatures involved in those muskeg beds were very high and the organic material was transformed into what we know as anthracite. Radiating out from that area, the temperatures and pressures decreased, and we have coals of varying ranks from anthracite to high volatile bituminous.

Now, the range of characteristics we have available is almost infinitely variable. Radiating out from what we call the Altoona zone, the chemical nature and characteristics of the coal will change due to the difference in pressure and temperature. In addition to that, the vegetable material that grew there varied over a distance of perhaps ten or fifteen or twenty miles, just as it does today around here.

We might drive through this country and see at one place spruce and fir or balsam trees, and a few miles farther, perhaps birch and poplar—so in addition to the variation in pressure and temperature, we had during the growing period a range of types of vegetation as well. From the period of one seam to the next there was considerable evolution in plant life. Thus we would suspect a seam laid down above the previous one, might differ considerably in characteristics from just below it, and that is just what we do find.

To make proper application of coals we must make tests to determine what these characteristics are, and that is one of the toughest problems we have to contend with, in that the tests available are quite inadequate. We have tests which are helpful to us, of course; chemical and physical analyses are carried on and other tests by which we determine physical characteristics. One of the most important is the measuring of the content of volatile matter or gaseous and tarry matter, which is generally considered to be the main source of smoke emission in burning coal.

Now, this volatile content varies widely. Starting in the centre in Pennsylvania, the content increases as you travel in any direction away from the centre. These variations are not just as nice and uniform as all that, but, nevertheless, from its location we can get a rough estimate as to what the volatile content of a coal might be. Volatile content is not the whole story as far as smoke is concerned. I could name any number of examples where we have perhaps employed a higher volatile content on some particular job to alleviate a smoke problem.

The next factor is the fixed carbon, and that is simply the difference between the sum of moisture, ash and volatiles and 100 per cent. It means the residual carbon left after the coal has been heated in the volatile test, less the ash that remains in the sample. Another factor is usually reported as the ash content. It is important from the pollution point of view, but it also has a very important economic effect. We measure the economic importance of ash content in terms of fuel cost. It is very important that we try to keep the ash content as low as possible, and of course we automatically reduce dust loadings correspondingly.

Ash content in coal is controlled, as far as the producer is concerned, not only by selecting a coal with high carbon and low ash content to start with, but by using various cleaning processes, such as water flotation, we are able to remove most of the rocky material. The specific gravity of the impurities will run perhaps from two to seven. The coal itself is a relatively low gravity material, running from 1.45 to 1.65, and this gravity difference facilitates removal of part of the ash content.

Dr. Katz has mentioned sulphur, but in the fuel industry, we are more concerned with sulphur content in connection with damage to the equipment and other operating problems, rather than with air pollution. We have to endeavour to keep the sulphur content low to get around our mechanical problems, and so, to the best of our ability, we are already taking care of the sulphur problem.

Another factor of importance is ash fusion temperature. A low ash


**Left to right: Dr. Morris Katz, Dr. E. A. Watkinson, Prof. E. A. Allcut, R. L. Broad, J. G. Hall.**

melting point can cause serious problems in a power plant by upsetting the air flow and distribution and so creating a smoke problem and other operating troubles. We have to keep ash fusion temperatures at reasonable levels.

There are quite a number of other tests; some of which are beginning to receive more attention. One of these is a test which indicates the extent to which the coal swells when the volatiles are being driven off in the laboratory, and this factor has quite an affect in the various types of fuel beds. It probably influences the dust carry-over in firing, and has quite a lot to do with air pollution. However, we don't yet know enough about it to say of how much benefit this test will be. The values are expressed in numbers referred to as the free swelling indices, or British swelling indices.

What I have been trying to say is that the proper selection of fuel and proper application of fuel burning equipment from houschold burning up to the utilities,—is not yet a very scientific procedure. We are trying to make it more so but it is still fairly much of an art. The reason is that we don't have enough yardsticks; we are not able to express the characteristics well enough through numbers.

We are making progress along those lines however, and so I think it is a good idea to avoid, as far as possible, introducing references to coal specifications in air pollution by-laws. We would like that to be left out. In some cases, it creates an unnecessary economic dislocation, as there are factors involved which cannot as yet be specified, and we feel it is better to leave that aspect of air pollution by-laws to us in the industry, who feel we can do the job without those specifications. I thank you.

*The Chairman*—Thank you, Mr. Broad. Now, having heard something about the nature of fuel, I will call upon Mr. Hall to tell us what we can do with it.

### Integrated Equipment Design

*Mr. J. G. Hall*—Mr. Broad covered a part of the subject as far as coal itself is concerned in a very helpful and intelligent way. In view of the importance of what is to come,—I am going to make my remarks very short, particularly in view of your statement to me, Mr. Chairman, that most people know all about coal anyway. At least, that is the feeling some people have.

I believe Mr. Broad inferred there were lower grade coals. That is a term which is sometimes misconstrued. I object to the term "poor coal" or "poor grade coal" because coal is something like human beings. We don't like a man because we don't know him and we sometimes call coals "poor" because we have not yet learned their burning characteristics. But generally speaking now, within reason, the manufacturer can design equipment which will successfully burn almost any grade of coal. However, when a man makes the statement that he has equipment that will burn all grades of coal with equal success or satisfaction, that is the man to be suspicious of.

There is also the question of oil. Many people up until recently had the idea that all their problems would be over if they used oil. It may interest some of you to know, —and here I am referring to the larger, not the household type of equipment,—that an efficient oil burning installation is just on the verge of smoking at all times. True, you can cut down the smoke if you increase the air, but that is going to make it an uneconomical proposition. In fact our lads in the Navy, found if they wanted to throw a smoke screen, the best way was to burn oil with a deficiency of air.

I have mentioned already that the manufacturer can design equipment to burn coal successfully, but there are three factors that determine the success or failure of an installation. First comes the design of the equipment and the layout. Secondly, there is the installation—and thirdly, the operation, and Mr. Broad touched on this last point. That is one of the factors which so many of the anti-smog departments or anti-air pollution departments in the various cities are confronted with today—the lack of proper operation.

Operation is regulation of performance. This is a type of work requiring constant attention as well as considerable experience. Too often owners tend to underpay the men who control operation and it is in the interest of all concerned that proper remuneration be paid. If a boiler room is to produce satisfactory results, management must realize the important part which operation plays. The operation of the boiler room must not be looked upon as an expensive nuisance but should be regarded as an essential part of plant management and treated accordingly.

Consider the matter of combustion which Dr. Katz has mentioned. I am not now talking about motor cars, which present an entirely different combustion problem. I am talking about power plants. When we try to alleviate the air pollution problem in our boiler rooms, we run up against two different problems. First, of course, there is the old installation. Many of our heating and process plants were designed years ago, before we knew as much as we do today. We still have a great deal to learn—and where we have inefficient equipment, lack of furnace volume and lack of stack heights and diameters, etc., to a great extent we have to consider the burning of very low volatile coal, anthracite or coke.

I know of one particular case in a certain city, where one of the officials asked me what could be done about a certain plant which was in a residential area and was giving serious trouble. I looked it over and said, "George, there is only one thing you can do and that is to throw out all this old equipment and put in new equipment." After about ten years, he is just completing that job.

There are other cases where you can alleviate the situation very materially by over-fire air and turbulence (time, temperature and turbulence). By getting enough air properly controlled in the right places, you can help the situation very materially. But there are many cases where the only solution is to throw out the equipment and start with new.

When we come to new installations, manufacturers can, within reason, design equipment to suit the fuels economically available in that area. There are different types of firing; I will run over, roughly, the different types. You can have hand firing, and it is surprising what a good fireman can do with a hand-fired installation with coals that formerly could not be burned without smoke. Here again the use of over-fire air and under-fire air, under proper control, is one of the big factors.

Underfeed and chain grate stokers can cause a great deal of trouble with smoke, but not so much with fly ash emission, although there is always a certain amount of fly ash with either of these two types of equipment. Probably the newest popular type of combustion equipment is the spreader stoker, but this is not very new because I recall 30 years ago we had the pleasure of throwing out a great many badly designed spreader stokers. But in my opinion the spreader stoker is coming to the point where it will be the most popular type on the market.

However, we must remember or consider the fundamental principles on which that stoker is designed. It is a combination of burning in suspension and on the grate. Now, in this case, your selection of fuel, is an important factor. If you have very fine coal, naturally there will be more of it burning in suspension, and with some types of coal you will have a tremendous carry-over as well as heavy smoke. Probably the type of firing which will give you the widest selection of fuel is burning entirely in suspension. Properly designed pulverized fuel equipment, I think, would give you the widest selection of solid fuel.

But we must remember that, in both spreader stoker firing and pulverized coal firing, you are facing the problem of fly ash, which a great many people did not realize was of any particular importance until a few years ago. We formerly thought of air pollution as smoke pollution; however a stack can be fairly clear, but may be emitting a tremendous amount of fly ash which will be a nuisance, if not a hazard. I will leave it to my good friend Dr. Watkinson to say to what extent it is either; but to meet that objection we have dust collectors.

The design of dust collectors, or dust collection equipment, has become very much of an art. It has developed materially in the last few years, and to me it is a question of the extent to which the employment of dust collectors is justified. We know that with spreader stokers or firing with pulverized fuels, we should have dust collection, but when that plant is out in the country or with a very high stack, the dust is spread over a very wide area.

*The Chairman*—Thank you, Mr. Hall. Your remarks remind me of a little problem that developed up in Toronto a few months ago where they had three entirely similar boilers. Two were working properly without smoke and one was smoking quite badly. They were all the same kind of boiler, all fired with the same fuel and all with the same amount of air.

Finally, however, after investigation, we found that the air, as usual, was taking a short cut. Most of it was going through the first two boilers and did not go into the third to the extent required, so that there was smoke emission from that source. It is not only a question of having the right amount of air, but it is necessary to have it in the right place.

Now, having heard from Mr. Hall as to what can be done in that regard, we come to the effects of pollution, and by far the most important of these is the human aspect of it. We have here Dr. Watkinson, who is an expert in that field, to tell us about it.

## Air Pollution and Public Health

*Dr. E. A. Watkinson*—Regardless of what our special interest may be in air pollution, I am sure that we are also interested in the effects which air pollution may have upon health. While much information in this field is already available, by no means is the full story known. Various studies are proceeding in different countries, but it would be a mistake to delay action regarding the control of present amounts of air pollution until we have answers to all our questions.

From what has occurred elsewhere, we know that certain levels of pollution, combined with certain atmospheric conditions, can cause widespread illness and even death. Certainly the evidence is such that the subject of air pollution should receive the highest consideration by engineers, health officers, and others, concerned with control measures and the maintenance of health of the people of this country.

Until recently we have been concerned mainly with the economic aspects of air pollution, and it was not until the occurrence of such disasters as that of the Meuse Valley in Belgium of 1930, when sixty persons died, that serious consideration was given to the possible effects on health. The Meuse Valley disaster was followed by the Donora incident of 1948, when 20 persons died and 6,000 of a community of 13,000 became ill within a period of four or five days. There was also the incident of Poza Rica, Mexico, when 22 persons died and some 300 persons became ill.

In December, 1952, in London, England, there occurred a disaster of great magnitude, one that compared with the flu epidemic of 1918-19, and with the cholera epidemic of the previous century. In this episode, 4,000 people are estimated to have died, and I understand that there are now figures to show that deaths attributed to that four-day London fog may actually be much higher. Furthermore, the death rate continued at an abnormally high rate for another two and one-half months.

These may be just figures for many of us. However, living as we do in urban communities, there are certain general facts in which we are personally concerned and which I now propose to mention briefly. First of all, there is the matter of fresh air. Persons living in rural areas or near the sea take fresh air for granted.

But for urban dwellers it is a different matter. For the latter, vacation time may be the only time of the year when they can really enjoy the benefits of fresh air. It is a fact that we believe the fresh air of the seashore or of the mountains has a special quality, because our sense of well-being is restored and we return to the routine of the shop or the office with a fresh outlook on life.

And then, what about sunshine? In our communities the sun may shine and there may not be a cloud in the sky, but if an appreciable amount of air pollution is present, we and our children are not receiving the maximum amount of sunshine to which we are entitled. Our children, particularly, depend in part on the rays of the sun to prevent such conditions as rickets.

There is also the effect of the sun upon green vegetables to be considered. Such vegetables are necessary in our diet for the prevention of certain disease processes and, consequently, are an important factor in the maintenance of health. In some communities, these vegetables cannot be grown or perhaps, when they can only be purchased from other localities at a higher price, such vegetables cannot be afforded by some families.

Odour is another factor in air pollution. We all know, for example, the smell of hydrogen sulphide, and this odour may be continuously present in some degree in some of our communities. The smell of certain fumes is quite unpleasant, and for some people causes discomfort varying from loss of appetite to a feeling of illness.

The mental health of those obliged to live in heavily polluted areas may also be affected to some degree. Apart from the loss of bright sunlight, it can be very depressing to have to live in a community devoid of the freshness and colour of green grass, trees, and flowers. This is especially true if there is no opportunity to get away to more colourful surroundings from time to time.

The mental attitudes of people living in areas devoid of vegetation may well be reflected, for example, in the poor maintenance of homes or the lack of proper facilities for rearing children. In any case, the end result is scarcely conducive to the maintenance of health or the development of strong and healthy children.

In addition to these general effects on health, we should keep in mind such disasters as Donora and London. In these episodes, deaths occurred within a short period of time and thousands became ill. Of those affected, the majority were either older people or the very young and, in the case of the older age groups, many were weakened by chronic illness. However, those affected were not limited to these groups,—even healthy persons in their prime became seriously ill.

While the immediate effects upon health from exposure to harmful amounts of air pollution are of the greatest concern, it is also important that consideration be given to the problem of possible effects on health from long exposure to a polluted atmosphere. As I have already mentioned, studies on health and air pollution are being conducted in various countries but, as yet, we do not know conclusively if a relationship exists between air pollution and certain types of human illness. One study of interest is that presently being undertaken in the Windsor-Detroit area, where 1,000 families are co-operating in a survey of illness as related to changes in pollution and atmospheric conditions.

In conclusion and in view of the available evidence regarding the possible effects of air pollution on health, may I suggest that each of us should take whatever preventive steps we can now—not next year or sometime in the future—to ensure the health of Canadians no matter where they live. As the future will undoubtedly present new and perhaps greater problems in air pollution, I also believe that, in addition to coping with the present, we should be initiating whatever research may be required to assist in future control methods.

*The Chairman*—Thank you, Dr. Watkinson. I think at this stage, before calling on Dr. Katz to amplify his remarks more particularly with regard to sulphur trioxide, I will throw the meeting open to questions and discussions from the floor.

Many things have been touched upon but not elaborated upon because there was not time to do so. There are many things we should have liked to hear more about, but the things you want to hear about are known only to yourselves. I can imagine that there may be a representative of the oil industry present and in that event there would be all the elements available for an argument between him and Mr. Hall.

## Questions and Answers

*Mr. Sharp*[1]—I have in mind a flagrant case in the area in which I live, in Montreal. I am not aware if there are any federal laws governing this yet or if it is governed by municipal by-laws, and to what authority I should complain. For instance, at Beauharnois, near the lumber plant, there is a plant that makes nickel alloys, I believe, and I have seen that smoke many a time drifting for 30 miles in a visible cloud that drifts right over Montreal. Now, does Montreal have any chance to do anything about that, or is it the affair of the local community?

Here is a plant where, quite obviously, nothing is being done about it. It is a very bad condition, because at times you cannot see across the road. Do we have to wait for years for experiments in the industry, when we well know that some system might be devised which would alleviate the situation?

*The Chairman*—Before you spoke, I always thought Montreal was a city with a particularly pure atmosphere, but as Dr. Katz has carried on experiments with matters of this kind, I will ask him to reply.

### Determining Cause and Effect

*Dr. Katz*—A very interesting point has been brought up, but I would not be too sure about a remedy for anything. In the Los Angeles area in 1947 and 1948, when the smog problem became so bad that the authorities felt they had to do something about public clamor, they introduced very drastic legislation. The regulation which was adopted was based on what was, at that time, a wide law against excessive pollution. It prohibited industries from emitting from individual plants more than 40 pounds of dust per hour.

This meant, of course, that if the maximum emission was greater than that, the owner had to go out of business or else put in the most expensive equipment. Even so, and even if you put in equipment that will cut out 95 to 98 per cent of your impurities, if your operations are on such a scale that the remaining 2 per cent totals more than 40 pounds per hour, then, in Los Angeles, you 'have had it'. Furthermore, in the case of sulphur dioxide, it was stipulated that only 2/10 of 1 per cent would be allowed in the stack discharge gas and so on, down the line.

Now, you would think, with these very severe measures, within a year or two the smog problem would have vanished. Millions of dollars have been spent in two years using methods of every kind, but the problem is still there, which indicates that control action was too hasty in the first place. So, one can see that anything that might on the surface look to be not complicated, may in reality represent a very complicated problem.

In the case of the plant referred to, it may not be a simple matter to reduce that visible effect. That is to say, though you have evidence as seen from the ground, whether you have a visible dust discharge or a chemical reaction in that operation is another thing. In the case, for instance, of an efficient sulphuric acid plant, a very small amount of sulphur trioxide in the waste gas will react with the moisture in the air, and produce a haze which will give a very bad visible appearance.

I am merely pointing out that problems which are apparently simple, in reality may be very complicated. Before you take drastic measures against any situation, therefore, you should make an investigation, and establish first of all the cause and effect basis.

### The Matter of Jurisdiction

*The Chairman*—I think there is one aspect of the question, however, to which Dr. Katz did not refer and I think this was implicit in the question. The jurisdictional factor, as I understand it, was that the Montreal by-law covers only the City of Montreal, but I must point out that the Committee on Atmospheric Pollution in Canada, formed two or three years ago, recommended that these matters be put on a regional basis, despite opposition from politicians.

We have seen this done in lots of places, other than Montreal. We have sent copies of that report to all the provinces in the hope that they will enact similar legislation, thereby doing the sort of thing that we want to be done, in the way that we want it done. I am pleased to say that a recommendation has gone to the Legislature in Ontario, to the effect that, with the setting up of a metropolitan area in Toronto, our juris-

[1]The Hart Company, Montreal.

diction should be extended to include the whole area.

We are hoping that other municipalities will make similar applications. Whether this project will go through or not is more than I can say, but the course of politics is generally against such decisions. We have however made an attempt to find a solution to our problem and, if successful, we shall have an opportunity to try it out. If it is adopted and works well, then it is quite possible that somebody in Montreal will get the same idea.

*T. C. Main*[2]—With regard to the pollution caused by motor vehicles, and what can be done about it, may I ask if there is further information on that ?

**Traffic is a Factor**

*Dr. Katz*—The motor car problem is one which is receiving increasing attention because, in the overall pollution problem, we must not neglect the habits of the public. I think that in the case of a car, using on the average two gallons of gas a day, you can have about 2000 cubic feet of exhaust generated.

If you have a large area, let us say one where you have a million vehicles operating, you have two billion cubic feet of exhaust gas to contend with. This contains aldehydes, hydrocarbons, nitrogen oxides, and other complex compounds. For example, in the Los Angeles area where we have 2,000,000 vehicles operating, there is a certain amount of air pollution which must be attributed to industry. In the overall contamination picture, excluding carbon dioxide and monoxide, we have about 1,800 tons of contaminants released daily, but about 1,000 tons of that will be due to public operations, including traffic, transportation, the combustion from home-made incinerators, and so on.

*The Chairman*—Some time ago in Toronto, we had a violent protest from some people near a widely-travelled highway with regard to the pollution taking place at that point, particularly at rush hours, and so two men were sent there to look into the situation and to make a report. They found no evidence of any considerable concentration of carbon monoxide or of carbon dioxide.

The smell which remains often gives people the impression that exhaust gases are entirely responsible, rather than the combination of stuff in the atmosphere. Nevertheless, where a temperature inversion takes place and the gases are unable to get away, particularly if the area is a low lying one, I can quite imagine that large amounts of carbon monoxide remain in the air at ground level.

*A. R. Harrington*[3]—A problem arises at many large oil-burning plants where they are burning heavy oil. They are getting great paint damage on automobile finishes and houses in the surrounding settlements. I wonder if Dr. Katz knows of this offending product.

*Dr. Katz*—One of the offending products is sulphur dioxide, which is of course present in most fuels, and which would be fairly high in heavy oils as compared with lighter oils. Then we have organic acids and aldehydes. But the corrosion probably is due not only to the acids but also to the fine particulates in the products of combustion.

These very small particulates I mention have a tendency to stick to surfaces, and that, together with the acid nature of the sulphur dioxide and the organic acids, induces a corrosion problem. This problem is encountered quite frequently in the vicinity of foundries and forge shops which use oil for combustion purposes, and operations of that kind.

*The Chairman*—There was a court case in Ontario last year that did involve a foundry, where the paint finishes on new automobiles were seriously affected, causing considerable damage. In that instance, there was no oil used at all, so it does not follow that oil is the bad factor. There may be other factors coming into it too, and in the case that I speak of, there were.

**Effect of Improved Combustion**

*T. C. Main*—Let us assume that combustion is about as perfect as man can make it. Will there still not be a serious pollution problem ?

*Mr. Hall*—That depends on what you mean by perfect combustion, and also perfect combustion of what?

*Mr. Main*—I am referring to coal, oil, gas, and gasoline.

*Mr. Hall*—Well, to begin with perfect combustion, it is impossible to have perfect combustion in a practical way in a steam plant. I presume you are referring to a steam plant.

*Mr. Main*—Yes.

*Mr. Hall*—I do not believe this question of air pollution control as it refers to steam plants can be eliminated entirely. To what extent are we justified in spending money to make the gases from a smoke stack absolutely harmless or devoid of any nuisance value ? In this regard, our chairman referred to a report by the Committee on Air Pollution in Canada. Here is one sentence that was included, and I am quoting from the 1951 edition:

> "The objective throughout is to uphold the common right of all citizens to have the air that they must breathe come to them in a reasonably uncontaminated state.
>
> "However, to establish a permissible value for atmospheric pollution in any community, that which is possible must be distinguished from that which is ideal, and the responsible authorities must not forget that our civilization depends for its very existence on industrial activity."

We can reduce atmospheric pollution to a minimum but, as I said in my opening remarks, it is a question of how far we are justified in going.

*The Chairman*—In addition, of course, the fact has been mentioned repeatedly in the course of this discussion that no matter how perfect the combustion may be, if you are dealing with solid fuels, you will still have ash. That has to go somewhere, you cannot catch it all. The rest of it must go into the air. With most gaseous fuels, you will still have carbon dioxide. Whether you call that a pollutant or not, as Dr. Katz pointed out, depends on your point of view, because in some respects, carbon dioxide is valuable, but at the same time, what limits you can have in that regard depend largely on local circumstances.

For instance, when we proposed to include in the operation of the Toronto by-law the metal processing industries (including foundries), that had already been exempted by the Provincial government, the foundrymen came along in a body with a lawyer and said (in effect), "If you are going to do that, we shall have to move out of the city, because our costs will go up to such an extent that we shall no longer be able to compete." At that, the city fathers took fright and as a consequence, the action proposed was not taken, although perhaps in the general interest, it should have been.

**Concentration of Population and Industry**

*E. R. Davis*[4]—I have two questions. One is: "Has there been any success in correlating population density to areas in which a pollution condition exists ?", and the second which follows from it is: "If you

[2]Main, Rensaa and Minsos, Toronto.

[3]Nova Scotia Light and Power Company, Halifax.

[4]Consulting Engineer, Toronto.

permit a concentration of pollution of a given kind to exceed permissible values, will you have a condition that no one can do anything about?"

The conception of progress in any community is often based on the degree to which you can attract industry to it, and I can think of this as leading to a dead end. For instance, if a particular area in which I was living manufactured chemically its product say, of leather goods, immediately the probability is created of a concentration in that area, where a second and third tannery would add materially to the problem. Has there been any progress or thought given to the difficulties peculiar to industry on a population or area basis?

*The Chairman*—The question of towns and what may arise from them and of the concentration of population in certain areas is an interesting question; it is quite evident that the authorities who are doing the sort of things that you described are doing the wrong kind of things from the pollution standpoint. I should like to hear from Dr. Katz on this subject.

*Dr. Katz*—The question of community planning and of population density is intimately related to the air pollution problem. As I have indicated before, it is quite evident that in an area like Los Angeles and certain other areas, the major problem is probably due to the fact that there is too great a concentration of population and industry.

Los Angeles had no air pollution problem until after about the middle of the Second World War, when tremendous numbers of industries moved into the area; the population increased rapidly and then by 1946, people awoke to the fact that they had a persistent air pollution problem.

Up to that time, the existing topography and meteorological conditions were such that natural air cleaning processes could take care of whatever pollution was produced within the area. Now, there are other areas which are approaching the same state, and while some of us also like to live close together and be neighborly and feel more at home when we are not separated by too great distances, I think nevertheless in the overall growth of a city or area, we must not let residences encroach on industry, and vice versa.

I might say however that some elements of industry rightly have recognized the air pollution problem. In some of the newer plants they are considering air pollution as one of the important factors to contend with, just as they would their raw materials, transportation and markets. These industries design their plants in such a way as to produce no air pollution problems of a serious nature from their operation. If industry generally had done that in the past, we would have very few such problems today.

*The Chairman*—I think that in your reply, Dr. Katz, you omitted to state that there has been established a definite relationship between the amount of atmospheric pollution and the density of population. If I remember correctly, in the report on a survey made at Leicester some years ago, there were some definite figures and a formula devised, indicating the average amount of pollution resulting from cities of different sizes. I think if you will refer to this report you will find the figures given there and the evidence obtained thus far.

*Dr. Katz*—That is correct. In fact, they even calculated the concentration of sulphur dioxide in a particular coal burning area where they used fuels of comparable sulphur content, by simply taking the population as a factor and dividing it by the distance from a principal area, so that you can then get the concentration at a certain point.

*Dr. Watkinson*—I believe that a relationship has also been shown between the acreage of chimney stacks and the incidence of certain illnesses. In regard to the other factor, that is, the need to decentralize industry, I think that the way to handle it should be similar to that used in connection with the water pollution problem.

Already, in Canada there are areas with limited water resources, and it is a difficult problem to decide which industries should be permitted to build up in those areas. The answers to such questions as the following should be known beforehand: How much water is going to be required and where is it to be obtained? How much is going back into the river and in what condition? What are the products of pollution and how are they to be handled?

I think that we are faced with a similar type of situation in regard to air pollution. We have just so much atmosphere for so many people and for so many different kinds of occupations. We are going to have to tackle the problem of seeing that whatever is returned to the atmosphere will provide a proper balance in relation to the use of the air by other people, and particularly in regard to the requirement of safety.

**Relation to Meteorological Conditions**

*P. B. Dilworth*[5]—Is not this problem of air pollution subject to control by the concentration with which a pollutant is discharged into the atmosphere? In other words, Rutland tried to control the absolute amount discharged. Could it not be controlled on the basis of the proportion of those pollutants to the air with which it was intimately linked prior to being discharged into the atmosphere.

*The Chairman*—I think perhaps Mr. Hall can help us here.

*Mr. Hall*—I don't know. I think Mr. Dilworth refers more to the meteorological aspect, and not just to gases, but rather to smog.

*Mr. Dilworth*—I was thinking principally of gaseous products or suspended particles which in themselves, do not tend to concentrate, once they have been intimately mixed with a greater proportion of, say, fresh air.

*Mr. Hall*—In steam plant work, that is, where dust and fly ash emission is concerned, I think it is a question of economics. Now, all by-laws, or most of them, today set down standards by which the concentration of solids that can be emitted from smoke stacks is controlled, and this varies with the size of the plant. But it all comes down, really, to percentages in each case. It varies with the small plant as compared with the large plant.

Take for instance dust collectors. I think most people admit that dust collectors should be installed where you have either burning in suspension, or burning partly in suspension and partly on the grate. You can take out almost 100 per cent of the solids above a certain size but this may leave an enormous number of small particles. It is a question in my mind how far we are justified in going in demanding a very high efficiency dust collector.

In the larger plant, yes, because they throw out such a large volume of weight of materials, even though in some of them the material that does go out is of such a fine nature that it will be diffused over a very large area and will not cause much trouble. When it comes to the metallurgical industry, I don't know. I will have to refer again to Dr. Katz.

*Dr. Katz*—The question that you ask is intimately related to the meteorological conditions of a particular area, because you see, there are times of the day and periods of the year when a certain mass rate of emission will be dissipated and dif-

[5]Paul Dilworth and Company, Toronto.

fused quite readily and you won't have a pollution problem. On the other hand, there are other periods when, because of meteorological factors, those products cannot be diffused or dissipated properly.

We recently mentioned the problem of cause and effect. It is difficult, except in a very general way, to lay down a regulation or standard as to what one should expect at ground level. One could say perhaps that a certain maximum should not be exceeded, but to relate the problem in the way you mentioned, to certain specific concentrations in the air, is virtually impossible. Did you mean that these concentrations should be at ground level or in the air ?

*Mr. Dilworth*—Under normal conditions, the absolute amount of these contaminants that are ejected into the atmosphere by industry or by motor cars is not so important. The key factor in the problem is the concentration which is maintained, or at least the rate at which they are discharged into the atmosphere, as actually related to the prevailing atmospheric conditions, and of course, those vary from time to time. It seems to me that, rather than try and control the amounts of foreign matter discharged into the atmosphere, where there are very fine particles—if these were mixed with a sufficiently large proportion of fresh air before being freed to the atmosphere they would never reconcentrate, and their nuisance value would be considerably reduced thereby.

*Dr. Katz*—I am afraid your suggestion is contrary to the laws of diffusion. What you are suggesting is that if you are going to emit from a stack, say, 1,000 pounds per day of sulphur dioxide, that you mix that with enough air in the stack so that when it gets out, you will not have a pollution problem.

Unfortunately, diffusion which goes on in the atmosphere—not molecular diffusion—is such a rapid progress that it does not much matter relatively what the concentration in the stack is. What matters is the mass rate of emission from the stack.

In other words, you can put in twice as much air as waste material in that stack, but that is not going to do much to your concentration in the atmosphere, because there the concentration is diluted 10,000 times or more. In the laws of diffusion there is no room for any such factor as volume dilution, because you don't operate on volumes, you operate on masses.

The important thing is this: are you going to discharge 1,000 pounds for 24 hours, or 1,000 tons in 24 hours. If you are going to discharge 1,000 pounds you will have a certain type of stack and certain other conditions. If you are going to discharge 1,000 tons successfully, you must have a much taller stack and a higher velocity, and higher temperature levels, and so on. To attempt to solve the problem by dilution with excess air in the stack is useless.

### The Present Situation

*Dr. L. F. Grant*[6]—Referring to Mr. Dilworth's question and Mr. Davis' question: supposing we take a typical North American city of say, 100,000 people, where everybody is free and happy. Are we doing a permanent injury to the atmosphere ? Does it completely purify it, or will a solution of this question possibly be found in poisoning everybody ? Is the atmosphere getting progressively worse ?

*Dr. Katz*—I don't think we are in any danger of poisoning ourselves to that extent and for this reason. Natural air cleaning processes operate, and where we have pollution problems they are due to a great concentration of industry or population, or to too great a rate of emission or lack of proper control over particular areas, or else they are due to the peculiar conditions, those of meteorology, in these areas.

However, all areas—even the worst of them,—are periodically provided with a system which cleans up the air. First, there is the action of the wind. In high winds, the pollution tends to be less than at low wind velocity. Then, you have turbulence, which is something made up of two main variables, the wind variations and temperature gradients. Ordinarily the temperature decreases as you go higher up.

The third process is that of temperature anomaly, and that is related to the passage of warm and cold fronts. Now, the temperature anomaly is the difference between the normal mean temperature and the prevailing temperatures, and let us say that it is on the negative side. In other words, let us say it is a lot colder than it is usually, which means that a cold mass of air has moved in, which is generally a clean mass. This reduces the pollution. If the reverse is taking place, you have a warm air mass, and unfortunately it is usually a dirt-carrying mass which is not so clean.

However, in addition to that, you have another factor; I mean the passage of a clean front. Every time a front passes over an area, it brings clear air into that particular area and particularly after it changes the wind direction when some of it may be air from the uncontaminated rural districts. Finally, you have got precipation; every time it rains you have a clean-up of the atmosphere by the dissolving of impurities, and so on.

[6]Engineering Institute of Canada, Toronto.

*T. C. Chown*[7]—I would like to ask, is it the idea of the Engineering Institute to have all Provinces put in certain by-laws to cover smoke pollution or elimination ? I know that Mr. Hall has talked about different kinds of stoker equipment and I can remember 20 years ago when the first collection equipment was sold in Canada for a smoke stack. We quite agree that on an underfeed stoker or a chain-grate stoker we do not get the fly ash that we do with pulverized fuel or spreader stokers. We have found that on an underfeed stoker 15 per cent of the ash goes up the stack.

Spreader stokers run around 40 per cent and pulverized fuel from 75 to 80 per cent, and maybe a little higher than that in some cases. I know a case right here in the city, on the top of a hill, where a man can't get rid of fly ash, so he puts it in the bottom of the stack and opens the door and away it goes all over the city. In other cases, I have seen a similar thing. I know of people who used tons of paper and gallons of paint every year, and who tried to keep a painting crew with them all year round, who put in dust collectors. I would emphasize that if you are going to put in these dust collectors, you should put in some type of standard equipment. We have a bid in now, where the request came in for "dust collectors with 85 per cent efficiency". There is no analysis of the equipment, we don't know whether it is going to be used for pulverized coal or for spreader stokers, or what.

*Mr. Hall*—The question is in two parts. First, referring back to that report, I will read you a sentence which you might find interesting:

> "It is strongly recommended that the problem should be dealt with on a regional basis, by means of appropriate control areas to be set up by the various provinces themselves, because only those governments have the power to take such action."

In air pollution, there is no civic boundary, and therefore it should be dealt with on an area basis.

Now, with regard to the policy of the Engineering Institute. When this report was submitted to the

[7]T. C. Chown Limited, Montreal.

various organizations represented on the Committee, one of them passed a resolution requesting the Engineering Institute to take into consideration the organization of the Canadian Standards Association which could take up the problem and develop a model specification. That is now in the hands of the Canadian Standards Association. The E.I.C. is cooperating very closely with the A.S.M.E. Air Pollution Control Committee.

#### Study of Radioactivity Dissemination

*L. H. Dickson*[8]—In the request for regulations, is there anything to cover the amount of radioactivity dissemination? I am referring particularly to Chalk River.

*Dr. Watkinson*—The Department of National Health and Welfare, through its Radiation Section, has the responsibility for the health supervision of radioactive isotopes outside of Chalk River. However, I can tell you that in the history of public health in this country or in any other country, there never has been a greater amount of study on a problem beforehand, in order to ensure safeguards of every kind. Such study is going on constantly in the Radiation Control Section of Chalk River. As far as the future use of radio activity in Canada is concerned, you can be assured that the Federal Department of Health, the Provincial Departments of Health, and every physician and physicist who is concerned with radiation generally, are watching every advance step by step.

#### Studies on Light Scattering

*A. F. Brooks*[9]—Dr. Katz and Dr. Watkinson have both emphasized light scattering as leading to lack of sunshine. That, possibly, is due to a large extent to sub-micron fuel and gases which are not normally collectible. Some are, but not always within mechanical possibilities. Can this problem of light scattering be resolved or handled by legislation, particularly as legislation usually emphasizes masses rather than numbers of particles? I ask this question in view of Dr. Katz's remarks that a major light scattering problem still exists in Los Angeles in spite of legislation.

*Dr. Katz*—These sub-micron particles are the subject of intensive study, and a successful approach has been made in removing them in the case of metallic fume, zinc oxide fume, or sulphur trioxide, by use of suitable types of mechanical equipment, such as venturi scrubbers, electrostatic and various other types of equipment. Now, there is always a residue of small particles which cannot be collected. The optimum light scattering is caused by particles which are 3/10ths to 4/10ths of a micron, but particles down to 1/100th of a micron can cause haze, so that a certain amount of haze is inevitable over industrial areas.

I don't think we should worry too much about it or attempt to legislate in that field. If we do our best to control obvious sources of pollution and also to control certain habits of the public, and do a little planning in regard to city and industrial areas, I know the major part of the problem will be successfully solved.

#### Conclusion

*The Chairman*—I have perhaps said enough this afternoon on this particular subject but I know there is much more that might be said. There are many other aspects of the matter that might be considered and probably should be, but in the space of one afternoon it is impracticable to deal with a subject which would require many days and weeks and months to handle adequately.

Perhaps one note that might be struck at this particular time is this; there is a time factor concerning this particular problem. With the increasing sizes of communities, with increasing sizes and concentration of industry and other similar things, the atmospheric pollution in certain areas is likely to become progressively worse.

There is great difficulty at the present time in getting municipalities and other people concerned to provide even a reasonable amount of money for the purpose of finding out what the situation actually is. Until we know what the situation is, what pollutants are concerned therewith and where they come from, we cannot take any successful steps to deal with the situation, or at least we shall have considerable difficulty in doing so.

The only thing that I fear is this, that effective action in this regard will be postponed until the cost of handling the situation becomes vastly greater than it is at the present time.

[8]Arvida, Que.
[9]Consolidated Mining and Smelting Company, Trail, B.C.

## Philadelphia's Air Pollution Control Ordinance

On March 9 Philadelphia's Mayor Joseph S. Clark signed an Air Pollution Ordinance that is considered by many as the most advanced and constructive in the U.S.

The new law prescribes fees for permits, calls for an increase in penalties for violators and gives the city's Department of Health and the Air Pollution Control Board stronger enforcement and administrative powers. Its definitions are:

"Air Pollution"—The emission or escape of dust, fume, gas, mist, odor, smoke, vapor, or any combination thereof, in a quantity and of a character which constitutes a direct health hazard or detriment, or the contamination of the air in any manner detrimental or harmful to the health, comfort, living conditions, welfare and safety of the inhabitants of the City of Philadelphia.

"Air Pollution Nuisance"—The emission or discharge into the open air of dust, fume, gas, mist, odor, smoke or vapor, or any combination thereof, of a character and in a quantity which as to any group of persons interferes with their health, repose or safety or causes severe annoyance or discomfort, or tends to lessen normal food and water intake, or produces irritation of the upper respiratory tract, or produces symptoms of nausea, or is offensive or objectionable, or both, to normal persons because of inherent chemical and physical properties, or causes or is likely to cause injury or damage to real or personal property of any kind, or which interferes with normal conduct of business, or is detrimental or harmful to the health, comfort, living conditions, welfare and safety of the inhabitants of the City of Philadelphia.

One of the unique features of the new ordinance is that it makes provision for the important problem of controlling odors.

"Odor"—Smells or aromas or stinks, which are commonly recognized as offensive or objectionable, or which are very unpleasant to persons possessing normal olfactory senses, or which tend to lessen human food and water intake, interfere with sleep, upset normal appetite, produce irritation of the upper respiratory tract, or create symptoms of nausea, or which by their inherent chemical or physical nature, or method of processing are detrimental or dangerous to health, or which are of a quantity or character that violates any of the provisions of this Ordinance or any of the regulations promulgated pursuant thereto. Odors and smells are used herein interchangeably.

# Discussion of Technical Papers

## Transistors and the Electrical Industry

by E. L. R. Webb, Head of Air Force Section, and P. A. Redhead, Research Officer, Radio and Electrical Engineering Division, National Research Council, Ottawa
*The Engineering Journal*, June 1954 issue, page 678

**L. G. Eon, M.E.I.C.**[1]

I find myself asked to discuss a paper which is not at all controversial. The facts stated by the authors are to my knowledge correct and their conclusions are satisfactory. I will therefore give briefly my thoughts on the possible impact of the transistor on our Canadian electrical industry.

Various statements have been made during recent years by many important people to the effect that transistors are about to revolutionize electronics. Let us take a closer look and see just what the effect of the transistor will be on Canadian industry during, say the next five years.

Messrs. Webb and Redhead have indicated that completely new techniques in circuitry are required to utilize the transistor. These techniques require a re-education for the design engineers, and also the provision of associated parts such as resistors, condensers, transformers, etc., which are compatible with the operation and size of the transistor.

Military equipments generally are designed to very stringent standards to enable them to operate under conditions of extreme shock, temperature, humidity and atmospheric pressure. It is generally known that today's transistor will not meet these requirements. Again the wide variation in some of the characteristics of present transistor production requires an approach to circuitry which will enable the transistor to be useful and yet not affect the requirements of circuits when certain of its characteristics are varied. This, by the way, is quite possible. Our Defence Research Telecommunications Establishment is a leader in this field.

To have an impact on industry, military orders must be for large quantities of equipment. Generally speaking, even in a time of emergency, military orders represent but a small percentage of our electrical industry's potential. I therefore foresee very little impact on the production capacity of Canadian industry by transistors for *military* orders in the next five years.

However, from the development point of view, our Defence Laboratories are continually reviewing new devices in order to determine how effective these will be in meeting military requirements. Transistors are no exception. Therefore, it can be expected that within a few years, new circuits will have been proven which are ready for engineering development in industry.

If industry is to get its fair share of this development, it must ensure that the training of its own design engineers is in step with the work carried out in Defence Laboratories. Otherwise, the tendency will be for those Laboratories to go beyond the step of proving feasibility to that of developing engineered prototypes.

The success of our Canadian electrical industry in meeting the many requirements of our armed forces has been mainly due to the know-how acquired in designing and manufacturing commercial equipments. It therefore follows that to be successful in meeting the design needs of the Services which may arise in a few years, industry should now be introducing the transistor in the design of commercial equipment.

Industry is faced at the present time with a device which is still relatively expensive, which demands new circuitry, whose performance still leaves much to be desired and whose reliability has yet to be assessed. I am no expert in this field, but I would suggest that except in very limited applications, transistors are unlikely to be used in such mass produced items as mantel radio sets, car radios, etc.

On the other hand, there are many electrical control circuits manufactured for the industry, which may very well be made simpler and more reliable by the use of this new device.

While I agree with the authors that the application of transistors to computers is one of those most likely to take place in the near future, I should add that the telephone industry is another, which may very well be the first one to use this device in large quantities. These specialized fields are unlikely to have an impact on the Canadian electrical industry as a whole.

[1]Senior Scientific Officer (Electronics), Defence Research Board, Ottawa.

**J. R. Houghton, M.E.I.C.**[2]

The impact on the electrical industry of the advent of the transistor can be divided into two phases: (a) the effect of the transistor itself; and (b) the miniaturization of associated apparatus such as resistors, capacitors, inductors, etc.

Let us discuss the latter first. To obtain full advantage of the minuteness of the transistor, it follows that these associated components must be reduced in size as well. Great strides in this direction have already been made through the use of very high permeability materials such as ferrite and permalloys for the construction of inductors and transformers. Coils not much larger than the transistor itself have already been produced. Capacitors, manufactured from tantalum, have been reduced to the size of a matchhead and have a capacity of 25 mf. In the resistor field the carbon deposited type has been reduced to a diameter not much larger than the terminal leads.

When these miniaturized components are assembled and used with printed circuits, then it is possible to attain the overall miniaturization commensurate with the transistor. The low heat dissipation of the transistor favours the practice of packaging these components in a minimum space either in plastics or potting compounds. To reduce maintenance costs, these assemblies can be of the plug-in unit type construction.

[2]Superintendent of Manufacturing Engineering, Northern Electric Company Limited, Montreal.

While it may be true that the commercial use of transistors in equipment has not kept pace with the laboratory developments, it is a fact that a very large number of companies in the United States and at least a couple in Canada have been licensed by the Western Electric Company to manufacture transistors. Speaking on behalf of the Northern Electric Company, we have been in production of the point contact type transistor since January, 1953. While facilities are set up on what might be termed a pilot plant basis, sizable quantities are being produced and facilities could be expanded very rapidly should larger demands arise. Grown junction type transistors can also be produced in reasonably large quantities in this pilot plant and are available now.

What does all this mean to industry in general? It probably can be assumed that heavy capital investment will be necessary on the part of transistor manufacturers since it is doubtful if present vacuum tube or other facilities could be used. As the use of the transistor and other miniaturized components increases, it will be necessary to spend further capital to revamp the methods of assembly both in the apparatus and the equipment factories. In short, the whole field of miniaturized apparatus and subsequent equipment will in the future necessitate either full or semi-automation. The automatic factory will involve considerable expenditure with perhaps lower than normal utilization of facilities. Selection of operating personnel for dexterity and vision will be preferable and more than normal training will be necessary.

To return to the transistor, it is felt that the manufacturer and public will expect that so small an item, containing fewer parts and simpler in construction than the vacuum tube, should cost a few pennies. Hence it will be necessary to plan for semi-automatic production processes at least in order to lower the cost. How soon this will be necessary will, of course, depend upon the demand. Pilot plant production will remain until enough transistors are produced and in the hands of the designers so that the demand is created which will warrant mass production techniques. To date, only small requirements for development purposes have been forthcoming. This is, of course, logical since the design of the transistor is only recently reaching any degree of stabilization, and the design of equipment and circuit application has not as yet been proven conclusively in very many instances.

Finally, there are many who believe that quantities of transistors many times more than present day vacuum tube usage will be required in the future. Transistors are used in current manufacture of national toll dialing equipment and very shortly a rural carrier system using sizeable quantities will be in production. In the communications field indications are that transistors will play a part in every phase of the art and it is certain that demands will arise in many other fields.

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## Fire Protection Aspects of Building Design

by W. E. Emmerson, Jr.E.I.C., and D. R. Abbey, M.E.I.C., Fire Protection Division, Underwriters Laboratories of Canada, Toronto, Ont.

*The Engineering Journal*, April 1954 issue, page 426

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**F. E. Wellwood, M.E.I.C.**[3]

The authors are to be congratulated on the clear manner in which they have presented the various fire protection aspects of building design. All too often, we engineers are prone to be content to confine our attention to structural safety if engaged in structural design, and to mechanical efficiency if engaged in mechanical design.

As a member of a municipal buildings department, I feel that all engineers should be made aware that their function in safeguarding life and property should go farther than the prevention of collapse of the structure or the efficient operation of the plant or the various mechanical or electrical contrivances entering into a modern building. I believe the work of the engineer should also include a detailed study of the hazards involved in the processing of material in a factory, or the possibility of fire spread in other occupancies.

The authors have referred to the tremendous fire loss, due to improper design, which resulted in rapid unrestrained fire spread at the General Motors plant near Detroit. The loss of buildings and equipment was tremendous, but the loss to the company from the interruption of the use of such plant and equipment was equally important.

Another aspect of the serious consequences resulting from large fires was touched on by the authors in their reference to the Cocoanut Grove fire in Boston and the LaSalle Hotel fire in Chicago. In these buildings, and in others such as the Hotel Winecoff in Atlanta, Georgia, and the Knights of Columbus Recreation Hall for service men at St. John's, Newfoundland, the property damage was extensive, but of more serious consequence was the heavy loss of life. In these four fires alone, seven hundred and seventy-five persons lost their lives. Yet the two hotels were advertised as "absolutely fireproof". In all these cases, certain weaknesses existed in fire protection, in design, or in subsequent application of interior combustible finishes; and in all four cases inadequate exits were provided or the exits were unavailable for use in simpler control of the building.

I would like, in this connection, to sound a note of warning against the use of heat actuated devices in the operations of closers on doors leading to stair or other shaft enclosures. Most loss of life in fires arises from the panic hazard of smoke, rather than from fire itself. Unless such doors are kept in a normally closed position, smoke will spread through the full height of the building long before the heat rise has been sufficient to close any doors except those immediately adjacent to the fire's origin. By this time there exists not only the hazard of a crowd in a panic, but also the reduced efficiency or perhaps total loss of the exitways due to poor visibility, and discomfort in breathing due to high smoke density.

It is this latter aspect of building design for fire protection that all building officials feel should be stressed, for it is always possible to renew property but life is irreplaceable.

[3]Deputy Commissioner of Buildings, Department of Buildings, City of Toronto.

**T. R. Durley, M.E.I.C.**[4]

It is a pleasure again to see a paper having to do with fire protection and this is a valuable one. I do

[4]Assistant Vice-President and Engineer, Manufacturers Mutual Fire Insurance Company, Montreal.

not agree entirely with the order in which the tools of the fire protection designer are mentioned, but it would be a dull world if we all thought alike.

To me the most important aspect of fire protection design is to study the hazard and isolate it, to provide automatic extinguishing equipment. There seems to be no need to discuss hazards—in general, they are well recognized and are usually adequately taken care of. The problem, in any building, is that knowing what automatic protection is necessary, and of developing the necessary judgment in the designer himself. As the authors point out, justifying automatic protection by a saving in insurance cost is seldom possible. It must be based, in part, on the fact that with proper fire protection the property owner knows with certainty that his property will still be there the next morning and can continue to operate safely for many years. This confidence is difficult to evaluate but is usually ample justification.

The real measure of the need for automatic protection is undoubtedly the number of B.t.u.'s which will be liberated, by the structure or occupancy, or both, in a fire. The amount of heat, expressed in weight of burnable material per square foot, just as live loads in a building are computed, dictates what protection is required, whether by distance, fire walls or automatic extinguishing equipment. Protection must be balanced very carefully against loss of life and property values.

This concept has been introduced into the new National Building Code, but since it is new, we must proceed slowly, and we also run into the old problem that many of our friends in the building trades still don't know how quickly wood burns. It is, in the main, a question of education, and architects and engineers must obtain and study the wealth of information available, not only from the National Fire Protection Association and the Dominion Board of Insurance Underwriters but also if I may be permitted to mention my own organization, the Factory Mutuals. There are others too that maintain loss prevention services, and all do excellent work.

I don't know too accurately what the national loss ratio is, but, according to the report of the superintendent of insurance for Canada, the last recent 5-year average is about 33c. per $100.00 insured. We, the Factory Mutuals, know that this figure can be reduced to about one-tenth of its present level when proper fire protection is provided. This figure, as the paper indicates, is a great challenge to all engineers and represents a saving of many millions of dollars annually.

Let us hope that the new National Building Code and all other available information will be used—and in particular by the Federal Government which seems to be amongst the worst offenders when it comes to building unprotected properties which contain very high values. And, finally, let us hope that those of us in the fire prevention field may be able to help in the steady reduction of the large fire loss in this country.

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## The Application of Computors to Industry

by W. J. M. Moore, M.E.I.C., Assistant Research Officer, Radio and Electrical Engineering Division, National Research Council, Ottawa
*The Engineering Journal*, September 1954, page 1068

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**Henry A. Spencer**[5]

It is of interest to me to read articles like "The Application of Computors to Industry". Much has been said about the ethics of a mass production system of manufacture. One of its obvious faults is the deteriorating influence of routine jobs. If the modern computors mentioned by Mr. Moore can be applied in this direction there is a twofold advantage. The emphasis on the mental development of the nation should be increased and the chances of costly errors through disinterest in tedious jobs decreased, which benefits industrial management.

One or two comments by Mr. Glinski concerning the development of computor components raise another point which sometimes is overlooked. In any computor the designs are limited in scope by the limitations of the tubes, solenoids, springs, electrical contacts and thousands of other basic parts. Maintenance of these unit parts is a tremendous task where designers have not been familiar with the average life span of, say, a relay. Anyone who has watched as simple an electronic mechanism as television wonders what kind of repairman would be required to maintain an electronic "brain". Thus it seems that some effort should be bent in the direction of improved unit parts and groups of parts which at present are inadequate.

In the design of desk calculators, much effort has gone into mechanical design. Programmed sequences are carried out by cams, levers and latches made by mass production techniques. Very few desk calculators have been made from electronic components. From all appearances it seems that they are not reliable enough to give continuous service.

I would invite further comment on these points from engineers who are familiar with computors. Certainly the future of this field looks extremely interesting.

[5]Industrial Engineer, Research Council of Alberta, Edmonton, Alta.

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The Editor

cordially invites discussion

on papers appearing in the

*Journal*

# Abstracts of Current Literature

Abstracts of articles appearing in current technical periodicals

## NEW RESULTS IN TOOL AND DIE WELDING

Robert Groman, *The Welding Journal*, v. 33, no. 6, June, 1954, pp. 543-545.

The majority of people working with tools and dies are familiar with the present methods of repair and salvage with oxy-acetylene torch and electric arc-welding equipment. Much has been written about procedures for such repairs and their use is increasing daily. More and more people are realizing the savings from tool and die salvage welding.

However, there is a field in which very little work has been done because of the specialized equipment required and the extensive training necessary to complete the salvage work (reheat treatments, etc.). Examples are the repair of sharp cutting edges of high-speed tools, small chips or cracks on plastic dies, punches, clicker dies as used in the shoe industry, etc.

Building up a sharp cutting edge on a high-speed tool such as a drill or reamer with the electric arc is difficult because of burning the sharp cutting edges of the tool. Plastic dies are intricate in design and almost impossible to weld with the electric arc. Annealing of the base metal is detrimental when the oxy-acetylene torch is used.

Because of these problems a survey was made to determine what could be done to induce people to do more salvage welding and show them the savings that could be had by so doing.

### Carbon Arc Method

As a result the carbon arc method was introduced. Not the carbon arc torch which employs the twin carbons, but the single carbon method using a d-c machine, straight polarity.

For this type of work, a special coated carbon electrode has been developed. This special coated carbon electrode has a mineral and metallic coating which has produced results equaling in importance the introduction years ago of the coated mild steel electrodes.

The special coated carbon electrode is used at lower amperage giving it longer life, greater workability and gas coverage similar to metallic arc welding.

The single carbon method is excellent because it provides a pin point source of heat, extremely localized, which will melt the base metal as soon as the arc is struck.

The carbon arc method produces welds that are spatter free and, if the proper technique is used, no undercutting will occur adjacent to the weld deposit.

The filler metal used is the special low-watt input tool steel electrode used for conventional electric-arc welding. The prescribed technique used is very similar to torch welding, as follows:

1. Put a taper point on the coated carbon electrode using a grinding wheel.
2. Grip the special coated carbon electrode on the brushed end in an electrode holder.
3. Place the holder in the right hand.
4. Hold the special low-watt input tool steel electrode in the left hand and feed it into the arc as soon as the arc has started.

### Procedure for Salvage Welding

The recommended procedure is to grind out all defects in the die or tool so as to remove all chipped or broken areas. Preheat the die or tool to 400°F. (blue heat).

Use a small carbon electrode, preferably 1/8 and 1/4 in., set the arc machine at 60 amp. or less. Use a 3/32-in. diam. size special low-watt input electrode of the type of steel being welded, oil hardening low-watt input electrode for oil hardening steel or high-speed low-watt input electrode for high-speed steel, etc.

While there might be wide variations in the analysis of tool steels, the heat treatments, in each respective classification, are similar. Therefore, in welding it is not a question of matching the analysis of the steel, but of matching the heat treatment in its classification as closely as possible.

Strike the arc with the coated carbon electrode and feed the special low-watt input tool steel electrode into the arc using the torch welding technique. Build up the chipped area until the repair is completed. Excessive puddling is not necessary nor desirable.

Peening is recommended immediately after each pass or whenever the welding has been stopped. The chief effects of peening consists of relieving shrinkage stresses and improving the metallurgical structure of the weld deposit.

Sometimes peening is overemphasized and the tool welder will use a large hammer, thinking of forging the deposit. This must be avoided as too heavy a hammer blow will fracture the deposit and cracking will result. Always use a small hammer and a light hammer peening.

On corners or sharp edges, leave all the extruded coating on the filler metal electrode. If a fillet weld is to be made, it is advisable to remove 50% of the coating on the filler metal electrode, either by grinding or breaking it off with a hammer. Caution — never at any time remove more than half of the coating. If too much of the coating is removed, the weld deposit will be brittle, low in tensile strength and considerable porosity will be evident. Much can be derived from the alloying elements of the coatings as they help to compensate the percentage of alloying elements lost during the welding operation.

Drawing or tempering is usually done with the oxy-acetylene torch as the above technique is used only on small repairs. The drawing or tempering operation relieves contracting stresses set up by the cooling of the weld deposit.

In a salvage repair of this type, it is not wise to make repair that is greater than 3/8 in. in depth. If the break is larger than this, the normal arc welding procedure is recommended, using the cushion method of repair.

In all cases the part being welded must not be exposed to draughts of air as this would cause checking and cracking of the weld deposit. It is obvious that time and money can be saved by this type of reclamation.

## THE HISTORY AND CONSTRUCTION OF THE FOUNDATIONS OF THE ASIA INSURANCE BUILDING, SINGAPORE

William Joseph Robert Nowson, *Proceedings of The Institution of Civil Engineers*, P. 407—v. 3 no. 4, July 1954, p. 407.

This paper describes the underpinning of partially sunk reinforced-concrete cylinders by means of a precast concrete segmental lining. The early history of the foundations is related and reference is made to the main points in the design. The partial sinking of the cylinders, of which a brief account is given, was carried out by another contractor.

The cylinders form the main part of the foundations for the 18-storey steel-framed Asia Insurance Building in Singapore. The site is located over an old beach reclaimed within the past 70 to 80 years. The beach formation is 10 to 14 feet thick. Overlying it is 15 to 18 feet of fill and below it is decomposed shale and sandstone. Four borings, sunk at various points on the site, came to refusal at depths ranging from 30 to 42 feet. Firm sandstone chippings were obtained in each case. The consistency of these results suggested the existence of a firm rock stratum. Lack of suitable drilling equipment in Malaya at that time prevented the rock from being proved at depth.

On the basis of this information, cylinder foundations were selected to be sunk to rock level. The cylinders were designed for a bearing pressure of 10 tons per square foot exclusive of their own weight.

During the sinking of the cylinders the soil analyses were confirmed, except that the sandstone at depth proved to be core boulders of sandstone. The situation was aggravated by the inrush of soil during the sinking of the cylinders through the beach formation, causing considerable trouble and delay. The surrounding ground showed a series of cracks and, close to one side of the building line, the pavement had sunk from 2 to 3 feet.

The subsidence is attributed to the disregard, on the part of the previous contractor, of the specifications relating to the method of sinking the cylinders. Control of the water table was erratic and excavation inside the cylinders was allowed to proceed too far ahead of the cutting edge.

To avoid further risk of loss of ground, sinking of the cylinders was stopped. The cylinders were carried to their final level by underpinning them with a precast concrete segmental lining. The bearing pressure was reduced to 3.5 tons per square foot by belling out the bases. All cylinders were back-grouted, and also each ring of the lining as it was assembled. In certain cases underpinning through the beach formation was carried out in compressed air.

After sealing the bottoms of the shafts and encasing the segmental rings in a secondary lining, the tops of the cylinders were trimmed to a common level and a 4-foot-thick reinforced-concrete raft was cast over them. Into the raft were grouted the holding-down bolts and base plates for the stanchions of the steel superstructure.

The paper also gives a detailed account of the soil surveys. It describes the manufacture of the precast concrete segmental lining and gives notes on the plant and tools used during the execution of the work.

## FORWARD WITH THE TURBOPROP

D. M. Desoutter, *Aeronautics*. v 30 n 6 July 1954, pp. 60-62.

The Bristol Britannia suffers from one noticeable drawback: it looks like an ordinary aeroplane, albeit a very elegant and attractive one.

The first thing to grasp about the machine is that it is a big aeroplane. Its pleasing lines mean that in drawings and photographs it does not look very big: but it is. In span it is slightly greater than the Boeing Stratocruiser, and considerably greater than either the Douglas 7 or the Constellation 1049. In length it well exceeds all of these machines. Its maximum take-off weight, too, is far beyond that of the Stratocruiser and even farther beyond those of the Douglas and the Lockheed. In fact the disposable load of the machine is found to be greater than those of the other widely-used commercial machines that have been mentioned.

One has to bear in mind that just as the machine is bigger and heavier than one expects, so the engines are more powerful. They are, in fact, the most powerful civil engines in the world, eclipsing the Wright turbo-compound by a handsome margin. Indeed, only the gas turbine can offer a practical means of achieving the scale of power output needed for an aeroplane of this size. High power for small unit size is an accepted quality of the gas turbine in any field of application, but here the application is to the airscrew. Here is the core of the turboprop's claim to efficiency and economy, its enlisting of the airscrew's aid to apply the turbine's high power output in the best way.

### The "Free Turbine" Principle

The advantages of the propeller turbine are winning for it a steadily widening group of adherents in the world at large. Apart from being one of the leaders in this field, Bristol has put itself in a special position by the adoption of the 'free turbine' principle, that is by the use of two separate turbines of which one drives the compressor and the other the airscrew.

The free turbine is a very attractive idea because it separates two devices which have their own peculiarities of performance and their own critical conditions: that is the compressor and the airscrew. The compressor, which is the essence of the gas producer, gives a satisfactory performance only within a comparatively narrow range of rotational speeds, but the airscrew's relationship between rotational speed and power output is required to be more flexible as its pitch is varied to suit the differing cases of take-off, cruise and landing.

The free turbine avoids the issue by making the two entities independent, at once easing the task of the designer and simplifying the engine controlling apparatus. There are other advantages, among them the lessening of the starting load because the airscrew and its reduction gear do not have to be turned, and the low drag of the free-spinning airscrew in the event of an engine failure. There is naturally an increase of weight due to the double shafting and the necessary bearings, but that seems a comparatively negligible price to pay for the advantage of having an engine in which the power section can operate at its most advantageous condition without being hampered by the propeller, while the propeller in turn is equally free of the power section. The ultimate result, of course, must be measured in fuel consumption. Consumption figures for any engine vary over the range of operating conditions, but typical figures cited for the Proteus 755 by the makes are 0.218 kg./e.s.h.p. (0.48 lb./e.s.h.p.) at the maximum five-minute power, at 0.225 kg./-e.s.h.p.) (0.495 lb./e.s.h.p.) at maximum continuous power at an altitude of about 10,000 metres.

### Design for Economy

Given this economical form of propulsion with its low noise level, low installed weight and great power, the Britannia airframe has been designed to take advantage of it. The machine has a high disposable load coupled with a lay-out that leaves it to the operator's choice how that load shall, in fact, be disposed. The disposable load is mainly made up of fuel and payload, and although these two items are mathematically interchangeable they are not always physically interchangeable because one cannot put passengers, or even mail, in the fuel tanks. In the Britannia the volume of the cabin and of the under-floor holds is such that there is plenty of opportunity to devote lifting potentiality to revenue-earning load.

All these qualities of good load-carrying, low fuel consumption and so forth have one object in view—the earning of a profit. The assessment of an aeroplane's ability to earn a profit is no easy matter and many of the wise men of aviation seem to prefer to adopt the method of standing on the sidelines to watch another operator put the matter to the test. There are always a few, even wiser, who have confidence in their own ability to know a good thing when they see it. But at this point it is not our purpose to say too much about the estimated economics of the Britannia. For the moment the aim is to show in what class of aeroplane it falls.

Now it is a commonplace that an aeroplane's economic worth depends upon the difference between the rate at which it can earn money and the rate at which money has to be spent to operate it. The earning rate is the product of the payload carried and the average speed, and the exact relationship of these two variables is the field in which the aircraft designer can exercise his discretion to the best (or worst) effect. Now the Britannia can be characterised as a machine which achieves a high productivity by means of a high (but not very high) speed and a very high payload. This approach to productivity also has its effect upon operating costs, because the choice of a moderate speed reduces the fuel consumption, and this in turn is one of the things that makes possible a higher payload. Thus the machine is neither of the very slow and ponderous carriers nor of the extremely fast (circa Mach 0.85) light load carriers. While avoiding both these extremes it yet achieves a high productivity.

## HUMAN FACTORS IN TECHNOLOGICAL CHANGE

Professor C. A. Mace, *The Institution of Production Engineers Journal*, v 33 no 7, July 1954, pp. 421-425.

Theoretical science and practical engineering resources have now advanced to a point at which it is no longer fantastic to conceive the possibility of an electronic factory—one in which the human operator is replaced at almost every point by an automatic contrivance of a mechanical or electronic kind. The next step presumably would be to distribute the goods produced through automatic machines. This producer's pipe dream has at least the merit of drawing attention to the fact that, as we progressively displace the human agent, we reduce both the major sources of resistance to desired change and the major sources of inspiration of desired change.

In the electronic factory there would indeed be change—the wearing out of parts and eventual breakdown; but desired change and the resistance to desired change spring from something inherent in life itself: they derive in part from the homeostatic tendency characteristic of all living things. This is true not only of living things composed of organic tissues, but also of those living things which we call societies and social organizations, government departments, public and private bodies of every kind, including even those that exist in order to promote reforms. All are resistant to departures from established norms.

That resistance to change arises in part from the need to conserve and consolidate past achievements is illustrated by the function of standardization of tools, components and procedures. The uncontrolled spirit of invention and experiment makes for an uneconomic degree of variation in procedures and products. Hence the advantages of standardization. Hence, too, the difficulty in further advances. The dangers of premature standardization are greater when standardization is brought about not by conscious intention and deliberate organization, but by tradition and custom. Many things have been standardized by custom. It is most improbable that the ideal unit of building construction is the brick of any of the conventional dimensions. But what has been standardized by custom is not the bricks, but the skills of men who use these bricks in building. In the scientific study of the process of industrial production we have come to think of the "man-machine unit". We ought perhaps to think of the man-machine-materials unit. Pending the perfection of the automatic factory, production is effected by human beings performing certain operations with tools or machines upon given materials or components. We cannot standardize any one of these contributors to the end result without due regard to the others.

### Increased Rate of Discovery

There can be no doubt that the rate of discovery has increased enormously, and is still increasing. The pace has so quickened that in many fields of production technological change has been geared, through the seasonal interests of man, to the circuit of the earth round the sun. Each annual model of every make of car is expected to embody improvements.

Were we concerned to make the pace still hotter there would be several things to do. One would be to upgrade and develop our primitive system of technical and technological education. Originality of mind is something more than skill in the use of scientific method. It springs from certain attitudes which at present are fostered only in certain special places. If we review the greater educational institutions of the world the impression received is that those most productive of creative minds are precisely those in which trained and disciplined intellects are applied to the coolest consideration of the craziest ideas.

There is indeed a powerful case to be argued for making a liberalized system of technical education the main trunk of our education tree. It would need to be "liberalized" by introducing into the curriculum an appropriate selection of arts subjects, for the arts subjects contribute to inventiveness and originality as much as is contributed by science. A liberalized secondary technical education could lay the foundations for a balanced appreciation of the scientific, the aesthetic and the practical aspects of life. So far as discovery and invention is concerned the pace, it might well be said, is surely hot enough. The problem is to break down the resistance of consumers and producers. The consumer's resistance to change, and his demand for change, are combined in curious ways. The customer is not always right. He would be always right if he could always say what he really needs. When he says only what he thinks he needs he is not more likely to be right than wrong.

Hence the importance of advisory services. One of the most significant features of the times in which we live is the expansion of these services. In his personal affairs a citizen in the modern world has at his disposal medical, educational and innumerable other specialized bureaux dispensing the latest and best advice on any subject of concern to himself or his wife. Nor are such advisory services restricted to official bodies. Large-scale industry has developed similar services which are conducted in a responsible and professional way. In large part, the problems of getting ideas into production are of overcoming consumer resistance and are problems of "communication", meaning by "communication" not merely the transmission of information, but also the induction of a willingness to act in certain ways.

The lines of transmission are of various kinds. There is, for example, the line from the inventor through the research laboratories and test stations to the field of operation. In the process of production there is the line from higher management through the supervisory grades to the operators at the bench who actually do the job. Typically, the introduction of a new machine, a new piece of equipment, or a new procedure follows a now fairly well-established routine. Tests are first performed in the research laboratory. The new machine is then transferred to the field station in which it is still tested scientifically, but under as near as may be realistic conditions. Surviving all these tests, it is then tried out under the normal industrial conditions in the hands of ordinary operatives working in the ordinary way and with normal motivations. This third phase is apt to be the most critical, but it is one that receives the least attention. There is all the difference in the world between the man in the field station who is excavating a trench in order to test an excavator, and a man on building site who is using an excavator in order to excavate a trench. Technological inventions need to be tested not only for their physical capacities but also for "acceptability", and the latter tests require to be as searching and as rigorous as the former and every bit as much subject to scientific control.

### Resistance to Change

It is a basic misunderstanding to suppose that all resistance to change arises from sheer irrationality and prejudice. Men are not in general implacably opposed to the acceptance of something to their own advantage, but it is only common prudence to look a plausible gift horse in the mouth. Sheer prejudice is on the whole a less serious obstacle to progress than prejudice reinforced, as it so often is, by a measure of reason and good sense. When a man has invested not only his money but also his self-respect in the acquisition of rare skills, it is not a joke to find these skills supplanted by a gadget. The engineer, thinking only of the time it takes to design, construct and install a new and better machine, is naturally impatient at the delays imposed by the need endlessly to explain and convince and reassure everyone concerned, not least those in whose interest and for whose benefit the machine has been conceived. Even a labour-saving device makes work harder and calls for further effort for a time—during a longer or shorter period of transition from the old to the new.

There are cases in which technological changes come about not by changes in persons, but in personnel. New ways of sucking eggs are introduced through the passage of the generations, and this may apply to the techniques of egg production as well. Youth is proverbially susceptible to the arts of the propagandist for any new ideas, and this susceptibility can be turned to good account in technological education. This is yet another reason for the upgrading of the technical schools and colleges, for their closer integration with the organizations for technological research. Even before the age of nuclear fission, it was being suggested that one of the traits of character most needed for life in the modern world is that of being "adapted to insecurity". There would seem to be an almost equal need for being "adapted to change". Extreme attitudes in either direction are equally inappropriate, and equally unconducive to ordered progress. There is scope through our educational system and our publicity services to inject into society a pervasive sense of optimum rates of change, and to diffuse among consumers of goods appropriate habits of obsolescence and replacement. Things are made to last a certain time. A razor blade may be intended to serve the purpose only of a single shave; a pyramid is built to last ten thousand years. How long a thing should last is an item to be included in its specification. How long it is intended to last is something which the buyer of a blade or a pyramid has the right to know. Some goods are sold with a guarantee that they will endure for $x$ years. A buyer might as reasonably ask for a guarantee that they will wear out not so long after that. We hear of motorists who trade in their cars when the ashtrays are full. We all know motorists who contrive "to run the old bus" long after the cost of maintenance has exceeded what is economic.

It is sometimes suggested that industry has overemphasized the importance of durability and quality, and that it would do much better if it designed clothing, cars and buildings so that they wore out. On this there may be more than one opinion. But there can hardly be two opinions on the suggestion that, whatever we do, we should know what we are doing and do what we do with conscious intention.

### Control of Technological Change

The prospects of rational control of the rate of technological change have been significantly enhanced during the present century by the improvement of techniques of publicity, advisory and educational services, and by the development of higher ethical and professional codes in the use of these techniques. Publicity today tends to be factual, informative, genuinely advisory and educational.

Advisory services themselves stand in need of advice scientifically based. Although the relevant knowledge is still very sketchy, much more is established than has yet been applied. It is clear from first principles than an advisory service must be based upon knowledge of actual needs, and of the attitudes, tastes and interests of those to be served. It is clear also from first principles that the effectiveness of any communication will depend upon the extent to which the message is delivered to the right person, by the right person, in the right form and at the right time. It will also depend upon the extent to which the delivery of the message is followed up, its impact assessed and further communications modified in accordance with the "feed back" received. In this way, the results of "mass diffusion" methods of publicity are supplemented by the direction of specific beams of intelligence upon persons and groups in key situations, timed to arrive at the opportune moment, and the effects produced so checked up that future communications can be suitably adapted to the changing situation. Such techniques of communication admit of development in precision and in a scientific way, and through their systematic application the rate of technological change comes increasingly under control.

Here again the fact emerges that advance depends upon the application of scientific method to the human factors in the situation. In a world of electronic factories, directed by an electronic management, assisted by electronic servicing engineers, disposing of its products by electronic salesmen to electronic consumers, there might well be no resistance to technological change. But things have not yet come to that pass. Human management will employ human operators to produce goods and services for human consumers for some time to come. Control of the rate of technological change depends on control of the human factor. The rate of technological change depends upon the rate at which new ideas occur, it depends on the rate new ideas can be transmitted through the relevant lines of communication in production and it depends on the rate of consumer assimilation.

If predictions are not entirely out of order, the guess might be hazarded that the next great phase of technological advance will be one in which human factors in the technological situation are accorded the same scientific regard as is given to raw materials and machines; and when technologists begin to think in terms of the man-machine-materials unit.

How and when and where can we set about it ? Research and development in the human sciences do not follow quite the same sequence as that of research and development in physics, chemistry and the major branches of engineering. Human reactions can be tested in the laboratory and in the field station, but all the most crucial tests are in the field itself.

To summarize: the subject of this discussion has been the control of technological change—control not essentially with a view to its acceleration, since in some directions the pace, perhaps, needs to be slackened.

The major instruments of control are those of formal education, those of the advisory services and the new techniques of "communication", and not least the function of research. There would appear to be three major lines of action, the first directed to increasing the output of inventive minds, the second to the promotion of favourable consumer reactions and the third to facilitating the passage of new ideas into actual goods and services.

## ENGINEERING'S DIRTY WORD

John M. Allderige, *Yale Scientific*, April 1954, pp. 34-36.

Statistics is practically a "dirty" word these days to many engineers. Accordingly, the custom is to begin discussing statistics and engineering with some disarming bit of whimsy and proceed gently, very gently, into the subject. Making fun of statisticians is an accepted gambit, e.g., a statistician is one who has his head in the ice box, his derriere in the oven (burners lit), but on the average feels fine. This is of doubtful utility, however, for some engineers react as that now famous child in the New Yorker cartoon, "I say it's spinach (statistics) and I say the hell with it."

Every engineer in the country has had contact with modern statistical techniques. To some this has been frightful; to others it has been boring; but to an ever-increasing number it has been exhilarating. This last group—this happy band of warriors on the frontier of learning—are using statistics constantly to guide them in procuring and analyzing data, and they are enjoying spectacular success.

A glance through statistics texts would indicate the wide usage of statistics by engineers. Engineering problems form the bulk of problem material. Here is one, just for flavor and to show that this battle can be fought on any level—in this case, the crass, practical one. The following are measurements of the tensile strength of cap screws. The engineer has tested 17 of them and wants to know:

a. How reliable is the average tensile strength figure from these 17?

b. How many cap screws must he test to be sure that he has an answer within 100 lbs. of the right answer?

Tensile Strength
in 1000 lbs.

| $X$ |
|---|
| 18.1 |
| 18.7 |
| 17.3 |
| 18.3 |
| 18.2 |
| 19.0 |
| 18.5 |
| 17.8 |
| 18.3 |
| 16.4 |
| 18.1 |
| 18.3 |
| 17.8 |
| 18.0 |
| 19.4 |
| 17.7 |
| 17.7 |
| 18.7 |

$$\bar{\bar{X}} = \frac{EX}{N} = \frac{308.6}{17} = \underline{\underline{18.15}}$$

$$S^2 \sqrt{\frac{EX^2 - \frac{(EX)^2}{N}}{N-1}}$$

$$= \sqrt{\frac{5609.4 - 5602.0}{16}} = .68$$

$$2.12s_x = \frac{2.12s}{\sqrt{N}} = \frac{(2.12)\,(.68)}{\sqrt{17}} = .35$$

$$N = \left(\frac{2.12s}{.1}\right)^2 = \left[(21.2)\,(.68)\right]^2 = 208$$

His conclusions:

a. The average of 18,150 lbs. is within 350 lbs. of the right answer. That is, there is 95% assurance that the interval from 17,800 lbs. to 18,500 lbs. contains the average that would result from testing a very large (technically infinite) sample of these cap screws with the same testing device.

b. Approximately 208 cap screws will have to be tested to get within 100 lbs. of the "right" answer (as defined above).

The technique used here is not important. Those who know statistics will recognize it; the unfamiliar won't without some study. What is important is to note that two vital questions were answered, and that statistics offered the only objective way in which to answer them. These are two of many questions that statistics could have answered. Some others might have been: What are the major causes for variation? Is this sample the same as another sample just tested? Is there a relationship between tensile strength and, say, the machines used for production?

The fundamental problem facing every engineer is epitomized in this example. This is the usual situation (predicament):

1. The engineer has measured a phenomenon and has some data;
2. The data exhibit variation;
3. The data are just a sample of what the phenomenon can produce in the way of data;
4. He wants to make some statement about what would happen if he were to look at everything, i.e., all data from this phenomenon. Or, in other terms, he wants to make an inference about the total picture.
5. He wants to know just what risk he is taking in making his inference.

The key words are "variation," "sample," and "risk." Here we have the heart of statistics: that discipline which coherently relates variation, the behavior of samples, and risk or probability. So it is only logical that engineers do turn to statistics to learn, unequivocally, what inference to make and the associated risk, just as was done in the example.

Now, this line of reasoning applies regardless of the engineer's specialty whether the data are pounds, inches, time, or dollars. It very specifically applies to the latter—to general administrative work, reverently referred to as "management," which some engineers get to eventually. Organizational problems more and more are being tackled by statistical techniques. The whole field of operations research attests to this growing application of statistics (and mathematics). The manager of today is considerably better off if he has an idea of what these specialists are doing; some have worked hard on their own to do so.

The typical situation described, then, is easily seen to be universal; statistics offers the universal basis for resolving it. It is thus that many engineers in all capacities do and can use statistical techniques.

### Statistics and Scientific Method

But, is such apparently "vocational" material admissible in a course of study that is trying to be purely "educational"? Perhaps as a start it might be well to locate this discipline of statistics within the framework of the scientific method to see if it is just a "gimmick," or if it is fundamental. The scientific method has six traditional steps:

1. Definition of the problem by appropriate study of the facts at hand;
2. Formulation of a hypothesis—a purely tentative explanation relating the facts;
3. Design of an experiment to test the validity of the hypothesis;
4. Gathering the data from the experiment;
5. Analysis of the data;
6. Drawing a conclusion that the hypothesis is either affirmed or denied. This often offers more facts leading to a new hypothesis and so forth.

One school holds that statistical methodology only enters in Steps 3, 5, and 6. Statistics is generally recognized as a cornerstone of experimental design; it is vital in data analysis as we have seen in our example; and it suggests a conclusion by stating, quantitatively, the probability associated with accepting or rejecting the hypothesis. Another group maintains this to be a limited view, that experimentation is scientific method and, hence, statistical method is synonymous with scientific method.

The above discussion alone should convince the doubter that statistics is no "gimmick." From the previous remarks it is apparent that statistical training can help an engineer develop his abilities for formal thinking. Formal thinking implies objective reasoning or mutually understandable reasoning. This reasoning process quite often employs numbers—indeed, the more often, the more likely is objectivity—and statistics automatically comes into the picture since it is the mutually understandable manner of handling numbers.

Clear expression is usually linked with words—both written and spoken. Yet, in a profession, the avenues of expression are wider; they include symbols, numbers, and diagrams, as well as words. In the previous example there is no more succinct expression for the analysis used than that shown. At its own level, the meaning is immediately apparent. For those unfamiliar with the jargon, there is no meaning. Granted. Explanation at that level would be far more involved; it would entail a basic course in statistics. But how eloquently this fact points up the power of expression of this new language! How much it then behooves the engineer to embrace statistics with its great capacity for clear, compact expression.

Statistics appears to have deep roots. No discussion of the philosophy of science can disregard the impact of statistical methodology on science and, therefore, engineering. All this is not surprising; no really powerful tool, such as statistical inference, could possibly be without solid foundation. The subject matter is not just vocational, although most engineers can put statistics to work quite rapidly and with stunning success. It is definitely and thoroughly educational.

Quite frankly, an engineer with statistics can tap the mother lode. That's why it is used so much.

# From Month To Month

**Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers**

## Columbia River Power

From time to time the *Journal* has given space to comment on the state of the discussion on Columbia river power, which has been going on before the International Joint Commission since 1944. Briefly, the situation is that a proposed development near Libby, Mont., would back the river up some 40 miles into Canada to a depth of about 150 feet at the border, flooding roads, railways, settlements, agricultural and forest lands and other improvements and making some future forest and mineral development impossible. Storage of water in Canada would not only increase the available head and flow at Libby, but would also increase the flow at all plants on the river below Libby.

These general facts are agreed upon by both Canada and the United States. Both are also agreed that Canada should receive just compensation for the damages which its citizens would suffer from the scheme and for the benefits which the Libby and other developments would receive from water storage in Canada. Both are agreed on compensation, but they are far from agreement on the equitable method of compensation. The United States wishes to assess both damages and benefits in terms of money; Canada wishes to receive its share of the power which storage and head from Canada will produce — and there the matter rests.

Canada appears to be quite right in its position, and it is to be hoped its views will prevail. Not only does this position seem right in equity, but there are two factors supporting that belief.

A powerful one is that twenty-five years ago the International Joint Commission heard a case involving the flooding of a small area in Maine by a dam built across the St. John river at Grand Falls, N.B. Here it was successfully argued by the United States that the party whose land was to be flooded might permit it or not at its discretion, and that if it did permit flooding, then it could make the flooding subject to any conditions it wished. Counsel for the United States argued that compensation could be ordered in any form desired by the United States, including the delivery of power.

Gen. A. G. L. McNaughton, M.E.I.C., chairman of the Canadian Section of the International Joint Commission, in speaking recently to the Canada-United States Committee of the Canadian Chamber of Commerce and the Chamber of Commerce of the United States, said:

> "Out of this first experience of the International Joint Commission (i.e., the Grand Falls Case) in the allocation of power in compensation for flooding, has emerged the principle that the upstream state is entitled to receive an allocation of on-site power proportional to the increase in level at the boundary, or at the point where 'boundary waters' commence, as the case may be, multiplied by the flow pertaining to it at that point, that is, the whole flow in the case of 'rivers flowing across the boundary' and half the flow in the case of waters flowing out of 'boundary waters' where the two states have 'equal and similar rights'."

It would seem that this principle, arrived at twenty-five years ago upon the insistence of the United States, applies just as much to the Columbia as it did — and does — to the St. John. We do not profess to know all the ins and outs of the law, but we do feel strongly that the attitude of the Canadian Section of the International Joint Commission is the right one and we hope they will stick to it. It has precedent and it is equitable. It is to be hoped that Canada does not suddenly withdraw its resistance to the United States claims, as they appear to have done recently in the St. Lawrence seaway project.

Second, it may be mentioned as a hopeful trend that claims between the states of the United States for compensation in connection with the development of the Columbia, which it was first proposed to settle by money payments, now look as though they might be adjusted by compensation in power. If this is a fair method as between states, why

## Cover Picture

The cover picture is a view of the main assembly bay at the Guelph Works of the Canadian General Electric Co. Ltd. The test area is in the background.

The bay, 804 feet long by 80 feet wide, is part of C.G.E.'s 8.5 acre plant recently opened to manufacture power transformers with a lower limit of 201 k.v.a. and 15 k.v., and an upper limit of 200,000 k.v.a. and 287 k.v. Total personnel when in full production will be about 1,000.

is it not equally fair as between nations?

The International Joint Commission has arrived at workable compromises in some sixty cases since it was set up and there is no reason to believe that it is going to fail in this one, but the Columbia case needs to be kept before the public. It should not be forgotten merely because it is not in the headlines every day. Members of the Institute and all other Canadian engineers can do much to see that it gets the publicity it deserves during the four or five years yet which are required for the completion of surveys, for study and for discussion.

## The Pendulum Swings

In the News of the Associations, from British Columbia, readers will find details of an event which will mean relief to a group of young engineers in that province, and to the profession generally it marks another important step toward freedom from unfair labour laws. Far too long we have had the unpleasant spectacle of a group of professional men being forced to belong to a union against the wishes of their majority. Some felt that the pendulum of fair play and justice had become stuck on the wrong side. However, the situation appears to be righting itself at last, and the *Journal* wishes to commend those of the B.C. Association, and the others, who are fighting with such determination to correct this fault. The final whistle in this struggle has not yet blown, but our team have made a nice gain and they are getting in position to score.

## Famous French Dam Builder Visits Canada

For a period of about three weeks in October the E.I.C., through seven of its branches, was host to one of France's most eminent engineers. Monsieur André Coyne, one of the world's foremost authorities on the design and construction of dams, made a speaking tour by air transportation to seven of the larger branches between Montreal and Vancouver. His subject at each meeting was the same — "Twenty-five Years Designing and Building Dams". Mr. Coyne's lecture was well illustrated both with slides and moving pictures, and reports reaching Headquarters indicate that it was received with interest and enthusiasm.

The visitor arrived first at Montreal on October 8, where he was met by a representative of Headquarters staff and final itinerary details were arranged. Mr. Coyne flew next to Saskatoon where he was booked to spend Thanksgiving week-end, although he did not speak in that city until later in the trip. The P.F.R.A. arranged for him, while there, to visit the site of the proposed South Saskatchewan River Dam, in which he showed keen interest.

The speaker then went on to open his lecture schedule in Edmonton on Tuesday October 12, and repeated it in Vancouver on the 14th. The West Coast city branch executive were able to include a trip to the Vancouver Capilano water system where Mr. Coyne saw the new Cleveland Dam. His itinerary then took him eastward again, and the lecture was delivered at Calgary, Regina, Saskatoon and Winnipeg from October 18 through the 21st. The final presentation was before the Montreal branch on Tuesday the 26th.

At every branch he visited, the reception given to Mr. Coyne's address was testimony to the high calibre of his work and ideas. This is certainly borne out by the many distinctions he enjoys, which include the past presidency of the International Commission on Large Dams, occupancy of chairs at Ecole Nationale des Ponts et Chaussées and the Ecole Supérieure d'Electricité, and honorary membership in the American Society of Civil Engineers, to mention only a few.

The Institute is indeed fortunate in having been able to arrange a lecture tour by such an eminent French colleague.

## New Officers for ASCE

William Roy Glidden, of Richmond, assistant chief engineer of the Virginia State department of highways, has been elected the 86th president of the American Society of Civil Engineers, succeeding Daniel V. Terrell, of Lexington, dean of engineering at the University of Kentucky.

A native of Boston, Mr. Glidden graduated from the Massachusetts Institute of Technology in 1912. For several years he was on the staff of the Massachusetts Highway Commission. Upon recommendation of the U.S. Bureau of Public Works, he was invited by the State of Virginia in 1916 to take charge of the bridge division of its highway department. He has been engaged since then in Virginia's many millions of dollars of highway and bridge construction.

Mr. Glidden has made important contributions to the evolution of highway bridge engineering during the past generation through his own practice and through membership on various technical committees. He is also well known as a lecturer on engineering subjects at colleges and universities and before professional societies throughout the United States.

The newly-elected vice-presidents of the Society are Frank L. Weaver, Washington, D.C., chief, division of river basins, Bureau of Power, Federal Power Commission, and Louis R. Howson of Chicago, partner in Alvord, Burdick & Howson.

The Society's new directors are Don M. Corbett, Washington, D.C., district engineer, U.S. Geological Survey; Lawrence A. Elsener, San Francisco; Jewell M. Garrelts, professor at Columbia University; Frederick H. Paulson, Providence, R.I.; George S. Richardson, Pittsburgh, and Graham P. Willoughby, Birmingham, Ala.

### Athlone Fellowships

The existence of Athlone Fellowships for Canadian engineering students completing a bachelor's or higher degree, and for engineers who have already spent some time in industry, is well known.

Prospective candidates can find a complete outline of provisions and regulations in *The Engineering Journal* for November 1953. The closing date for applications is January 15, each year.

# REGISTRATION IN ENGINEERING AT CANADIAN UNIVERSITIES

| University | Year | General Course | Aeronautical Engineering | Agricultural Engineering | Petroleum Engineering | Chemical Engineering | Civil Engineering | Electrical Engineering | Engineering and Business Administration | Electro-Mechanics | Forest Engineering | Geology and Mineralogy Engineering | Mechanical Engineering | Metallurgical Engineering | Mining Engineering | Engineering Physics | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Memorial | 1st | 57 | | | | | | | | | | | | | | | 57 |
| | 2nd | 25 | | | | | | | | | | | | | | | 25 |
| | 3rd | 17 | | | | | | | | | | | | | | | 17 |
| Total | | 99 | | | | | | | | | | | | | | | 99 |
| Dalhousie | 1st | 56 | | | | | | | | | | | | | | | 56 |
| | 2nd | 69 | | | | | | | | | | | | | | | 69 |
| | 3rd | 28 | | | | | | | | | | | | | | | 28 |
| Total | | 153 | | | | | | | | | | | | | | | 153 |
| St. Mary's | 1st | 46 | | | | | | | | | | | | | | | 46 |
| | 2nd | 33 | | | | | | | | | | | | | | | 33 |
| | 3rd | 21 | | | | | | | | | | | | | | | 21 |
| Total | | 100 | | | | | | | | | | | | | | | 100 |
| St. Francis Xavier | 1st | 78 | | | | | | | | | | | | | | | 78 |
| | 2nd | 104 | | | | | | | | | | | | | | | 104 |
| | 3rd | 78 | | | | | | | | | | | | | | | 78 |
| Total | | 260 | | | | | | | | | | | | | | | 260 |
| N.S. Tech. College | 4th | | | | | 6 | 38 | 30 | | | | | 40 | 3 | 5 | | 122 |
| | 5th | | | | | 7 | 16 | 18 | | | | | 24 | 3 | 2 | | 70 |
| Total | | | | | | 13 | 54 | 48 | | | | | 64 | 6 | 7 | | 192 |
| Acadia | 1st | 60 | | | | | | | | | | | | | | | 60 |
| | 2nd | 45 | | | | | | | | | | | | | | | 45 |
| | 3rd | 31 | | | | | | | | | | | | | | | 31 |
| Total | | 136 | | | | | | | | | | | | | | | 136 |
| Mount Allison | 1st | 63 | | | | | | | | | | | | | | | 63 |
| | 2nd | 72 | | | | | | | | | | | | | | | 72 |
| | 3rd | 34 | | | | | | | | | | | | | | | 34 |
| Total | | 169 | | | | | | | | | | | | | | | 169 |
| New Brunswick | 1st | | | | | 2 | 64 | 23 | | | | | 16 | | 2 | | 107 |
| | 2nd | | | | | 4 | 62 | 23 | | | | | 26 | | 3 | | 118 |
| | 3rd | | | | | 4 | 36 | 22 | | | | | 12 | | 1 | | 75 |
| | 4th | | | | | | 21 | 7 | | | | | 14 | | | | 42 |
| | 5th | | | | | | 26 | 12 | | | | | 15 | | | | 53 |
| Total | | | | | | 10 | 209 | 87 | | | | | 83 | | 6 | | 395 |
| Laval | 1st | 150 | | | | | | | | | | | | | | | 150 |
| | 2nd | 160 | | | | | | | | | | | | | | | 160 |
| | 3rd | | | | | 12 | 42 | 21 | | | | 4 | 12 | 10 | 7 | | 108 |
| | 4th | | | | | 8 | 31 | 15 | | | | 2 | 9 | 7 | 5 | | 77 |
| | 5th | | | | | 5 | 33 | 11 | | | | 3 | | 1 | 2 | | 55 |
| Total | | 310 | | | | 25 | 106 | 47 | | | | 9 | 21 | 18 | 14 | | 550 |
| Ecole Polytechnique | 1st | 176 | | | | | | | | | | | | | | | 176 |
| | 2nd | 173 | | | | | | | | | | | | | | | 173 |
| | 3rd | 130 | | | | | | | | | | | | | | | 130 |
| | 4th | | | | | | 43 | | | 40 | | 7 | | 16 | | | 106 |
| | 5th | | | | | | 51 | | | 42 | | 12 | | 4 | | | 109 |
| Total | | 479 | | | | | 94 | | | 82 | | 19 | | 20 | | | 694 |
| McGill | 1st | 234 | | | | | | | | | | | | | | | 234 |
| | 2nd | 302 | | | | | | | | | | | | | | | 302 |
| | 3rd | | | | | 36 | 48 | 58 | | | | | 65 | 8 | 17 | 25 | 257 |
| | 4th | | | | | 32 | 62 | 62 | | | | | 84 | 16 | 5 | 9 | 270 |
| | 5th | | | | | 27 | 49 | 33 | | | | | 71 | 6 | 6 | 11 | 203 |
| Total | | 536 | | | | 95 | 159 | 153 | | | | | 220 | 30 | 28 | 45 | 1266 |
| Ottawa | 1st | 14 | | | | 13 | 7 | 6 | | | | | 7 | | 1 | | 48 |
| | 2nd | 10 | | | | 5 | 10 | 12 | | | | | 8 | | 1 | | 46 |
| | 3rd | | | | | 5 | 9 | 13 | | | | 1 | 4 | | 1 | | 33 |
| | 4th | | | | | 4 | | | | | | | | | | | 4 |
| Total | | 24 | | | | 27 | 26 | 31 | | | | 1 | 19 | | 3 | | 131 |
| Carleton College | 1st | 43 | | | | | | | | | | | | | | | 43 |
| | 2nd | 35 | | | | | | | | | | | | | | | 35 |
| Total | | 78 | | | | | | | | | | | | | | | 78 |
| Queen's | 1st | 291 | | | | | | | | | | | | | | | 291 |
| | 2nd | 239 | | | | | | | | | | | | | | | 239 |
| | 3rd | | | | | 42 | 54 | 37 | | | | 13 | 41 | 8 | 6 | 9 | 210 |
| | 4th | | | | | 33 | 25 | 36 | | | | 6 | 30 | 6 | 7 | 7 | 150 |
| Total | | 530 | | | | 75 | 79 | 73 | | | | 19 | 71 | 14 | 13 | 16 | 890 |

| University | Year | General Course | Aeronautical Engineering | Agricultural Engineering | Petroleum Engineering | Chemical Engineering | Civil Engineering | Electrical Engineering | Engineering and Business Administration | Electro-Mechanics | Forest Engineering | Geology and Mineralogy Engineering | Mechanical Engineering | Metallurgical Engineering | Mining Engineering | Engineering Physics | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Toronto | 1st | | 37 | | | 112 | 120 | 77 | 77 | | | 27 | 118 | 9 | 29 | 50 | 656 |
| | 2nd | | 14 | | | 82 | 66 | 70 | 50 | | | 20 | 86 | 14 | 7 | 35 | 444 |
| | 3rd | | 13 | | | 72 | 66 | 61 | 34 | | | 10 | 79 | 8 | 9 | 33 | 385 |
| | 4th | | 11 | | | 59 | 74 | 50 | 41 | | | 8 | 49 | 7 | 8 | 27 | 334 |
| Total | | | 75 | | | 325 | 326 | 258 | 202 | | | 65 | 332 | 38 | 53 | 145 | 1819 |
| Western Ontario | 1st | 20 | | | | | | | | | | | | | | | 20 |
| | 2nd | | | | | | | | | | | | | | | | |
| Total | | 20 | | | | | | | | | | | | | | | 20 |
| Manitoba | 1st | 238 | | | | | | | | | | | | | | | 238 |
| | 2nd | 158 | | | | | | | | | | 2 | | | | 3 | 163 |
| | 3rd | | | | | | 30 | 25 | | | | 10 | 42 | | | 3 | 110 |
| | 4th | | | | | | 29 | 26 | | | | 2 | 42 | | | 3 | 102 |
| Total | | 396 | | | | | 59 | 51 | | | | 14 | 84 | | | 9 | 613 |
| Saskatchewan | 1st | 283 | | | | | | | | | | | | | | | 283 |
| | 2nd | 140 | | | | 17 | | | | | | | | | | 17 | 174 |
| | 3rd | | | 6 | | 13 | 34 | 17 | | | | 19 | 34 | | | 14 | 137 |
| | 4th | | | 1 | | 12 | 26 | 12 | | | | 13 | 26 | | | 4 | 94 |
| Total | | 423 | | 7 | | 42 | 60 | 29 | | | | 32 | 60 | | | 35 | 688 |
| Alberta | 1st | 323 | | | | | | | | | | | | | | | 323 |
| | 2nd | | | | 11 | 45 | 75 | 37 | | | | | 1 | | 11 | | 180 |
| | 3rd | | | | 22 | 37 | 55 | 29 | | | | 1 | | | 11 | 1 | 156 |
| | 4th | | | | 17 | 11 | 37 | 17 | | | | | | | 5 | 2 | 89 |
| Total | | 323 | | | 50 | 93 | 167 | 83 | | | | 1 | 1 | | 27 | 3 | 748 |
| British Columbia | 1st | 304 | | | | | | | | | 8 | | | | | | 312 |
| | 2nd | 189 | | | | | | | | | 1 | | | | | | 190 |
| | 3rd | | | 1 | | 15 | 20 | 40 | | | 2 | 9 | 50 | 7 | 6 | 11 | 161 |
| | 4th | | | | | 13 | 25 | 25 | | | 6 | 3 | 32 | 6 | 10 | 9 | 129 |
| Total | | 493 | | 1 | | 28 | 45 | 65 | | | 17 | 12 | 82 | 13 | 16 | 20 | 792 |
| **Canadian Services Colleges** Royal Roads | 1st | 75 | | | | | | | | | | | | | | | 75 |
| | 2nd | 40 | | | | | | | | | | | | | | | 40 |
| Total | | 115 | | | | | | | | | | | | | | | 115 |
| Royal Military College (Kingston) | 1st | 75 | | | | | | | | | | | | | | | 75 |
| | 2nd | 62 | | | | | | | | | | | | | | | 62 |
| | 3rd | | | | | 12 | 45 | 14 | | | | | 13 | | | | 84 |
| | 4th | | | | | 12 | 20 | 12 | | | | | 24 | | | | 68 |
| Total | | 137 | | | | 24 | 65 | 26 | | | | | 37 | | | | 289 |
| Collège Militaire Royal de St-Jean | 1st | 70 | | | | | | | | | | | | | | | 70 |
| | 2nd | 25 | | | | | | | | | | | | | | | 25 |
| Total | | 95 | | | | | | | | | | | | | | | 95 |
| Grand Total | | 4876 | 75 | 8 | 50 | 757 | 1449 | 951 | 202 | 82 | 17 | 172 | 1074 | 139 | 167 | 273 | 10292 |
| Prospective 1955 Graduates | | | 11 | 1 | 17 | 171 | 391 | 240 | 41 | 42 | 6 | 47 | 289 | 33 | 40 | 63 | 1392 |

The upturn in registration of engineering students at Canadian universities which started in the fall of 1952 is still continuing.

Total registration for the 1954-55 term as compiled by The Engineering Institute shows 10,292 as against 9,047 a year ago, an increase of approximately 1,250.

Two institutions have registered students in first year engineering for the first time this fall. These are the Collège Militaire Royal de Saint-Jean at St. Johns, Que., and The University of Western Ontario at London, Ont. where engineering has now been added to the other courses given previously. Including the registration of these two newcomers in the field of engineering education the total of first year students is 3,441. This represents an increase of almost exactly 10 per cent over that in the fall of 1953. Of the twenty institutions which reported first year students last year, fourteen show an increase this year, five show a decrease and one reported the same number.

As was anticipated, the graduating class for next spring is larger than the 1954 class was by just over 10 per cent. Furthermore the number who should graduate in 1956 is likely to exceed the number of 1955 graduates by approximately 20 per cent. This will represent an increase over the small class of last spring approximating 50 per cent.

Registration in the different courses has departed only slightly from the pattern already established. Most of the courses are larger in proportion to the amount of the overall registration. Only one course —forest engineering—contains fewer students. On the other hand the increases in aeronautical and mining engineering are somewhat greater relatively than the overall average increase.

# C.A.I.-I.A.S. International Meeting

About 400 aviation people registered in Montreal on October 14-15 for an international professional conference of special significance. This meeting marked the first advance of the Canadian Aeronautical Institute in the field of international exchange of technical knowledge, as well as a new avenue of professional co-operation for the Institute of the Aeronautical Sciences. Dr. J. J. Green, M.E.I.C., of Ottawa referred to it as a milestone in Canadian aviation.

Dr. Green is the president of the C.A.I., a Canadian organization founded earlier this year with the object of advancing the art, science and engineering relating to aeronautics. At the invitation of the I.A.S. the joint meeting was arranged, with a program which was in effect a thorough survey of the art and science of aeronautics on this continent as of today—and a look at the future. The program is printed here as a matter of interest:

**The Role of Fluid Mechanics in Aeronautical Development**
Dr. G. N. Patterson, Director, Institute of Aerophysics and Head, Department of Aeronautical Engineering, University of Toronto.

**Flying Techniques on Research Airplanes**
A. Scott Crossfield, Aero Research Scientist, NACA High-Speed Flight Station, Edwards Air Force Base.

**The Nature and Stiffness of Swept Wing Deformations with Reference to the Prediction of Normal Modes and Frequencies**
Albert H. Hall, Associate Research Officer, National Aeronautical Establishment of Canada.

**The Orenda and the Future; Mechanical Design Considerations of Canada's First Production Turbo Jet**
B. A. Avery, Assistant Chief Design Engineer, Gas Turbine Division, A. V. Roe Canada Limited.

**Bases Unlimited**
Ernest G. Stout, Chief of Naval Aircraft Research, Convair Division of General Dynamics Corporation.

**Production of an All-Weather Long-Range Jet Fighter**
R. K. Anderson, Assistant Industrial Engineering Manager, Aircraft Division, A. V. Roe Canada Limited.

**Air Traffic Control for Turbine Transports**
Charles W. Carmody, Civil Aeronautics Administration.

**R.C.A.F. Training Operations**
W/C C. H. Mussels, C.O., R.C.A.F. Central Flying School, Trenton.

**Design Aspects of the Boeing Model 707**
Kenneth C. Gordon, Boeing Airplane Company.

The response was enthusiastic. This was evident early in the proceedings—when a good attendance could be reported by I.A.S. secretary H. C. Luttman, as the first session began on Thursday, October 14. As the registration continued, Montreal, Ottawa and Toronto provided the greatest part of the group, though there were representatives from all over Canada, and more than 100 from the United States.

Members from the technical staffs of the manufacturing firms, and from the government departments, the airlines and the Services made up an audience with real interest in what the speakers had to report. For the layman, too, there was information of value in many of these stories of development, for example, the evolution of the Avro Orenda 9 and 10 turbo-jet engines; the system of design and production that saves two years' time in the delivery of production models; the story of Boeing's first venture into jet transport; the plans for air traffic control of jet transportation.

Canadair Limited provided for the group a tour of inspection of the manufacturing facilities for the Sabre (F-86) and Silver Star (T-33) aircraft.

Dinner on Thursday evening, brought together more than five hundred members, guests and friends of the two sponsoring societies, with Dr. Green presiding, and with Rear-Admiral L. B. Richardson representing I.A.S. Here again, in the social part of the conference, there was an impression of a rapidly advancing aviation industry lending support to the successful initial efforts of its professional society.

Dr. Green and Admiral Richardson each expressed hope in the effectiveness of this new link between Canada and the United States. The further close contact of the two societies with the Royal Aeronautical Society, Admiral Richardson said, would tend to benefit the aeronautical profession and contribute to the peace of the world.

Dr. Green announced the award of honorary fellowship to George H. Dowty in recognition of his contribution to aeronautical science. Through the Royal Aeronautical Society of which he is a past president, Mr. Dowty had given encouragement and help in the formative stages of the Canadian institute.

Dr. Hugh L. Dryden, director of the U.S. National Advisory Committee for Aeronautics, was the principal speaker for the dinner meeting. He mentioned the inaugural

**Some of the head table guests at the Montreal C.A.I.-I.A.S. meeting. Left to right, Dr. E. P. Warner, I.C.A.O.; Dr. O. M. Solandt, Defence Research Board; Dr. Hugh L. Dryden, the speaker; Dr. J. J. Green, president of C.A.I.; Rear-Admiral L. B. Richardson, Canadair Limited; John Baldwin, Department of Transport.**

technical meeting of the Institute of Aeronautical Sciences in 1933, at which one of the topics was "The Application of Science to Design".

Then, Dr. Dryden said, it was advocated that designers keep abreast of advances in aerodynamic theory and study their possible practical applications. A few months earlier the United States had achieved the land plane speed record of 296.287 miles per hour. The projects occupying design engineers today differ to the extent that we can now talk about a research plane that has attained a speed of about 1,650 miles per hour.

While this improvement in performance has been accomplished during 20 years by scientific method, Dr. Dryden expressed the opinion that there remains an art as well as a science of aeronautics, and he went on to discuss the interplay of scientific research and the art of design in aeronautical progress.

"Research advances knowledge by isolation of limited aspects of development problems which are analyzed by specialists in specific fields", said Dr. Dryden. "The designer of an aeroplane or missile must solve all of the many problems in a single integrated prototype. Design is still an art practiced by individuals or groups of individuals in a design team. They must have general knowledge of many fields and the ability to synthesize information from many sources."

The collaboration of scientist, designer and user which has multiplied speed more than 5 times in 22 years, will solve new problems already being encountered, Dr. Dryden predicted. Supported by a vigorous scientific activity in aeronautical research, the art of design will flourish, and visions hitherto unrealizable, will become practical engineering projects.

T. R. Loudon, M.E.I.C., the well-known professor of civil and aeronautical engineering at University of Toronto until his retirement this year, spoke briefly in appreciation of Dr. Dryden's contribution to the program.

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# IATA Meets in Paris

The tenth annual general meeting of the International Air Transport Association, head office for which is in Montreal, was held September 13 to 16, inclusive, at the Maison de la Rochefoucauld, Paris, France, its first general meeting to be held in that city.

Some 250 delegates from 40 countries, representing 47 member and associated airlines which carry 86 per cent of the free world's scheduled air traffic, as well as observers from other international organizations and aviation and transport groups, were welcomed by spokesmen from the French government. Max Hymans, president of Air-France, presided as the first president of the organization from the French Republic. Juan Trippe, president of Pan American World Airways was elected IATA president for the ensuing year.

Sir William Hildred, director general of the association, in surveying the global operations of member companies at the opening session, told delegates that the margin between Airline costs and revenues "has steadily narrowed down until it is in many cases non-existent. One can foresee no miracles, technical or otherwise, in the near future which can be expected to change this balance."

### Economic Situation of the Industry

Airlines, he said, are now collectively paying almost 13 cents out of every dollar collected to governments in taxes and charges, and are left with only one cent to pay interest on their indebtedness, to satisfy shareholders and to keep as reserves. Present and proposed new passenger taxes and landing fees are "a problem for the trunk carriers and a disaster for the short-haul airlines, particularly in Europe".

He urged "scrutiny of our own operations to make certain we are not wasting a penny on a single unnecessary procedure or paper". Increased productivity through technical efficiency alone, he said, was no longer sufficient in itself to offset other cost increases.

### Airline Performance

Continuing, Sir William reported that an increase in productivity of IATA airlines in terms of seat-kilometres during 1953 of 22 per cent had been achieved, with only a five per cent net increase of airline fleets. This had been due to modernization, conversion of many aircraft to tourist seating, and to increased efficiency generally. Traffic itself had increased in all categories over the 1952 records, but while passenger traffic increased 16 per cent, cargo traffic only rose four per cent. The seven per cent increase in airmail carried had been small, considering the reduction in the rate paid to airlines.

Airlines still derive 70 per cent of revenue from passengers, and would continue to rely on them for their main income. But fares had been cut to a point where the margin was extremely small. "Our remaining hope for expansion, then", he predicted, "lies primarily in the cargo field. The cargo rate structure needs careful examination. If risk is involved, we can take comfort from the fact that we have taken equal risks in the passenger field and they have paid off."

### Tourist Service

Growth in extent and popularity of tourist service had been gratifying. Almost two thirds of North Atlantic traffic now flew tourist, and before long the bulk of world passenger traffic would be tourist, he stated. Nevertheless, conversion to tourist class had in some cases been too swift and sweeping, resulting in first class passengers being refused while tourist seats had gone unfilled. Aircraft, he warned, should be kept as fully adaptable as possible until the differences between first and tourist are fully crystallized.

### Helicopter Development

"Helicopter operations have been spreading rapidly", reported Sir William, "The helicopter is ideally suited to certain types of scheduled operations, especially in Europe and in other regions of high population densities, but limitations placed on single engine helicopters keep them from being ideal vehicles for scheduled traffic at the moment."

### Technical Committee Report

Paul W. Goldsborough of TWA, reporting as chairman for the IATA Technical Committee, told delegates that the airlines' chances of having governments provide adequate air navigation services and facilities would be improved, only if they keep the requirements for the number of ground systems to a bare minimum consistent with safety and efficiency. Airlines stand to gain both technically and economically, he said, by purchasing modern airborne equipment as soon as possible.

The present high frequency radio telephony system in Europe was not adequate to fulfil the present need, though it was coming into ever more widespread use, the report said, but more extensive examination of the whole regional system was needed.

More effective co-ordination of civil and military aircraft operation was another pressing need in Europe, stated the committee report. It continued, however, "There are now first indications, at long last, that the importance of this problem has been recognized by military authorities." Another repeated problem was lack of agreement on uniformity of altimeter setting procedures. A uniform system was almost achieved by ICAO last year, but inability of some states to accept an ICAO system leaves the choice to the discretion of individual countries.

Airline search for the ideal turbine fuel for jet and turboprop craft is proceeding well, the Committee reported, defining the ideal fuel as one "which would have lowest cost consistent with other requirements; be no less safe than kerosene; be generally available at world airports; preferably marketed already for other users; ensure reliable and economic engine operation; and have as high a heat content per gallon as practicable".

"Up to now high grade and costly fuels had to be developed for high performance aircraft and engines", the committee reported. "Looking to the future, we (hope) to present to manufacturers a specification for a cheap turbine fuel so (they) will design the engines and aircraft for the fuel we want."

Development of an economically satisfactory helicopter for regular transport is outpacing provisions of adequate facilities and regulations for its operation, the committee warned. Present helicopters are limited by high operating costs in relation to payload, and a commercially attractive helicopter suitable for public transportation is still in the development stage. However, airlines have developed specifications of what they require. To keep pace, IATA is working on such questions as flight rules, different requirements between conventional aircraft and helicopters as regards air traffic control, communications, meteorology, navigation, licensing and integration of operations.

With regard to training and licensing, discussions of pilot training indicated a need for greater concentration on the problems of the men who fly the airline's planes, the Committee said. "Airlines themselves can do useful service in attempting to curb government regulations: flexibility in training is essential to ensure safety of operation. Excess regulations can impede this flexibility, and hence impede safety."

The committee declared that airlines over the next five to ten years would have to spend money on a new type of instrument to replace the present conventional altimeters, which are becoming obsolete as aircraft begin to operate in more and more rarified atmosphere. Levels would have to be based on constant pressure intervals, instead of the number of linear units above the ground, it pointed out.

Special importance was also attached to the establishment of future operational requirements for long distance navigational aids. A further imperative objective must be to lower the operating limits within which flights are capable of landing and taking off under adverse weather conditions. Whether improvements could be achieved by the development of automatic landings would have to be revealed by further research. An international review of national legislation affecting air transport operations from the point of view of economic sufficiency as well as of safety, was also becoming necessary, the committee reported.

# Thirty-five Years Ago

**Comment on the *JOURNAL* of December 1919**

The first thing that struck this writer when he leafed through the December, 1919, *Journal*, preparatory to getting out these notes, was the obvious shake-up in its advertising pages. Not only was there a general improvement in typography, including more use of illustrations, but many firms appear for the first time, firms some of which are still with us as advertisers. Somebody had very evidently been stirring the advertising pot with good results.

### Peterborough Branch

Council meetings for October 28 and November 25, 1919, were reported, both with fairly heavy agenda. The formation of the Peterborough Branch was approved; elsewhere in this *Journal* there was a short account of its installation, which attracted quite a concourse of engineers from the area. The Toronto Branch salary schedule, of which we have previously written in these notes, came up for discussion, but, because of its importance, consideration of it was postponed.

The Society of Chemical Industry was granted permission to meet in the Institute's hall in Montreal twice a month. The design of the Plummer Medal was approved. A suggestion from H. M. Morrow for the reclassification of the Institute's membership was held over for discussion. It took many years to get any such scheme into effect. It would be interesting to know why the Institute's bank accounts were ordered transferred to the Canadian Bank of Commerce, but no hint is given, just the bare fact.

In the long list of admissions and transfers the name of J. N. Aggiman appears; he was then chief engineer of the Ha Ha Sulphite Co., Ltd. Aggiman was a Turk who had been educated in Canada and who subsequently went back to his own land, where he built up a most successful contracting business. He was an ardent supporter of the new order in Turkey and did much of the work incident to setting up Ankara as the new capital of the country. He also served as consultant to the government on numerous projects. Aggiman was—and perhaps still is—the kind of man who enhances Canada's reputation abroad.

An editorial apology notes that the author of "Can the Standard Measure of Value be Improved?", of which we had something to say here last month, was John G. Sullivan, of Winnipeg, and a similar apology was extended to another author whose name had been omitted in the November, 1919, *Journal*. The tradition of editorial errors extends back a long way.

### Research in Canada

In the course of some remarks on research in Canada, the editor said:

> "The word 'research' is much like 'calculus' to the engineering student. Just when the engineer-to-be is becoming thoroughly convinced that calculus is an invention of the evil one . . . he discovers that it is not merely an instrument of torture in the hands of a professor, but an extremely practical help in the solving of such matter-of-fact

problems as the design of steam turbines."

The *Journal* is, of course, all for the proposal that the Federal Government should set up a research bureau and thinks that the Institute could "do a great deal in . . . promoting the furtherance of research in the Dominion." This proposal was the genesis of the National Research Council which has developed to the point where there is hardly anything in which it is not interested.

Reclassification of the Civil Service was still in the news. The bill had become law, to take effect effect on April 1, 1920. The general features of the act were set forth in another editorial by C. V. Putnam. He concluded that the new arrangements would "give Canada, if not the best, at least one of the best and most workable civil service acts in any country."

**Technical Discussions**

S. B. Wass discussed "The Economy of Treating Railway Ties." Tie treatment in the United States began in 1880 in a small way; by 1914 about 44 million ties were being treated annually, while in Canada the figure was 3,915,000 for 1915. According to Mr. Wass, a treated tie cost about 19c a year, against 22c for an untreated one. The saving amounted to about $68 per mile of track per year.

Slightly out of the engineering groove was "Duty-of-Water Investigations in Alberta," by F. H. Peters. "Duty of water" means the quantity of water required to irrigate one acre of land for the irrigation season and naturally varies with the crop grown. The Alberta experiments showed that wheat needed the most water and sugar beets the least. The chief value of this paper lay in the graph summarizing the results, which is presumably as good today as when it was drawn.

A paper by P. A. N. Seurot, "Coal Briquetting and Conservation," may have been of great interest in 1919, but would not be today. The arguments for making a marketable product out of slack and dust may yet be strong, but changes in our fuel situation have made the financial aspects of the process less attractive than formerly. Mr. Seurot's paper showed evidence of careful preparation and was certainly one of the best to appear during 1919.

**Report of Boundary Commission**

J. J. McArthur published a summary of the "Report of the International Alaska-Yukon Boundary Commission," which had just been submitted to Parliament by the Commissioners appointed in 1906.

In 1825 the 141st Meridian was set as the boundary between Russian and British possessions in the northwest, and this boundary remained in effect, of course, after the sale of Alaska to the United States. No effort was made to locate it until 1887, when Ogilvie located the point where it crossed the Yukon river. He used a spruce stump for his instrument stand and worked in temperatures down to 30° below zero. During the gold rush, Ogilvie's line was extended to prevent international complications.

The 1906 Commissioners, O. H. Tittman for the United States and Dr. W. F. King for Canada, found the meridian 17.62 feet west of Ogilvie's line. 1913 saw the end of the field work and the rest of the time up to the submission of the report was occupied in preparing maps and the like. These included a triangulation map along the boundary and a topographic map at 1:62,500 with 100-foot contours covering a strip two to two and half miles wide.

Mr. McArthur paid especial tribute to the complete co-operation between the forces of the two countries. They functioned as a single unit and nobody ever stopped to think whether he were American or Canadian. Engineers seem generally to get along with less friction in international relations than some other people.

**The Branches**

The Halifax Branch was shooting for an attendance of 200 at its forthcoming professional meeting to beat Saint John's record of 125 in 1919. The Saint John Branch had recently listened to papers on the Cape Bald breakwater and on New Brunswick highways. The Montreal Branch was debating the formation of a Quebec Provincial Division. The Ontario Division was getting ready to present a bill, based on the Institute's model, to the provincial legislature, to regulate the practice of engineering. The Toronto Branch had had a "social evening", with magic, music and recitations, mostly by its own members. The Niagara Peninsula Branch was trying to persuade Premier Drury to appoint an engineer as provincial minister of public works. The Ottawa, Edmonton, Vancouver and Victoria Branches were granted only a paragraph or two each, as they had little to report.

A letter from a member in England asked for drawings of frame buildings as "There is a big movement now taking place to adopt Canadian style of housing." He also wanted data on hot air heating, as "People cannot realize here how simple and inexpensive such installations are in Canada."

Even if the *Journal* has never published special holiday numbers, members in 1919 got a Christmas present of a better than usual issue.

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# The St. Lawrence Had a Lover

**by G. R. Stevens**

The article which follows, concerning the St. Lawrence River and Thomas Keefer's life-long association with it, first appeared in the *Montreal Star* of April 6 of this year. The *Journal* feels that in addition to its general interest, Mr. Stevens' article can well be reproduced at this time in view of the start recently made on the consummation of his great dream—a steamer passage from the lakes to the sea. The article, however, fails to mention another striking fact concerning Mr. Keefer's life. In addition to being the first president of the Institute in 1887, in the following year he achieved the same office in the American Society of Civil Engineers—a feat which has never been duplicated to this day.—Ed.

Every year, when the ice goes out, the master of the first ship to reach Montreal gets a gold-headed cane and his picture in the newspapers; but nothing ever is done about the river. The pleasant Indian and Italian custom of casting garlands upon streams in springtime spate is not observed upon this continent, where Ol' Man River is expected to keep rolling along. Nevertheless the St. Lawrence has had its devotees. For nearly three-quarters of a century it had one constant lover, a diverse and talented man of many parts—engineer, poet, evangel and social philosopher. Today he would be classified as Public Relations. He regarded himself as a dreamer of dreams.

His name was Thomas Coltrin Keefer, born of loyalist stock at the village of Thorold in the Niagara peninsula in 1821. Throughout his life he insisted upon the mystic and indissoluble union of Canada with its parents, Great Britain and France. At eighteen he was an engineer upon the Erie Canal; he soon returned to Canadian waterways, to become their protagonist and special pleader for the remainder of his long life. In 1845 he was

Chief Engineer of the Ottawa River Works, in charge of the log chutes and skidways which expedited the passage of timber to ports of lading.

Eight years later he was Chief Harbor Commissioner of Montreal. But he never was chair-borne for very long at a time. Throughout the sixties and the seventies he planned and supervised scores of waterway projects, mostly for the improvement of traffic conditions upon the Canadian rivers. He became the Grand Old Man of Canadian engineering and honors were heaped upon him, not only by Canada but also by Great Britain and the United States. He died in 1915.

### Writing Was His Joy

The prolific period of his life lay between 1848 and 1863. In the former year he lost his job through a change of government. Whereupon he took up the pen; in a series of books and in scores of pamphlets, articles and addresses he hymned his devotion to the bounty of nature as revealed in Canadian lakes, streams and rivers. As one writer put it, "Keefer believed that the good God (with due regard for the theories of Jeremy Bentham) had located the St. Lawrence in such a way as to promote the greatest happiness for the greatest number." He saw that river as the tie which had bound New France together; which had given Quebec the cohesiveness and stability which it retains until this day. It was both a material and a spiritual highway. It had made Canadians out of Frenchmen.

That cohesiveness and stability, according to Keefer, was only the first of the great gifts of the St. Lawrence. The river was a broad passage into the heart of a virgin continent whose commerce sooner or later must take to the seas. There were two great water-roads to the oceans—the Mississippi and the St. Lawrence. Keefer was certain that the St. Lawrence could command the traffic of the West; as proof he drew what was perhaps the first strategic map; he tilted North America to show that the St. Lawrence flowed towards Europe while the Mississippi flowed away from that continent. The Erie Canal, which had made New York the metropolis of the Atlantic seaboard, disturbed him no whit. The three factors which bestowed or withheld greatness from a transportation system were time, expense and convenience. On each count Keefer believed that the St. Lawrence could win.

As an engineer he was not blind to the imperfections of his beloved river. It was frozen for five months of the year; therefore there must be railways and ocean ports to supplement it. But although in one of his books ("The Philosophy of Railroads" which is perhaps the first essay in distinctively Canadian economics) he argues strongly for the social and material benefits of land lines, he always maintained that railways should be auxiliary to water transport, which is handier and cheaper. Insofar as natural obstacles were concerned on the St. Lawrence system—falls, rapids, and portages—he had one sovereign remedy—to cut more and more canals, until there was uninterrupted navigation for a thousand miles to the west, so that the ships of all nations could pick up cargoes at every cove on the Great Lakes. If New York could cut in on Great Lakes traffic by means of the Erie Canal, Montreal, declared Keefer again and again, could help herself to Hudson and Lake Champlain traffic by means of a canal no more than fourteen miles in length between the St. Lawrence and the Richelieu. He fought vehemently for this particular waterway. To his great sorrow it never came to pass.

### The Prophet

It was H. G. Wells who coined the phrase "Transportation is Civilization." Keefer had expounded the same idea explicitly forty years before the Fabian Essays appeared. He drew a vivid picture of what communications meant to pioneers:

"A town arises. Land increases rapidly in value. The neglected swamp is cleared and the timber is converted into all sorts of wooden notions. Tons of vegetables, grains and grasses grow where none grew before. The tick of the loom, the rush of the shuttle, the thundering of steam hammers mingle in a continuous sound of active industry." But it did not stop there. Keefer saw the St. Lawrence as another Ganges, not only enrichening the land but purifying its inhabitants. He declared that commercial intercourse as engendered by better communications, would raise the tone of Canadian life, which he plainly regarded as low. He speaks of "agricultural rustics" beholden to the local storekeepers in such matters as "mortgages, long credits, tea and tobacco" and dependent for their political opinions upon "nisi prius wranglers." How the St. Lawrence was going to clean up this situation remains a little obscure. It was asking a lot of the river. But it was the measure of Keefer's faith that he demanded so much.

When the St. Lawrence Seaway finally goes through his name should be preserved upon one or another of its works, for it was he who first dreamed the dream of its consummation.

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## Addresses Wanted

The records office at E.I.C. Headquarters requests information about the present addresses of the following members with whom it has lost contact. The last known location of each is listed, and any current information will assist in making membership records complete. The list will be concluded in the January issue.

### Members

Ansley, F. C., Riverside, Ont.
Bickerdike, Robert, Westmount, P. Que.
Boudreau, M. G., Montreal, P.Que.
Buckley, R. R., Ottawa, Ont.
Busso, E. G. M., Ste-Adele, P.Que.
Cantwell, H. H., Ville St-Laurent, P.Que.
Carey, C. J., Halifax, N.S.
Christopherson, J., Edmonton, Alta.
Dawson, F/L. H. W. A., Edmonton.
Edwards, J. B., Nitro, P.Que.
Groundwater, James Ross, New York.
Hobson, Paul D., Ottawa, Ont.
Hofer, M. H., Dorval, P.Que.
Ingraham, H. A., Toronto, Ont.
Klein, F., Montreal, P.Que.
Langevin, Jacques, Montreal. P.Que.
Light, R. H., Cobalt, Ont.
Lupton, M. J., Fort Garry, Man.
Madeyski, A., Toronto, Ont.
Manson, C. A., Vancouver, B.C.
McLaughlin, Maj. I. M., Pointe aux Trembles, P.Que.
McManus, Edward Francis, Reading Pa.
Mitescu, Stefan, Montreal, P.Que.
Myra, Allen, Edmonton, Alta.
Ord, Lewis R., St. Lambert, P.Que.
Ortloff, E. D., Regina, Sask.
Peck, R. C., Newport, England.
Phillips, H., Saint John, N.B.
Riley, Francis X., Terrebonne, P.Que.
Roberts, S. O., Medicine Hat, Alta.
Ross, Carl W., Ottawa, Ont.
Sharp, J. Andrew, Kingston, Ont.
Sherwood, H. M., Brownsburg, P.Que.
Sigurdson, B., Jasper, Alta.
Spector, Philip D., Boston, Mass.
Tribe, N. G., Edmonton, Alta.
Weinstein, S. A., Regina, Sask.
Zorzi, J., Montreal, P.Que.

### Juniors

Ackerman, R. A., Hamilton, Ont
Allen, W. D., Edmonton, Alta.

Armstrong, Andrew D., Madawaska. Me., U.S.A.
Baldwin, Norman Ross, Vancouver, B.C.
Barnes, D. J., Montreal, P.Que.
Beach, Richard Kenneth, Faringdon, Berks, England.
Beaton, Robt. Harwood, Edmonton, Alta.
Beauchamp, M. R., Montreal, P.Que
Beaulieu, Herve P., Ottawa, Ont.
Bell, T. R., Hamilton, Ont.
Best, Donald G., Montreal, P.Que.
Biddle, G. A., Riverside, Ont.
Blair, John W., Oakville, Ont.
Blanc, G. Jean-Pierre, Montreal.
Bosomworth, J. H., Toronto, Ont.
Boyd, Gerald, Montreal, P.Que.
Boylan, G. B., Dauphin, Man.
Brisson, Jacques, Sherbrooke, P.Que.
Brown, Colin James, Montreal, P.Que.
Buckingham, Dalton R., Montreal.
Burgoyne, David Graham, Kingston.
Burke, U. P., Windsor, Ont.
Butterworth, J. F., Montreal, P.Que.
Byers, Albert Douglas, Montreal.
Cadieux, Leonard, Montreal, P.Que.
Campbell, L. R., Seattle, Wash.
Caron, Jean-Yves, Quebec, P.Que.
Colwell, C. R., Ottawa, Ont.
Cornell, R. W., Rosemount, P.Que.
Corrall, R. E., Windsor, Ont.
Cuddy, L. M., Quebec, P.Que.
Dube, P., Montreal, P.Que.
Dubuc, Jacques, East Pakistan.
Duncan, Donald R., Maryland, U.S.A.
Duthie, N. H., Montreal, P.Que.
Eddy, R. W., Cadillac, P.Que.
Edwards, Robert Nay, Hampstead, Que.
Elliott, J. Edward, Highland Park, Mich.
Everts, James A., Ottawa, Ont.
Fallow, W. L. J., Little Rock, Arkansas.
Forsberg, Gerald, Toronto, Ont.
Frank, R. F., Montreal, P.Que.
Fuller, P. E., Montreal, P.Que.
Fulton, Kenneth R., Saint John, N.B.
Gale, R. M., Toronto, Ont.
Gascon, Gerard, Montreal, P.Que.
Godson, Richard W., Ville St-Laurent, P.Que.
Gravel, J.C., Lachine, P.Que.
Griffin, V. O., Kitchener, Ont.
Gross, C., Winnipeg, Man.
Gudgeon, K. B., Hamilton, Ont.
Gunby, Paul T., Fort Worth, Texas.
Haas, F/L. L. R., City View, Ont.
Harris, J. P., Rosemount, P.Que.
Hill, Lt. R. A., Vancouver, B.C.
Hookings, R. S., Maitland, Ont.
Howin, John, Rosedale, Alta.
Hunchak, Peter M., Montreal, P.Que.
Hyde, John B., Roseland, Ont.
Jamshedji, J. S., Montreal, P.Que.
Jones, R. E., Sherbrooke, P.Que.
Juillet, Jean-Louis, Lachine, P.Que.
Jull, G. W., London, England.
Kaeding, Arthur, Regina, Sask.
Kazakoff, F/L. M. J., Lachine, P.Que.
Kent, Joseph D., Saint John, N.B.
Kent, K. N., Kingston, Ont.
Kunigiskis, J., Falher, Alta.
Lachance, Leo, Roberval, P.Que.
Lafontaine, Edward O., Saint John.
Lambert, Rolland, Mont Rolland, Que.
LaMothe, A. S., Montreal, P.Que.
Lancaster, W. G., Calgary, Alta.
Langlois, R. P., Arlington, Mass.
Lecomte, Paul, Montreal, P.Que.
Lee, George, Montreal, P.Que.
Leigh, E. D., Vancouver, B.C.
Lescarbeau, Andre, Montreal, P.Que.
Long, Joe, Mayo, Yukon Territory.
MacNeil, Hector J., Halifax, N.S.
MacRury, Auley F., Summerside, P.E.I.
Madsen, B. S., Vancouver, B.C.
Marcoux, Camille, Montmagny, Que.
Marien, Thos. R., Asbestos, P.Que.
Martel, William L., Montreal, P.Que
Masse, Honore, Quebec, P.Que.
Mazur, John T., Buffalo, U.S.A.
McCarthy, J. W., Hamilton, Ont.
McDonald, John, Calgary, Alta.
McDougall, F. H., Montreal, P.Que.
McNally, P. B., Montreal, P.Que.
Milligan, Geo. B., Vancouver, B.C.
Moller, Paul, Montreal, P.Que.
Montambeault, Gerald, Quebec.
Moore, W. A., Calgary, Alta.
Morais, M., Montreal, P.Que.
Morden, R. S., Valleyfield, P.Que.
Morin, Marcel, Quebec, P.Que.
Morrison, R. G., Edmonton, Alta.
Murray, R. L., Montreal, P.Que.
Nadeau, L. J., Casey, P.Que.
Nadeau, Marcel G., Montreal, P.Que.
Nicolson, M., Saskatoon, Sask.
Nugent, B. L., Regina, Sask.
Paolucci, Jean C., Ville St-Michel, Que.
Patchell, R. J., Goose Bay, Labrador.
Pawson, D. H., Montreal, P.Que.
Peake, T. R., Montreal, P.Que.
Presky, A. G., Port Arthur, Ont.
Purdon, A. D., Kimberley, B.C.
Radford, C. J., Riverside, Ont.
Ridler, D. A., Toronto, Ont.
Roach, Joseph A., Quebec, P.Que.
Robertson, T. J., Medicine Hat, Alta.
Rowsell, K. A., Ottawa, Ont.
Salonen, E. S., Toronto, Ont.
Shoemaker, J. J., Windsor, Ont.
Shore, Robt. Ellis, Brancepeth, Sask.
Siekawitch, L. G., Downsview, Ont.
Smith, D. T., Ottawa, Ont.
Smith, R. E., Richmond Hill, Ont.
Stunden, G. R., Lachine, P.Que.
Surroca, F. J., St-Joseph d'Alma, Que.
Talbot, Henri, Quebec, P.Que.
Thomson, Edward C., Williams Lake, B.C.
Thomson, James Harvey, Vancouver.
Thomson, John Harley, Kingston.
Timoschuk, P. J., Ottawa, Ont.
Timoshek, S., Montreal, P.Que.
Tremblay, Jean-Claude, Quebec.
Vallee, E. C., Sillery, P.Que.
Wade, F/O. L. A., Clinton, Ont.
Walker, Chas. E., Toronto, Ont.
Wallace, H. J., Edmonton, Alta.
Walsh, Michael H., Toronto, Ont.
Ward, R. A., Hamilton, Ont.
Watling, Winfield J., Aylmer, Ont.
Watson, D. I., Hamilton, Ont.
Weldon, W. H., Montreal, P.Que.
Williams, N. A. J., Portland, Oregon.
Zink, Jos. W., Vancouver, B.C.

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# News of Other Societies

The 41st annual meeting of the **Canadian Pulp and Paper Association,** technical section, is scheduled for January 26-28, 1955, in Montreal.

Other officers, are J. J. Waller, vice-chairman; A. H. Lewis, past-chairman, A. W. Smith, honorary treasurer, and H. Neville Mason, secretary.

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Meetings of all sections of the three divisions of the **Canadian Electrical Association** (Room 714 Tramways Building, Montreal 1) in eastern and western zones, will be held in Niagara Falls, Ont., January 25-28, 1955, and at Saskatoon, Sask., March 7-9, 1955.

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The Ontario Section of the **American Society of Lubricating Engineers** is sponsoring a course in industrial lubrication through the facilities of the extension department of the University of Toronto.

Information about the course, beginning February 9, 1955, can be obtained from C. I. R. McDougall of the Ontario Hydro, or from Mr. Kirk of the University of Toronto Extension Department.

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Professor James U. MacEwan, chairman of the department of metallurgical engineering, McGill University, was elected chairman of the Montreal chapter of the **American Society for Metals for 1954-55.**

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The **Chemical Institute of Canada** (18 Rideau Street, Ottawa 2, Ontario) announces the following schedule of meetings: February 24, 1955, conference of the Protective Coatings Division, Toronto; February 25, conference of the Protective Coatings Division, Montreal; March 7-9, conference of the Chemical Engineering division, Ottawa; April 14-15, sixth Canadian High Polymer Forum of C.I.C. and the National Research Council, St. Catharines, Ont.; May 30-June 1, the thirty-eighth annual conference and exhibition, Quebec City.

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The annual meeting of the **American Society of Heating and Ventilating Engineers** (62 Worth St., New York 13, N.Y.) will take place at Philadelphia Pa., January 24-27, 1955.

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The **American Concrete Institute** (18263 West McNichols Road, Detroit 19, Mich.) will hold the fifty-first annual convention at the

Hotel Schroeder, Milwaukee, Wis., February 21-24, 1955.

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The winter general meeting of the **American Institute of Electrical Engineers** (33 West 39th, New York 18) will be held in New York, January 21 to February 4, 1955.

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**The American Institute of Mining and Metallurgical Engineers** (29 West 39th St., New York 18) announces the annual meeting for February 13-17, 1955, at Chicago, Ill.

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The 1955 committee week of the **American Society for Testing Materials** (1916 Race Street, Philadelphia, Pa.) will take place from January 31 to February 4, at the Netherland Plaza Hotel, Cincinnati, Ohio.

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# Elections and Transfers

At the meeting of Council held at Lethbridge, Alta. on Saturday, November 27, 1954, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

*Members:*

D. A. Aitken, *Montreal*
K. H. Barnard, *Kingston*
A. M. Clark, *Toronto*
G. H. Crase, *Calgary*
N. Gritzuk, *Whitehorse*
H. C. Gunning, *Vancouver*
W. H. Hall, *Kitchener*
I. M. Hamer, *Ajax, Ont.*
W. C. Hedge, *Montreal*
A. P. E. Hopkins, *Toronto*
W. B. Landers, *Calgary*
A. Leinasars, *Toronto*
F. Macenko, *London*
R. F. Mucklestone, *Brockville*
O. Mykleby, *Toronto*
E. W. Oddleifson, *London*
A. M. Tallman, *Winnipeg*
L. K. Tempelman-Kluit, *Vancouver*
O. R. Wuczkowski, *Montreal*

*Juniors:*

W. F. Allen, *Hamilton*
I. Bayduk, *Sarnia*
C. F. Blancher, *Asbestos*
D. J. Clough, *Toronto*
A. Cohen, *Medicine Hat*
D. K. Dickey, *London*
I. D. Hynd, *Montreal*
N. Kudrenecky, *Chandler*
W. V. McKnight, *Sudbury*
A. F. Piggott, *Grand'Mere*
R. A. van Eck, *Montreal*

*Transferred from the class of Junior to that of Member:*

D. R. Burns, *Toronto*
J. C. Cant, *Terrace*
R. Dubuc, *Montreal*
G. A. Hamel, *Amueseo, S.A.*
B. A. Hastings, *London*
N. A. Lau, *P. of Spain*
G. Meilleur, *Montreal*
G. I. Mulvihill, *Winnipeg*
M. F. Painter, *Okanagan M.*
H. E. Seely, *Hamilton*

*The following Students were admitted:*

*McGill University*

G. A. Adams
P. G. Albert
L. R. Arseneault
W. D. Bailey
H. D. Bailey
P. E. Barolet
K. G. Bartlett
A. J. Bergel
P. Biron
B. D. Blair
P. G. Bowie
M. Brossard
C. R. Brown
Wm. Brownlee
D. G. Butler
B. J. Clavet
A. J. Craig
T. W. Crowe
C. C. Dakers
H. P. Desfosses
R. M. Desjardins
N. A. Dinovitzer
A. W. Easton
P. E. Engler
S. J. Fainbloom
M. C. Feher
M. M. Ferenczy
G. T. Fisher
D. G. Garneau
J. E. Gauvin
D. R. Gilmer
H. L. Gitelman
J. B. Groleau
J. E. Harbert
D. F. Henry
J. O. Jennings
J. C. Keating
W. R. D. Kerr, Jr.
S. Kondziolka
W. Kowal
D. Lake
A. L. Lalonde
M. G. Laperriere
M. D. Lefcort
S. M. Lyle
C. S. McLachlan
D. J. McLeod
A. D. McNabb
B. Malina
M. M. Mikalachki
K. M. Milne
F. E. Morris
J. F. Noyes
R. H. Nye
U. Okapuu
H. K. Oliver
C. L. Papenhuyzen
G. W. Parsons
I. S. Pasternak
R. J. Pavia
J. Pekar
W. T. Perks
R. Piibe
J. E. G. Ricard
J. M. Robic
P. G. Roper
W. R. D. Ross
C. St. Onge
P. Safulko
W. A. Sauve
S. J. Savidant
J. P. Schell
J. Schneider
R. A. Shea
H. M. Simpson
L. K. Steels
C. Tiberghien, Jr.
P. P. Webb
P. A. Wilkins
B. W. Wilson
H. R. Yudcovitch

*University of Alberta*

M. F. Carty
D. V. Daily
P. M. Evjen
L. O. Fenniak
E. B. Garrett
M. M. Krpan
R. W. E. McDonald
J. Strynadka
E. W. Trischuk

*University of British Columbia*

A. J. Atkin
B. B. Berto
B. H. Campbell
K. H. Darke
A. G. Dent
A. M. Drummond
H. Elder
G. H. Etheridge
S. T. Fall
R. M. Gale
C. J. Goodman
R. A. Hafer
E. L. Johnsson
E. P. Jones
J. D. Lowood
L. G. Maranda
R. R. Mitchell
D. H. Patrick
S. W. Potter
R. D. Pousette
D. C. Read
R. J. L. Rogers
R. R. Schram
J. Swierstur

*University of Toronto*

D. G. Barker
R. J. Budicky
R. D. Despotovich
P. C. Eberlee
D. P. Flint
B. I. Guest
J. C. Hurlburt
E. Iwach
J. M. Karpinski
I. A. Kolsi
V. Levitsky
W. J. Logan
N. B. Monteith
T. B. Mosgrove
D. B. Sampson
G.W. Stephenson
W. P. Taylor
J. R. Weir

*University of New Brunswick*

J. P. Blanchard
C. E. Bonnyman
R. A. Chiasson
P. J. Collis
G. D'Amours
L. J. Griesbach
K. K. Larsen
F. R. Long
I. P. L. Macdonald
R. C. Nolan
G. A. O'Brien
V. Robichaud
E. D. Thompson
D. J. Thornton
A. F. White

*Nova Scotia Technical College*

H. K. Allen
M. E. Flett
G. H. Good
A. L. Mills
L. W. Morgan
A. R. Murphy
P. G. Napier
D. F. Oakley
J. R. Sutherland

*Queen's University*

R. W. T. Birchard
J. D. Brunt
D. P. Carswell
J. H. Connor
D. A. Evans
J. A. Gaiser
J. D. Hagerman
G. R. Harry
V. Ireton
P. Mantyla
R. Salmon

*University of Manitoba*

W. J. Dutkiewicz
W. E. Millar

*St. Mary's University*

D. S. Walker

*St. Francis Xavier University*

J. G. Azar

*Student N.S. Assoc.*

K. D. Tuddenham

*E.I.T. Alberta Assoc.*

E. W. G. Marsh

*Students C.P.E.Q.*

H. J. Camm
J. E. Guay

*Student Inst. of Civil Engrs.*

J. F. Booth

**Applications through Associations:**

By virtue of the cooperative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

ALBERTA

*Members:*

M. G. Elston
J. D. Hale
J. C. Martin
L. C. Stevens

*Junior:*

A. J. L. Fisher

*Junior to Member:*

G. D. Harvey
P. Miller

*Student to Junior:*

T. Covello

SASKATCHEWAN

*Members:*

J. G. Alston
W. W. Kembel
A. E. Meyer
G. E. Padbury
E. A. Paynter
A. Prior

*Students:*

B. D. Forster
P. Langeman
D. H. Shields

NOVA SCOTIA

*Members:*

G. P. Bezanson
J. B. Gilliatt
H. W. MacKay
R. W. Wilson

*Junior to Member:*

C. G. Hemming
D. W. Perry

*Student to Member:*

D. M. Baker
I. V. Silgailis

QUEBEC

*Junior to Member:*

W. B. Miller

# NEWS OF THE ASSOCIATIONS & CORPORATION

**Information received through co-operation with the provincial organizations**

## Quebec

**Policy of Council for 1954-5**

Some time ago the following policy was established by Council to guide the Corporation's activities during the year.

During the present term Council will again follow the long range policy first adopted by the Corporation in 1949. Council however will devote special attention to the important problem of increasing the prestige of the professional engineer as an individual.

It is evident that, in order to fulfil its main duty of promoting the welfare of the public of this province, the engineering profession must be well organized, strong and respected, and it is with this objective in mind that your Council has adopted the following broad program for the year 1954-55:

I—*It will attempt to clarify the status of the professional engineer in Quebec by:*

a) Specifying precisely who shall be permitted to practice engineering and under what conditions.
b) Enforcing strictly the provisions of the Professional Engineers' Act regarding the use of the title "engineer".
c) Preparing necessary amendments to the Act to clearly establish the rights and privileges of professional engineers in all fields in which they are qualified to practice.
d) Establishing definite rules and regulations governing the admission to special yearly membership of non-Canadian applicants and the scope of their practice.

II—*It will increase the prestige of the professional engineer by:*

a) Improving the Code of Ethics and enforcing same more strictly to eliminate all practices not consistent with the welfare of the public.
b) Directing the Public Relations program towards achieving greater recognition of the services of engineers to the community in general and to industry in particular.
c) Intensifying the program of elimination of illegal practice and abuse of the title.

III—*It will promote the welfare of the professional engineer by:*

a) Continuing the search for improved methods of obtaining and maintaining adequate remuneration for engineers' salaries.
b) Adopting an improved schedule of minimum fees for engineering services, and collaborating with other provincial associations so that a uniform schedule of fees may be adopted throughout the country.
c) Improving the co-operation with other engineering bodies in all matters affecting the welfare and status of professional engineers.

IV—*It will consolidate the Corporation as an organization by:*

a) Providing additional staff.
b) Providing adequate facilities and space at headquarters.
c) Supporting the organization of local groups by providing assistance and guidance whenever required.
d) Securing greater membership participation in Corporation affairs through committees, meetings, etc.
e) Undertaking a serious campaign to secure by persuasive means the registration of all qualified engineers in this province.

**"Engineering Is Your Profession"**

The newest publication of the Corporation of Professional Engineers of Quebec was distributed to the membership a few weeks ago. The result of long and careful preparation, this booklet, entitled "Engineering is Your Profession", discusses various aspects of engineering as a profession, and contains a great deal of information of interest to every person engaged in the broad field of engineering endeavour, whether or not he is a registered member of the Corporation. Basic facts about the Corporation, its purpose, its method of operation, its activities and the advantages it offers its members are contained in this illustrated booklet. It deals with the legal status of non-Canadian graduate engineers, and describes the national affiliations of the Corporation, the growth of membership, the activities designed to protect the public, and the activities designed to protect the professional engineer.

Designed for easy reading, this booklet has been prepared in bilingual form for wide distribution to anyone interested in the activities of the Corporation.

Persons wishing to receive a complimentary copy should contact Corporation of Professional Engineers of Quebec Headquarters, 1600 Pine Avenue West, Montreal, Que.

## Ontario

***News of the Members***

**Capt. B. H. Goodings**, of R.C.E.M.E. will shortly attend the Canadian Army Staff College following duty with the Commonwealth Division in Korea. In 1949 he graduated in mechanical engineering from the University of Toronto and since that time has made the Army his career.

**J. A. Bossert**, has joined the staff of the Approvals Laboratories of the Canadian Standards Association and is located at the new research and approvals building in Etobicoke, Ontario. Mr. Bossert graduated in electrical engineering in 1951 from Queen's University and prior to the above change was with the Canadian Carborundum Co. at Niagara Falls, Ontario.

The appointment of **Fred A. Sweet** as general manager of the Canadian Standards Association, Ottawa, has been announced. He succeeds the late Col. Walter R. McCaffrey in this office.

Mr. Sweet graduated from the University of Toronto in civil engineering in 1936 and for the past fourteen years has been the chief technical officer of C.S.A.

Two members, **Harold C. Pinder** and **H. C. Dawson** are officers of the newly incorporated Evershed and Vignoles (Canada) Ltd., of 2781 Dufferin Street, Toronto.

This company is sponsored by Evershed & Vignoles of Chiswick, London, England, a firm engaged in the manufacture of electrical instruments. The new Canadian company will handle exclusively the telemetering and process control side of Evershed's business. R. H. Nichols Ltd. will continue as sole representative for Megger and other electrical testing instruments.

At the recent fall meeting of the board of directors of the General Alumni Association of Queen's University, Kingston, **W. A. Dawson,** of Dawson, Rhoades Thibodeau Machinery Co. Ltd., Hamilton, and **D. G. Geiger,** of Bell Telephone Co. of Canada, Toronto, were elected vice-presidents.

Also elected to the board of directors was **H. I. Marshall,** consulting engineer, and patent agent with Alex E. MacRae & Company, Ottawa.

**R. B. Carson** retired on October 31 after 41½ years with the Canadian General Electric Co. Ltd. At the time of his retirement he was engineering consultant at the Davenport Works of the company where he was formerly works engineer for a number of years.

A son of the manse in Pictou, N.S., Mr. Carson first attended Dalhousie University in Halifax and in 1913 graduated in electrical engineering from the Nova Scotia Technical College of the same city.

Immediately joining the Canadian General Electric organization he first completed the test course at Peterborough. For two years he was chief of test before being attached to the engineering department as transformer designer. In 1921 the transformer section was moved to the Davenport Works in Toronto, at which time Mr. Carson was placed in charge of power transformer design engineering. In 1943 he was named assistant works engineer and in 1948 he was appointed works engineer. Prior to his appointment as engineering consultant this year, Mr. Carson was for a time manager of engineering policy and service.

# Manitoba

### Operation and Goals

This article was written for the purpose of giving the engineering group in Manitoba as a whole, some idea of the operation of its association and the goals that it has set for itself and which require the complete co-operation of its members.

The Association of Professional Engineers of Manitoba is fortunate to have many distinguished persons as members of its organization. They are greatly interested in pioneering engineering knowledge as well as being good citizens of our country.

#### *Engineers-in-Training*

The young engineering student meets these men in every day life. Many of the professors of the faculty of engineering at the University of Manitoba are members and through their guidance and knowledge the student is prepared for his engineering future. It is very important the graduate students keep in touch with these men. To do this the association offers them the opportunity of becoming Engineers-in-Training. As such they become members of the Association of Professional Engineers shortly after graduation and during their early practical training are able to gain from the experience and knowledge of more mature men.

This is only one phase of the work being done by the Manitoba association. The aim of the Council is to make the engineers of the province of Manitoba a well knit unit, and by means of salary schedules, consulting fee schedules, and standardization of qualifications for admission to the association, it hopes to accomplish this aim.

#### *Salary Schedules*

Recently the Manitoba association adopted a salary schedule as approved by most of the other provincial associations and corporation. This outlines a suggested minimum salary for various classifications of engineers that can be used as a guide by engineer and employer, classification of engineers will combine two excellent effects. It will provide the younger engineer with a yardstick for measuring his progress in the profession and it will offer the employer a satisfactory method of keeping his personnel happy. This schedule, of course, is not rigid and does not have to be strictly adhered to, but it is a step in the right direction to better employer-employee relationships. Every member should have a copy of it.

#### *Fees for the Consultant*

Professor J. Hoogstraten has recently been named chairman of a committee whose duties consist of studying the work and fees of consultant engineers across Canada and devising a satisfactory schedule of consulting fees to be adopted by the Manitoba Association. The consulting engineering business in this province is growing and the need for an accurate and fair schedule of this type is becoming extremely important. Evidence of this is the increasing number of enquiries received by your Council in the past few months. Professor Hoogstraten has selected for his committee members of various consulting engineering firms as well as purchasers of engineering services.

#### *Qualifications for Admission*

At the Dominion council meeting held in Toronto, it was decided that certain rigid qualifications for admission to the Provincial Associations and Corporation of Professional Engineers were required in order to maintain a high standard of engineering personnel across the country. The Manitoba Association has adopted these decisions and the Council is doing everything in its power to analyze carefully the qualifications of anyone seeking admission to the association. In the long run this type of discipline will make the Association of Professional Engineers of Manitoba and all its members a respected group in the community. This new prestige, it is hoped, will place engineering at the high level enjoyed by certain other professions.

Mr. C. S. Landon, who is presently, and has been for the past 21 years, a member of council and Secretary-Treasurer and Registrar of the Association, will be happy to receive enquiries about our Association from interested members and non-members.

# Saskatchewan

### Water and Sewage Conference

The sixth annual convention of the Western Canada Water and Sewage Conference was held in Regina on September 22-24. Over 300 delegates and visitors were in attendance.

Among the Saskatchewan Professional Engineers who presented papers were: Eric Davis, assistant sanitary engineer with the Saskatchewan Government; M. D. MacKenzie of Associated Engineering Services Ltd.; M. H. Prescott, senior sanitary engineer for Saskatchewan; H. M. Bailey, city engineer of Yorkton; Prof. C. R. Forsberg of the University of Saskatchewan; Allan Shattuck of the Regina Water Works staff.

Other Saskatchewan engineers who participated were: W. G. McKay of Saskatoon; W. L. Sharpe, city engineer of Weyburn; J. W. D. Farrell, Regina Water Works Superintendent; I. B. Sveinbjornson of Yorkton, and W. A. Friebel, Saskatoon's city engineer.

### Saskatoon Builds Water Supply Pipe Line

A project of considerable engineering interest is now being completed in Saskatoon. It involves placing a 30-inch welded steel pipe line across the South Saskatchewan River to connect the Nutana area water system to the main pumps. The new pipe replaces a 24-inch cast iron pipe that had been used for many years but is now leaking very substantially. Design work in connection with the project was carried out by the City Waterworks Engineer, Don Graham, with R. A. Spencer as consultant. The construction contract was awarded to Piggott Construction Company whose project engineer is Russ Ormiston, a recent University of Saskatchewan engineering graduate.

In making the river crossing the pipe was assembled on the north bank of the river on dollies and was then pulled across as a unit by winching from the south bank. This part of the work was in the hands of key personnel from the Missouri River Pipe Line Company whose equipment had been floated down river from Outlook, where it had been used in making a 20-inch oil pipe line river crossing.

### Potash Industry Described

Engineers in Saskatoon met at dinner on October 27, 1954, to hear a paper on "The Potash Industry" by Mr. J. B. Cummings, resident manager for the Potash Company of America's operations near Saskatoon. With the assistance of film he brought out the importance and uses of potash as well as methods of mining and processing. Certain features of the local project created considerable interest among the engineers.

The deposit is located some 3,000 feet below the surface with an intervening water-bearing sedimentary strata. To sink through this strata it has been decided to freeze the whole shaft area prior to excavation. To do this a number of shot drill holes are being drilled in a circular pattern and down to the full 3,000 feet. Refrigeration piping is to pass through these holes with the required capacity of the plant amounting to some 800 tons.

Included among the 80 engineers present were 30 guests from the Western Meeting of the Cement and Concrete Research Group of the National Research Council. A special guest was Dr. C. J. Mackenzie, former president of the National Research Council and the first Dean of Engineering at the University of Saskatchewan.

The meeting was conducted by Prof. W. R. Staples, as chairman. The guest speaker was thanked by Dr. J. B. Mawdsley.

#### André Coyne Presents Lectures on Arch Dams

Mr. André Coyne, an internationally known French authority on arch dams presented lectures dealing with designs he had been associated with in many countries in Europe and Asia. Some 70 engineers in Regina heard his lecture on October 19, and approximately 60 in Saskatoon on October 20, the latter including a number of senior students in civil engineering from the University of Saskatchewan.

Mr. Coyne's lecture was well illustrated by beautiful colored slides and a moving picture. In both cities, the lecture stimulated a lively discussion period. Mr. Coyne was thanked by Mr. H. Nicholl at the Regina meeting, and by Prof. F. H. Edmunds at the Saskatoon meeting.

## British Columbia

#### Engineers and Unions

On November 9, the culmination of some four years of effort on the part of the Association and those Engineers-in-training with the B.C. Electric Co. Ltd. who have been forced to belong to a union was reached, when the Engineers-in-training with the newly-formed B.C. Engineering Co. Ltd. and the B.C. Electric Co. Ltd. voted overwhelmingly in favor of relinquishing "membership in the Office Employees' Association, or any association of employees or any labour organization founded for the purpose of challenging the jurisdiction or certification of the O.E.A. or its successors". Fifty-two voted in favour with nine voting against. A total of sixty-six ballots were sent out.

The Office Employees' Association objected to recognition of the bargaining unit for which former employees of the B.C. International Engineering Co. Ltd. applied for certification when they became employees of the B.C. Engineering Co. Ltd. As a result of this, a meeting of all the interested parties was called at which the O.E.A. agreed to a secret ballot vote being taken among all Engineers-in-training of both the B.C. Engineering Co. Ltd. and the B.C. Electric Co. Ltd., the ballot to determine whether they wished to be members of the O.E.A. or any similar organization. In return it was agreed that the application for bargaining rights for the B.C. Engineering Co. Ltd. employees would be withdrawn. The O.E.A. further agreed that if the E.I.T.'s showed by majority vote that they did not wish to be members of the O.E.A. or any similar organization, the O.E.A. would exclude E.I.T.'s from O.E.A. membership. Subsequently, the ballot was carried out by the Association and scrutineered by representatives of the O.E.A. and the other interested parties.

The next step will be for the O.E.A. to have the exclusion of E.I.T.'s written into their agreement with the company.

In the meantime, Council will press once again when the legislature convenes in January for exemption of Engineers-in-training from the provisions of the Labour Relations Act.

#### Annual Meeting

The thirty-fifth annual meeting of the Association was held at the Hotel Vancouver in Vancouver, on Friday and Saturday, December 3 and 4. This notice went out to the members.

Information concerning the meeting has already been mailed to members and engineers-in-training. Members are urged to attend to use this, their principal opportunity, to have a voice in the affairs of their Association. When members are silent, Council can only interpret this to mean that they are satisfied with the way that the Association is being run. If this is the case, they should come and thank Council for doing such a good job. If it is not the case, the annual meeting is the time and place to be vocal, not at some other time or place. This applies to engineers-in-training and members.—If you want to be heard, be there.

Members have an additional method to express their opinion on the ballot for Council, which they should have received last week.

*"Silent Service Is Not Enough."*

#### Society Affairs

In December, members will receive the annual Salary Survey Questionnaire. It will be noted that this year's survey will be conducted under the auspices of Dominion Council, thus providing a Canada-wide survey as well as detailed data regarding salaries in B.C. Making the salary survey in December instead of in April, as it was previously done in B.C., makes it possible to compile the analysis of salaries within days after the end of the year and at a time when the data will be of greatest aid to all concerned.

The Salary Survey Questionnaire is a source of important information and this value increases yearly. It is obvious that the higher the percentage of returns, the greater will be the value of the resulting tabulations. Last year only 31.8% of the members and engineers-in-training returned their questionnaires, this compared to 45.5% return of the previous year. It means that only 1 out of 3 members gave their assistance in a matter which affects all.

Incorporated in the 1954 Salary Survey Questionnaire are several new questions. It will be noted that the annual "rate" of remuneration, as of December 1, 1954, is requested. New questions generally relate to any bonus received over and above salary; the annual value of any profit sharing plan; annual commissions; the annual contribution of the employer to pension, group plan, hospital, insurance, sickness plans. The question on the field in which work is done.

Experience has proved beyond doubt the value of the Annual Salary Survey. While its use as a reference has been valuable in the past year, participation by every member would provide data of incomparable worth.

#### Executive Changes

F. M. Cazalet, supervisor of mechanical engineering for the B.C. Electric Power and Gas Company, is the new chairman of the Vancouver Branch of the B.C. Engineering Society for 1954-55. He succeeds W. Thornber, of the B.C. Coastwoods Extension Bureau, who will continue on the executive as immediate past chairman.

Others elected to the executive at the annual meeting in the Engineering Building at U.B.C. last night were, W. C. McKenzie, vice-chairman; H. Taylor, secretary; and J. Sandrin, treasurer. H. T. Libby will be member at large, representing the professional engineers; and W. K. Broughton for the engineers-in-training. A. Webster and W. H. Doran, of last year's executive, will be the continuing members for the coming year.

#### Engineers-in-the-News

The Board of Directors of the Granby Consolidated Mining, Smelting and Power Company Limited has announced changes in officers. **Julian B. Beaty,** formerly president of the company is now chairman of the board. **L. T. Postle,** formerly vice-president and general manager, has been named president. **J. A. C. Ross,** formerly general superintendent, has been appointed general manager.

**R. C. Boyes,** who recently returned from England has accepted the position of Assistant Zoning Planner in the Vancouver City Planning Department.

**F. Hancock** has accepted a position on the teaching staff of the Vancouver Technical School.

**V. C. Fenton,** who was formerly with the Department of Mines in Victoria has taken up a position in the structural department of the chief architectural branch of the Department of Public Works at Ottawa.

**W. D. Hammond,** of Kennco Explorations (Canada) Limited has been transferred to Toronto to take charge of the Company's exploration program in Central Canada.

**I. L. Johnston** has left the Water Rights Branch, Department of Lands & Forests to accept a new position as hydraulic engineer with the St. Lawrence Seaway Authority in Montreal.

**George Wallbank** has accepted a position with Letson & Burpee Ltd. He was formerly with Stange Construction Co. Ltd. at Salmo, B.C.

**W. D. Cripps** is now employed by J. L. Miller. He was formerly with Associated Consulting Engineers.

**R. C. Robson,** who was with Alaska Pine and Cellulose Ltd. in Vancouver, has accepted a position with H. A. Simons Ltd. **E. H. Talbot** has accepted a position with J. L. Miller. He was formerly employed by H. A. Simons Ltd.

**C. G. Hewlett,** who received a Ph.D. degree in geology from the University of Wisconsin this June, is now on the staff of the British Columbia Department of Mines.

**A. L. Nicholls** is now industrial sales manager with Kemp Agencies. He was formerly employed by H. A. Simons Ltd.

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# Personals

## News of the Personal Activities of Members of the Institute

**Brian H. Colquhoun,** M.E.I.C., senior partner in the firm of Brian Colquhoun & Partners, London, has recently accepted the appointment of engineering advisor to the International Bank for Reconstruction and Development (World Bank) for a period of two years on secondment. During the period of his appointment, Mr. Colquhoun will be based at the headquarters in Washington, but will also visit the countries in the development of which World Bank is interested.

Brian H. Colquhoun, M.E.I.C.

A graduate of London University in 1924, Mr. Colquhoun was elected a Member of the Institute in 1950. For some years he was engaged in tunnelling works in and around the London area, and, later on oil exploration surveys and the construction of railways and port installation works in connection with the refinery at Minatitlan, Mexico.

In 1930 he was appointed resident engineer, then engineer-in-charge, on the construction of the Mersey vehicular tunnel under the river between Birkenhead and Liverpool, England. During this period he was also adviser on tunnel ventilation to the authorities responsible for the construction of the Maas Tunnel in Holland.

In 1938 he was appointed engineer-in-charge on the design and construction of a large Ordnance factory in Lancashire, and, at the outbreak of the War, was responsible for further large plants at Risley and Kirby, near Warrington, England.

Mr. Colquhoun was later appointed director-general of aircraft production factories in the Ministry of Aircraft Production, in which capacity he was responsible not only for aircraft production factories in the United Kingdom, but also for railway and port works overseas in connection with the transport and shipping of the raw materials for the manufacture of aircraft.

Mr. Colquhoun opened an office as consulting engineer in London in the latter part of the War and his firm has, over the last few years, been responsible for engineering works of all categories in various parts of the world including the United Kingdom, South Africa and the Rhodesias, India, Pakistan and the Argentine.

As a result of Mr. Colquhoun's appointment to the International Bank, the firm has taken into partnership three of its senior civil engineers, one of whom is **Alan U. Shiach,** M.E.I.C., who was elected a Member of the Institute in 1950.

At the 65th annual meeting of the Engineering Institute held in Montreal in May, 1951, Mr. Colquhoun presented a paper entitled, "Some Modern Aspects of Tunnelling".

**D. S. Abbott,** M.E.I.C., has been elected president of Alliance Paper Mills Ltd. and its subsidiary, Don Valley Paper Co. Ltd. He has also been appointed a director of Howard Smith Paper Mills Ltd.

Mr. Abbott joined the staff of Howard Smith Paper Mills Ltd. in 1944 as manager of the plastics division, now The Arborite Co. Ltd., of which he was elected president in 1953. He will continue to hold this office in addition to his new duties.

He is a 1930 mechanical engineering graduate of Queen's University.

**T. P. Lusby,** M.E.I.C., has been appointed deputy minister of public works for the Province of Nova Scotia. He has been chief engineer of the department of highways and public works since 1948.

A mechanical engineering graduate of the Nova Scotia Technical College, class of 1930, Mr. Lusby has been associated with the Department since 1947.

He has just completed a two-year term as councillor for the Association of Professional Engineers of Nova Scotia.

**N. S. Bubbis,** M.E.I.C., general manager of Winnipeg's Greater Sanitary District, was named president of the Canadian Institute on Sewage and Sanitation at the organization's 21st annual meeting in Montreal. **C. G. R. Armstrong,** M.E.I.C., consulting engineer, Windsor, Ont., was elected vice-president; **R. V. Anderson,** M.E.I.C., consulting engineer, Toronto, and **E. E. W. Oke,** M.E.I.C., city engineer, Waterloo, Ont., were elected trustees.

**A. E. Chalmers,** M.E.I.C., city engineer, Peterborough, Ont., is immediate past-president. **L. B. Allan,** M.E.I.C., metropolitan Toronto commissioner of works, is a trustee whose term will expire next year. **Nicol MacNicol,** M.E.I.C., will continue as federation director, and **Albert E. Berry,** M.E.I.C., as secretary-treasurer. **A. J. Deslauriers,** M.E.I.C., Lachine's city engineer, discussed incineration at a symposium on refuse disposal. One of the speakers in the forum was **G. H. Richards,** M.E.I.C., city engineer, Brantford, Ont.

Speakers during the three-day convention were **G. T. G. Scott,** M.E.I.C., manager of Canadian British Engineering Consultants, Toronto; **J. F. MacLaren,** M.E.I.C., of James F. MacLaren Associates, Toronto; and **J. G. Schaeffer,** M.E.I.C., director of the sanitation division of the Saskatchewan Department of Health, Regina.

Twenty-year membership certificates were presented to **N. G. McDonald,** M.E.I.C., of Gore & Storrie, consulting engineers, Toronto; **W. L. McFaul,** M.E.I.C., city engineer, Hamilton; **J. F. MacLaren,** M.E.I.C.; **W. B. Redfern,** M.E.I.C., of Proctor, Redfern & Laughlin, consulting engineers, Toronto; and **W. Storrie,** M.E.I.C., of Gore & Storrie, consulting engineers, Toronto.

**Thomas Ingledow,** M.E.I.C., has been appointed president of B.C. Engineering Co. Ltd., a new subsidiary of B.C. Electric Co. Ltd. which has been formed by the amalgamation of the company's engineering division and a newly-purchased private company, B.C. International Engineering Co. Ltd.

Mr. Ingledow, an engineering graduate of Glasgow University, is vice-president and executive engineer of B.C. Electric Co. Ltd.

**E. K. Dokken,** M.E.I.C., assistant superintendent of the Piggott Construction Company in Moose Jaw, has been elected chairman of the Moose Jaw section of the Saskatchewan Branch of the Engineering Institute.

Mr. Dokken was born at Olds, Alta. Upon completion of his studies at Thornton School, Saskatoon, and the Saskatoon Technical Collegiate Institute, he entered the University of Saskatchewan, graduating in 1944 with a B.Sc. degree in mechanical engineering.

Upon graduation he became maintenance engineer with the Consolidated Paper Corporation in Grand'Mere, Que. A year later he was appointed construction engineer and assistant mechanical superintendent.

In 1948 Mr. Dokken joined Montreal Cottons Limited in Valleyfield, Que., as

assistant plant engineer. He then served for a brief period in 1949 as field superintendent of Dokken Pipe Line Limited in Edmonton, afterwards joining the Prairie Well Servicing in Redwater, Alta.

In April, 1950 he entered the Piggott Construction Company as field superintendent in the pipe line division in Edmonton, and a year later was appointed resident engineer and assistant superintendent of the company at the Moose Jaw airport.

Mr. Dokken is a member of the Association of Professional Engineers of Alberta.

**Brigadier J. R. B. Jones,** M.E.I.C., has been promoted from the rank of colonel and is commander at the New Brunswick area headquarters in Fredericton.

Brigadier Jones, a 1935 mining engineering graduate of the University of Alberta, was formerly chief engineer at Army headquarters in Ottawa.

**W. A. Ketchen,** M.E.I.C., has been appointed to the position of technical director of Fraser Companies, Limited in Edmundston, N.B. As technical director he will be concerned with industry trends and development in materials, processes and products and their application to company operations. He will also be responsible for the operations of the technical departments and research divisions of the company and its subsidiaries, Fraser Paper, Limited and Restagouche Company, Limited.

A native of Montreal, Mr. Ketchen graduated from McGill University in chemical engineering in 1928 following which he was employed by Shawinigan Chemicals Limited, Shawinigan Falls, Que. For over a quarter of a century he has been with the Fraser organization being first employed as a chemist with Fraser Paper, Limited, Madawaska, Maine. In 1932 he became assistant to the chief chemist at Edmundston, later becoming head chemist at Madawaska. In 1937 he was named chief chemist of the company and its subsidiaries. From 1949 until recently Mr. Ketchen was also directly concerned with the company's kraft mill at Newcastle, N.B.

**Paul E. Cooper,** M.E.I.C., president of Crown Zellerbach Canada Limited and of Elk Falls Company Limited, will retire on January 1 due to ill-health. He will continue, however, as director of Crown Zellerbach Canada Limited, and also act as a consultant to the firm.

Mr. Cooper has been associated with the pulp, paper and allied forest industries for more than 30 years in Canada, the United States and abroad.

A native of Ottawa and a graduate in civil engineering of McGill University, Mr. Cooper began his career in business and industry as resident engineer of the Piercefield mill of the International Paper Company in New York State. Later, he became manager of the Continental Paper & Bag Corporation at Rumford, Maine.

In 1934 he went to Great Britain as chief engineer in charge of design and construction of a new board mill for the Thames Board Mills, Ltd. in Purfleet, one of the largest organizations of its kind in the world. He then became deputy director and general manager of the Thames organization, remaining in that office for nine years.

He was then appointed in 1943 vice-president and general manager of Pacific Mills, Limited, now Crown Zellerbach Canada Limited. The following year he was named president of Pacific Mills, which under his direction, developed into one of the largest integrated companies in the province. In the multi-million dollar expansion of the company during Mr. Cooper's term, the firm acquired three subsidiaries, Canadian Boxes Limited, Northern Pulpwood Limited, and Badwater Towing Company, which greatly widened plant and woods operations.

Mr. Cooper is credited with being the driving force behind many developments at the company community of Ocean Falls where he was instrumental in the establishment of a modern hotel and a low-cost housing development for employees. He also played a leading role in the formation in 1951 of the new Elk Falls Company and construction of a huge newsprint mill on Vancouver Island.

Mr. Cooper has been director and vice-president of Hudson Paper Company Limited, a distributing subsidiary with head office in Winnipeg.

**E. S. Chandler,** M.E.I.C., of Chappell & Company, Charlottetown, has been elected chairman of the Prince Edward Island Branch of the Engineering Institute.

Mr. Chandler was born in Charlottetown. He received his general education at the West Kent School, Prince of Wales College and Mount Allison University. In 1928 he entered the Nova Scotia Technical College, graduating with a B.Sc. degree in electrical engineering in 1931.

After graduation he was appointed acting superintendent of the Wolfville Electric Commission and in 1932 was named provincial electrical inspector for the Province of Prince Edward Island.

During World War II he served from 1940 until 1944 with the Royal Canadian Artillery on searchlights, and upon his discharge, was appointed superintendent of the Vocational Training School at Charlottetown. After a brief period as electrical contractor, Mr. Dokken became district meter inspector for the Department of Trade and Commerce in Charlottetown.

He is a member of the Illumination Engineering Society.

### H. G. Acres Organization

With the change in organization of H. G. Acres & Company Limited, consulting engineers, Niagara Falls, the board has announced that **S. W. Andrews,** M.E.I.C., continues as president and director; **A. P. McQueen,** M.E.I.C., continues as vice-president and director; and **H. E. Barnett,** M.E.I.C., has been appointed vice-president and chief engineer. Messrs. Andrews, McQueen and Barnett, together with **R. A. H. Hayes,** M.E.I.C., electrical engineer, will continue as the principals of the firm and there will be no change in policy or management.

**R. M. Hardy,** M.E.I.C., dean of engineering of the University of Alberta, has been appointed to the board of directors of Foundation of Canada Engineering Corp. Ltd.

Dean Hardy is president of R. M. Hardy Associates Ltd. and vice-president of Materials Testing Laboratories Ltd. of Edmonton and Calgary. He is a past-president of the Association of Professional Engineers and of the Canadian Good Roads Association. He is also an associate member of the American Society of Civil Engineers.

**Leroy Thorssen,** M.E.I.C., is president of Lightweight Aggregates of Canada Limited in Calgary, whose new Mcleod Trail plant began operations this summer.

Mr. Thorssen is a former professor of civil engineering at the University of Alberta where he served on the staff from 1939 until 1952. He received his B.Sc. degree in civil engineering from the University of Alberta in 1939 and his M.Sc. degree from the University of Iowa in 1946.

**B. A. Monkman,** M.E.I.C., is managing director of Light Weight Aggregates of Canada Limited in Calgary.

Previous to joining the company in 1953, he was associated with the Newfoundland Light and Power Company in St. John's where he served as operating superintendent for three years.

Upon graduation from the University of Alberta in civil engineering in 1940, Mr. Monkman was associated during the succeeding ten years with Calgary Power Company on construction and hydro development. In 1947 he was appointed resident engineer on the Berrier project.

Mr. Monkman is a past chairman of the Newfoundland Branch of the Institute.

**W. Douglas Baines,** M.E.I.C., research officer with the National Research Council of Canada in Ottawa, has been awarded the J. C. Stevens Award of the American Society of Engineers for technical papers published by the Society during the past year. Mr. Baines' paper was entitled "Application to an Hydraulic Problem".

Mr. Baines, formerly in the civil engineering department of Michigan State College, is an honour graduate in engineering physics of the University of Alberta, class of 1947. He received his M.Sc. degree from the State University of Iowa in 1948.

**Lt. Col. A. L. Maclean,** M.E.I.C., is a member of the Canadian delegation of the International Supervisory Commission in Cambodia, Indo-China, and is serving as senior Canadian representative in the provinces of Kampot and Takeo.

A graduate of the University of Toronto in metallurgical engineering in 1941, Lt. Col. Maclean served during the war with the R.C.E.M.E., after which he undertook a ten-month advance ordnance officers' course at the United States Army ordnance school in Maryland. He served from 1948 until

1952 as associate professor in the department of mechanical engineering at the Royal Military College of Canada, and was then posted to the directorate of quartermaster operations and plans at Army headquarters in Ottawa.

Lt. Col. Maclean is a past chairman of the Kingston Branch of the Engineering Institute.

**George N. Munro,** M.E.I.C., assistant chief engineer of the P.F.R.A., Department of Agriculture, Regina, has been elected chairman of the Saskatchewan Branch of the Engineering Institute.

A native of Deloraine, Man., Mr. Munro received his public and high school education in Winnipeg and North Battleford, Sask., after which he served with the Royal Canadian Dragoons during the first World War. He then attended the University of Saskatchewan, graduating with the degree of B.Sc. in civil engineering in 1926.

Previous to graduation he served during the summer as rodman and instrumentman with the Saskatchewan Department of Highways. In 1926 he joined Canadian National Railways as instrumentman, becoming resident engineer in 1928.

In 1931 he returned to the Saskatchewan Department of Highways as resident engineer, and in 1932 was appointed inspector with the Department of Public Works of Canada. He joined the Saskatchewan Department of Natural

George N. Munro, M.E.I.C.

Resources, water rights branch, in 1939, and in 1949 transferred to P.F.R.A. as assistant chief engineer.

**Fred A. Sweet,** M.E.I.C., has been appointed general manager of Canadian Standards Association to succeed the late Colonel W. R. McCaffrey. This announcement was made recently by **Dean R. E. Jamieson,** M.E.I.C., president of the Association.

Mr. Sweet, a civil engineering graduate of the University of Toronto, has been chief technical officer of the Association for the past 14 years.

He is a member of the Association of Professional Engineers of Ontario.

**Geddes M. Webster,** M.E.I.C., formerly manager of Bralsaman Petroleums Limited, is now vice-president and general manager of Franklin Exploration Limited.

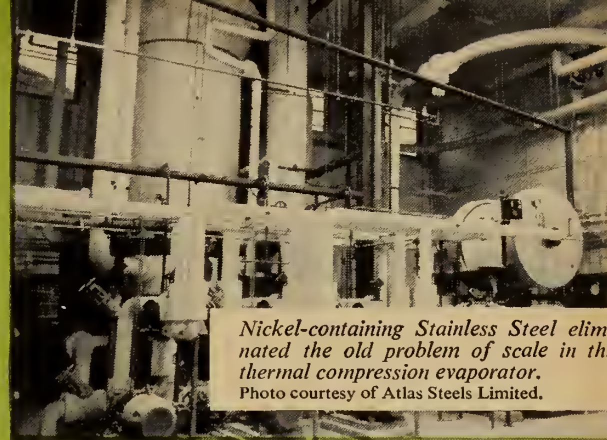
He received his B.Eng. degree in mining engineering from McGill University in 1941. After industrial work with Defence Industries Limited and Canadian Industries Limited he was active in the Yellowknife area from 1945 to 1951, first as a mining consultant and later as assistant mining inspector and mining recorder for the Yellowknife Mining District.

In 1951 he joined Transcontinental Resources Ltd. as a field engineer and in 1952 was transferred to Calgary with Bralsaman Petroleums Limited.

Mr. Webster in association with Norman S. Edgar, mining engineer, has recently formed Franklin Exploration Limited which is concerned with consulting in mining as well as with exploration and development of minerals in western and northern Canada and in the Western United States. His offices are located in Calgary.

**R. T. Hollies,** M.E.I.C., a past councillor of the Engineering Institute and

# YEARS AND YEARS OF DEPENDABLE SERVICE



*Nickel-containing Stainless Steel eliminated the old problem of scale in this thermal compression evaporator.*
Photo courtesy of Atlas Steels Limited.

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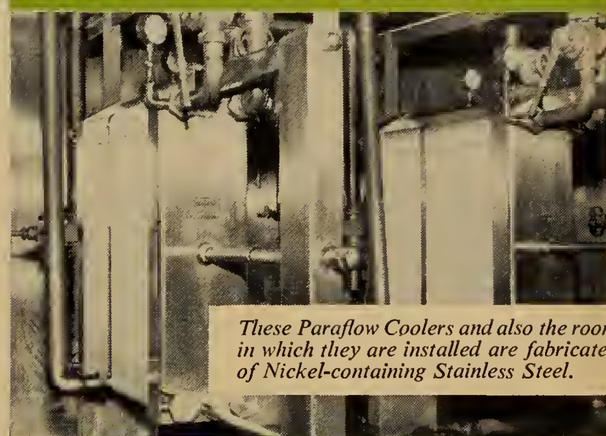
*This Cottage Cheese Vat is lined with Nickel-containing Stainless Steel.*

Dependability is the most important requirement of processing equipment. Important because it is not only necessary that equipment has long, easily maintained service life but that its ability to safeguard product purity is never reduced. These are tough standards for any metal. Nickel-containing Stainless Steel has excellent resistance to corrosion, ready formability and ability to keep high purity products free from harmful discolouration and contamination.



*These Paraflow Coolers and also the room in which they are installed are fabricated of Nickel-containing Stainless Steel.*

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Inco's Technical Service has, over the years, collected and catalogued information from laboratory studies, plant surveys and practical experience in a great variety of industrial equipment problems. This information and the qualified experience of Inco's Technical Staff is always available to help you with your metal problem.

*The pipes, fittings and kettles of this baby food process equipment are of Nickel-containing Stainless Steel.*
Photo courtesy of Atlas Steels Limited.

EMBLEM OF INCO NICKEL SERVICE
TRADE MARK

**THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED**
**25 KING STREET WEST, TORONTO**

a past chairman of the Calgary Branch, has retired as city waterworks engineer for the City of Calgary.

Mr. Hollies was born at Fort Macleod where he received his early education. He entered the University of Alberta before World War I, but at the outbreak of hostilities, interrupted his studies and enlisted in the Army. From 1916 until 1919 he served on the western front and saw action at the Somme, Vimy Ridge, Passchendale, Canal du Nord and Valenciennes with the 46th Battalion from Moose Jaw. He was wounded three times and at Passchendale was one of 15 of his entire company who returned from the battle.

After the war he resumed his engineering studies and graduated from the University of Alberta in 1920. He received his M.Sc. degree in 1921.

Mr. Hollies spent the following six years as assistant research engineer for the Research Council of Alberta and then went to Southern California for further studies and was employed on the construction of a 1,000,000 hp. steam plant at Long Beach.

After a brief period in the Caribou country he came to Calgary in the summer of 1929 as field engineer in the City's service on the construction of the Glenmore dam, the filter plant, pumping station and installation of mains from the reservoir. When the dam went into operation in 1933, he was named superintendent of production.

Mr. Hollies remained in this post until the fall of 1939 when he enlisted in the Royal Canadian Engineers. He was commissioned and went overseas in 1940, arriving in time for the Battle of Britain and in time to serve in the defensive corps set up for the protection of the south coast in the fall and winter of 1940 and 1941. After serving in England in the construction of camps, airports, roads and hospitals, he went to Normandy in July, 1944. Later in the year he was invalided home and in November was discharged with the rank of captain.

Returning to the city waterworks department in 1945, Mr. Hollies was promoted to assistant waterworks superintendent and in the summer of 1953 was appointed waterworks engineer.

In 1946 and 1947 Mr. Hollies was chairman of the Calgary section of the Chemical Institute of Canada; in 1948, chairman of the Calgary Branch of the Engineering Institute, and in 1950 and 1951, councillor of the Institute, representing that Branch. He was elected vice-president of the Association of Professional Engineers of Alberta in 1952.

**H. T. Miard,** M.E.I.C., has been transferred from Nelson, B.C., to New Westminster, B.C., as divisional engineer by the British Columbia Department of Public Works.

Mr. Miard joined the department at Nelson in 1947 coming from Lethbridge where he was assistant district airway engineer for the Department of Transport. He was appointed divisional engineer at Nelson in 1950.

A 1933 graduate in civil engineering of the University of British Columbia, Mr. Miard was employed by the Department of Mines and Resources until 1940 at which time he joined the Department of Transport.

**T. M. MacIntyre,** M.E.I.C., is associated with Cartier Construction Limited in Labrieville, Que. He was previously associated with Gulf Power Company in Clarke City, Que.

Mr. MacIntyre graduated in civil engineering from Queen's University in 1920.

**Andrew G. Watt,** M.E.I.C., has been appointed general manager of the new structural steel fabrication and steel material sales division of Consolidated Steel Corporation Ltd. in Saint John, N.B.

Mr. Watt, who was formerly assistant chief engineer of the St. John Drydock & Shipbuilding Co. Ltd. in Saint John, is immediate past chairman of the Saint John Branch of the Engineering Institute.

**Otis S. Cox,** M.E.I.C., district engineer of the Department of Public Works of Canada in Halifax has recently retired.

Mr. Cox was born in Upper Stewiacke, N.S. He attended public school there *things happen fast when*

**THE CURRENT SHOOTS THE CHUTE!**

*National Vulcanized Fibre barriers in the circuit breaker arc chute illustrated above really "torture" the arc—distort, elongate and tame it—so that no damage is done. Such severe service calls for excellent electrical properties and arc resistance. And, because it is a tough, strong material, vulcanized fibre also gets the nod for mechanical applications in the "breaker"—as bushings, pins, sleeves, washers, connector bars, etc. Maybe these applications will give you a clue as to how this material can help you. If you'll give us an idea of your intended end-use, we'll send appropriate technical and descriptive literature. Write to either of the addresses listed, attention Dept. AB-12.*

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In a circuit breaker when current overload occurs, the contacts open . . . a violent arc jumps across the gap . . . then is drawn upward through the breaker's "safety valves"—the arc chutes. In a split second, intense heat and dangerous gases are dissipated . . . the arc is quenched without harm to life or equipment.

National Vulcanized Fibre plays a vital and reliable role in this drama of industrial safety. It is utilized widely as a basic material in the sides and plates of arc chutes. Its inherent properties enable it to stand up under the rigorous punishment dealt by electrical energy "on the loose," and to help curb it effectively! These properties also make National Vulcanized Fibre the ideal material for dozens of other applications in power switching equipment and in thousands of uses within the broad electrical field. High dielectric and mechanical strength—excellent machinability—splendid formability—lightness of weight—great resistance to heat, shock and abrasion . . . name what you want in characteristics and capacity, and National Vulcanized Fibre is likely to have it, and more!

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ATLANTIC & HANNA AVES., TORONTO • 1411 CRESCENT ST., MONTREAL and later graduated from Colchester County Academy. After pre-engineering study at Dalhousie University, he graduated from the Nova Scotia Technical College in 1913 with the degree of B.Sc. in civil engineering. While at the technical college he was employed for a time on the engineering staff of the Dartmouth to Deans railway for the Department of Railways and Canals.

Upon graduation Mr. Cox accepted the position of assistant engineer with the Department of Public Works of Canada at Halifax. In 1931 he was promoted to senior assistant engineer and in 1935, to district engineer for the province, which position he held until his retirement.

Mr. Cox has always been active in the interests of his profession. He is a charter member and past councillor of the Association of Professional Engineers of Nova Scotia, and has been associated with the Engineering Institute since its beginning.

**J. J. Traill,** M.E.I.C., has resigned his position as consulting hydraulic engineer with the Hydro-Electric Power Commission of Ontario and has opened offices as hydraulic consulting engineer in Toronto.

A civil engineering graduate of the University of Toronto, class of 1906, Mr. Traill has been associated with the Commission for many years.

**Lt. Col. D. H. Rochester,** O.B.E., M.E.I.C., is assistant adjutant general (plans) at Army headquarters in Ottawa. He was formerly on the Canadian Army Staff College in Kingston.

A 1941 mining engineering graduate of the University of Toronto, Lt. Col. Rochester was awarded the O.B.E. for services in Korea.

**W. H. Ackhurst,** M.E.I.C., has been transferred by Canadian General Electric Co. Ltd. from Toronto to Peterborough where he will serve as manager of the sales, motor and control department.

A graduate in electrical engineering of the Nova Scotia Technical College, class of 1939, Mr. Ackhurst has been associated with the company before and after World War II during which he served as a captain in the Royal Canadian Electrical and Mechanical Engineers.

**Paul Pelletier,** M.E.I.C., Montreal consulting engineer, has been elected a councillor for the City of Montreal in the recent civic elections.

A graduate in civil engineering of Ecole Polytechnique, class of 1938, Mr. Pelletier began his engineering career as assistant to the chief engineer of the Montreal Catholic School Commission. In 1940 he was appointed consulting engineer to the Montreal Coke and Manufacting Company, and a year later, became service manager of the Montreal Coke and Manufacturing Company (LaSalle Coke Company).

In 1942 he was loaned by the LaSalle Coke Company to Collet Frères, engineers and contractors, as field engineer on construction of the Westmount Tool Works of Defence Industries Limited, and the following year to the Department of Munitions and Supply as technical adviser to the Solid Fuel Controller in Montreal.

In 1946 he became consulting engineer with Creaghan & Archibald of Montreal, and a year later, was appointed vice-president and chief engineer of Frank Ross Construction Co. Ltd. in Montreal.

Mr. Pelletier opened his own offices as a consultant in Montreal in 1952.

He is a member of the Corporation of Professional Engineers of the Province of Quebec.

**J. R. Grant,** M.E.I.C., and **T. B. Williams,** M.E.I.C., have been granted honorary life membership in the Association of Professional Engineers of British Columbia.

A graduate in civil engineering of Queen's University in 1905, Mr. Grant was one of the founder members of the British Columbia Association of Professional Engineers, becoming registered in 1920, and later serving as a member of the Council.

He came to British Columbia in 1908 and served overseas with the Royal Engineers in the First World War. Since that time he has been identified with many of the outstanding civil engineering developments in the province, including the Pacific Great Eastern Railway, the Greater Vancouver Water District intakes and reservoir, and Vancouver's Burrard Bridge. He was also a consultant on the new Granville Street Bridge in Vancouver.

Dr. T. B. Williams, until his retirement last year, was controller of the coal, petroleum and natural gas branch of the British Columbia Department of Lands. He is a graduate in mining engineering of Queen's University and holds a Ph.D. degree in geology from the University of Wisconsin.

He is a founder member of the Association of Professional Engineers of Alberta, where he discovered and brought in the "Red Coulee" oil field. In early years he was active in coal mining and later was prominent as a consultant in both mining and oil developments in Alberta before he came to British Columbia in 1946. He is the author of many technical publications such as "Coking Processes for Western Canada", "Geology of the Comox Coal Basin", and "Identification of Coals".

**C. D. Worby**, M.E.I.C., has been appointed district engineer for the Saskatchewan district of Canadian National Railways with headquarters in Saskatoon. He was formerly assistant engineer, maintenance of way, in Winnipeg.

A native of Winnipeg, Mr. Worby joined the Canadian National Railways in 1939 as a chainman at Atikokan. He served with the Royal Canadian Air Force from 1943 until 1945 and upon his return to the railway worked as draughtsman in Winnipeg, advancing to assistant division engineer in 1950. He was appointed division engineer at Regina in 1952 and later the same year became regional engineer of track at Winnipeg. He was promoted to assistant engineer, maintenance of way, early this year.

**Professor Alan H. Meldrum**, M.E.I.C., received his Ph.D. in petroleum engineering from the Pennsylvania State University in August of this year, and has been appointed associate professor of mining engineering at the University of North Dakota.

Professor Meldrum received his B.Sc. degree in chemical engineering from the University of Alberta in 1938, and his B.S. and M.S. degrees in petroleum engineering from the State of Oklahoma University in 1947 and 1949, respectively.

**Paul G. W. Walker**, M.E.I.C., former Penticton city engineer, has recently established a private practice in Vancouver.

Immediately before and after the war during which he saw active service as a pilot in the R.A.F., Mr. Walker was associated with Sir Alex Gibb and Partners in London, England. He came to Canada in 1947 as assistant city engineer of St. Thomas, Ont. and later spent two years in structural and hydraulic design work for Spruce Falls Power and Paper Company and for Longlac Pulp and Paper Company. He went to Penticton as city engineer in 1951.

Mr. Walker received his M.A. degree in mechanical sciences from Cambridge University in 1941.

**B. Paul Wisnicki**, M.E.I.C., associate professor at the University of British Columbia, is on leave of absence and is now residing in Montreal where he is serving as structural engineer with the Canadian section, St. Lawrence River Joint Board of Engineers.

Mr. Wisnicki is a mechanical and aeronautical engineering graduate of Lwow University, Poland, class of 1936.

**George Olson**, M.E.I.C., has been transferred by the Northwest Territories Power Commission from the Snare River Power plant in the Northwest Territories, where he served as superintendent, to Ottawa where he is electrical engineer on the head office staff.

Mr. Olson is a 1950 graduate of the University of Alberta in electrical engineering.

**R. M. Heaton**, JR.E.I.C., is assistant electrical engineer with H. G. Acres in Great Falls, Man. He was formerly associated with Canadian Westinghouse Co. Ltd. on field work.

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**Stelco High-Strength Bolts** bring to the construction industry the many proven benefits of high-tensile bolting for structural steel joints. This tested, accepted, and rapidly growing technique offers the following marked advantages over other methods:

**Economy.** High-Strength bolting has consistently shown on recent installations definite savings when compared with riveting. The initial cost of the bolt is higher, but reduced labour more than compensates for the difference.

**Speed.** High-Strength Bolts can be installed at an average rate of 150 per man day. To drive 200 rivets per day requires four men, plus a furnace.

**Strength.** Joints fastened with High-Strength Bolts are considerably stronger — both statically and in fatigue — than those fastened with either hot or cold driven rivets. This has been proven in both laboratory and field tests.

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5411 I.B.

Mr. Heaton is a graduate of the Institution of Electrical Engineers of Great Britain.

**J. M. Bird,** Jr.E.I.C., has been promoted to the position of general manager of General Equipment Limited in Vancouver.

A graduate in mechanical engineering of the University of British Columbia in 1946, Mr. Bird previously held the position of manager.

**G. J. Chalmers,** Jr.E.I.C., formerly manager of the midwestern office of Ross Engineering of Canada Ltd. in Port Arthur, Ont., has been transferred to the head office of the company in Montreal as Canadian sales manager.

Mr. Chalmers is a 1947 McGill University graduate in mechanical engineering.

**E. N. MacKay** Jr.E.I.C., has been transferred as A & S district manager to Montreal from Quebec City by the Canadian Westinghouse Supply Company.

Mr. MacKay is a 1947 graduate of McGill University.

**D. A. H. Farmer,** Jr.E.I.C., is on the staff of the canal services branch of the Department of Transport in Ottawa. He was formerly sales engineer with Canadian Westinghouse Co. Ltd., Ottawa.

Mr. Farmer graduated from Queen's University in electrical engineering in 1947.

**Rudolph John Scarabelli,** Jr.E.I.C., a 1947 civil engineering graduate of McGill University, has joined Spino Construction Limited in Montreal.

Since graduation he has been employed by Grant Mills Ltd., Montreal, general contractors; the Department of Public Works in Ottawa; and Gardner-Denver Company (Canada) Ltd. in Quincy, Ill.

**John David Dorey,** Jr.E.I.C., a 1948 engineering physics graduate of McGill University, is now systems engineer with Rogers Majestic Electronics Ltd. in Toronto. He was formerly associated with Federal Electrical Manufacturing Co. Ltd., as assistant project engineer

**G. A. Robb,** Jr.E.I.C., until recently associated as design engineer with the New Brunswick International Paper Company in Dalhousie, New Brunswick, has joined the staff of Atomic Energy of Canada Ltd., in Chalk River, Ont.

Mr. Robb, who has been chairman this year of the Northern New Brunswick Branch of the Institute, graduated in mechanical engineering from McGill University in 1948.

**R. L. Payer,** Jr.E.I.C., who has been associated with the Aluminum Company of Canada Ltd. in Montreal, is now on the staff of N. Slater Co. Ltd. in Hamilton, Ont.

He is an electrical engineering graduate of the University of New Brunswick, class of 1948.

**R. R. Cheyne,** Jr.E.I.C., is now in his second year of the M.B.A. course in business administration at the University of Western Ontario.

He was formerly on the staff of the Demerara Bauxite Co. Ltd. in British Guiana, and with General Steel Works Ltd. in London, Ont.

Mr. Cheyne graduated in mechanical engineering from the University of Saskatchewan in 1949.

**W. M. James,** Jr.E.I.C., manufacturing engineer with Canadian Westinghouse Co. Ltd. in Hamilton, has joined the H. O. Trerice Company in Toronto as branch manager.

He is a 1949 graduate in mechanical engineering of the Nova Scotia Technical College.

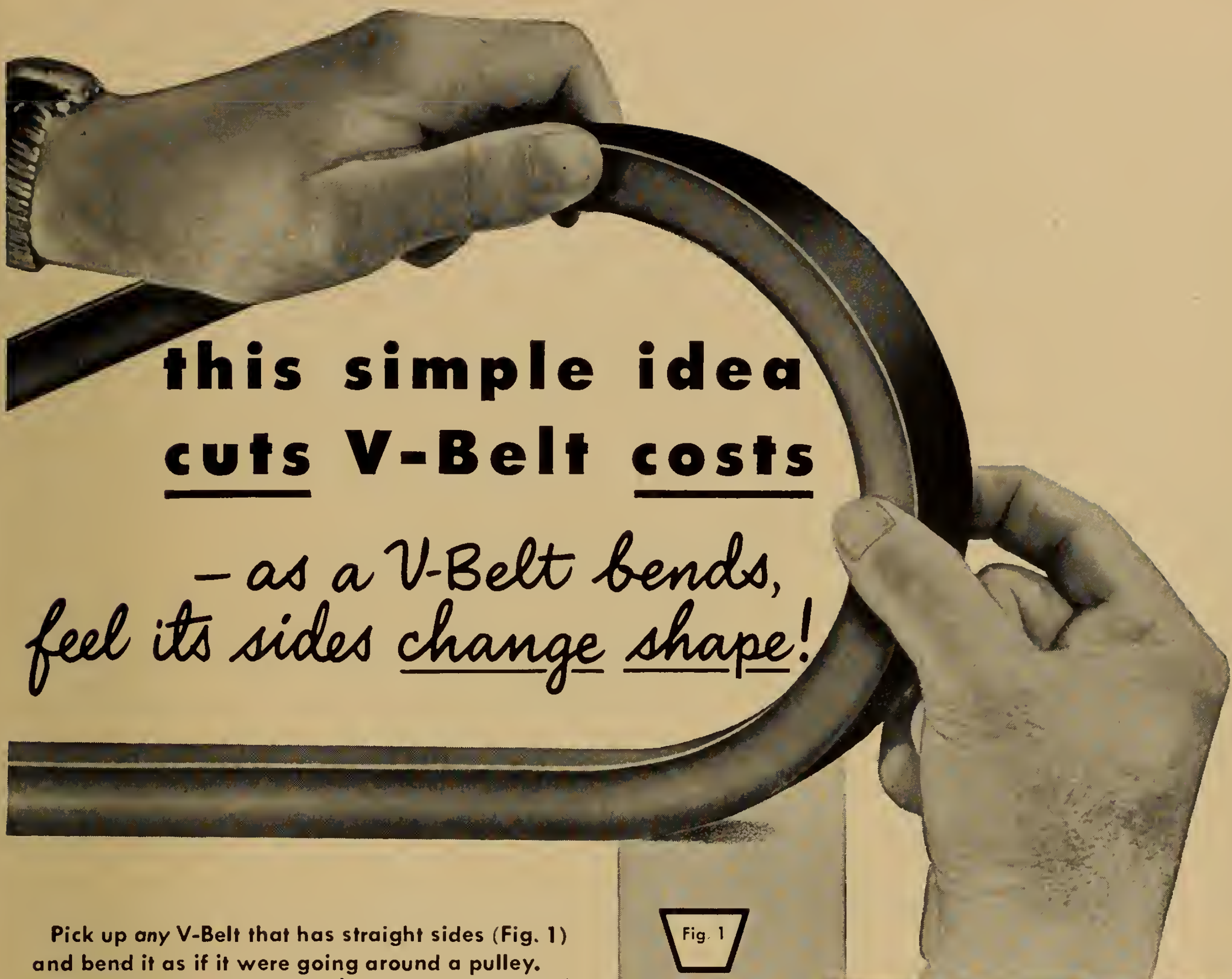
**A. A. Hills,** Jr.E.I.C., has been promoted to the position of senior mechanical engineer in the research department of Ferranti Electric Limited in Mount Dennis, Ont. He was previously with the research department.

Mr. Hills graduated with honors in physics from Queen's University in 1949.

**Ivan G. MacFarlane,** Jr.E.I.C., who was granted his M.Eng. degree in civil engineering by McGill University in October, is now on the staff as assistant research officer of the building research division of the National Research Council.

Mr. MacFarlane received his B.Eng. degree from the University of New Brunswick in 1949.

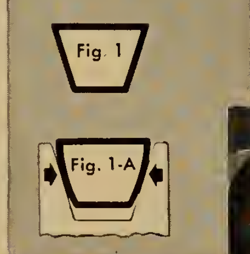
**Julius Weiss,** Jr.E.I.C., formerly associated with Nicolas Fodor & Associates in Toronto, has joined the staff of Flanagan & Black in Toronto.



# this simple idea cuts V-Belt costs

## — as a V-Belt bends, feel its sides change shape!

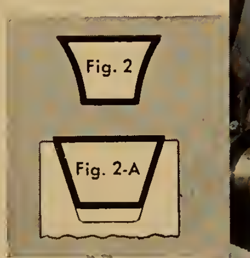
Pick up *any* V-Belt that has straight sides (Fig. 1) and bend it as if it were going around a pulley. At the same time, *grip its sides* with your fingers! You will feel the sides *bulge out* as in Fig. 1-A. Clearly, the bulging belt is forced to press *unevenly* against the V-pulley—and this concentrates wear at the points shown by arrows (Fig. 1-A).

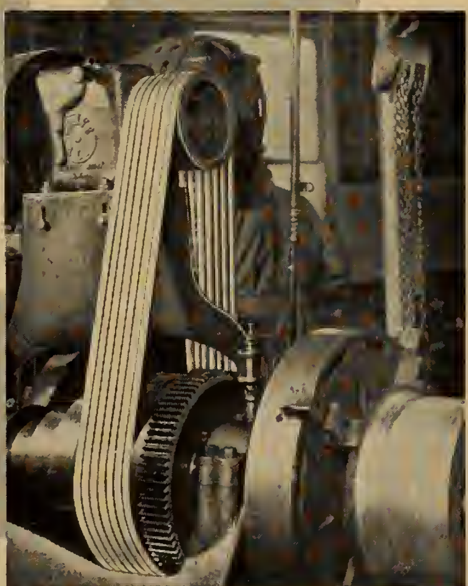



**Now bend the belt with CONCAVE SIDES** (U.S. PAT 1813698)

**. . . the GATES VULCO ROPE (Fig. 2)**

Instead of *bulging*, the precisely engineered CONCAVE SIDES merely *fill out* and become perfectly straight. This belt, when bent, *precisely fits* its sheave groove (Fig. 2-A). The sides press *evenly* against the V-pulley. Therefore, wear is distributed *uniformly* across the full width of the Gates Vulco Rope—and this means longer belt life and *lower belt costs* for you!



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*Gates distributor stocks and drive engineering service are quickly available throughout Canada*

He is a 1949 graduate in mechanical engineering of McGill University.

**M. E. Thompson,** JR.E.I.C., formerly associated with Sperry Gyroscope Co. of Canada Ltd. in St. Hubert, Que., has joined the Bristol Aeroplane Company in Winnipeg.

Mr. Thompson graduated in electrical engineering from the University of Manitoba in 1949.

**Arthur P. Earle,** JR.E.I.C., has been promoted from the position of assistant superintendent to that of superintendent of the generation and transmission department of the Shawinigan Water and Power Company in the Three Rivers district.

Mr. Earle has been associated with the company since his graduation in electrical engineering from McGill University in 1949.

**Bruce Emslie Moore,** JR.E.I.C., a 1950 graduate in engineering and business of the University of Toronto, is now on the staff of the Canadian Underwriters Association in Montreal.

He was formerly associated with William Kennedy and Sons Ltd. in Owen Sound, and with National Table Company Ltd. in that city.

**A. R. Sandall,** JR.E.I.C., until recently with the Ontario Northland Railway, has joined the National Steel Car Corporation in Hamilton.

Mr. Sandall received his B.Eng. degree in mechanical engineering from the Nova Scotia Technical College in 1950.

**Ferris J. Abbass,** JR.E.I.C., is installation engineer of Cossor (Canada) Limited, designers and manufacturers of electronic equipment in Halifax.

A graduate in electrical engineering of the Nova Scotia Technical College in 1950, Mr. Abbass was previously foreman in the special lamps department of Canadian Westinghouse Co. Ltd.

**G. J. Foley,** JR.E.I.C., is branch manager of Defence Construction (1951) Ltd. in Winnipeg. Prior to accepting this position he was army projects engineer in Ottawa and building estimator Central Housing and Mortgage.

Mr. Foley is a 1950 graduate in civil engineering of the University of Saskatchewan.

**Charles E. G. Smith,** JR.E.I.C., a graduate in electrical engineering of the University of Toronto, class of 1950, has resigned his position with Pembroke Electric Light Co. Ltd., and has joined Atomic Energy of Canada Limited, engineering division, in Chalk River.

**André A. Albert,** JR.E.I.C., has been transferred by the highway division of the Department of Public Works from Bathurst to Fredericton where he was employed as district highway engineer.

Mr. Albert is a 1950 graduate of the University of New Brunswick in civil engineering.

**W. D. Alexander,** JR.E.I.C., who recently received his master's degree in mechanical engineering from the University of Michigan, has been appointed test officer of the Canadian Army at the Vehicle Experimental and Proving Establishment in Ottawa.

Mr. Alexander received his B.Sc. degree in mechanical engineering from the University of Manitoba in 1950.

**William M. Wilson,** JR.E.I.C., has recently accepted the position of sales representative with the chemical division of Canadian Industries Limited in Toronto.

He was formerly associated with Building Products Limited in Havelock, Ont. and with British American Oil Co. Ltd. in Montreal.

Mr. Wilson is a 1951 mining engineering graduate of McGill University.

**Johannes DeFeyter,** S.E.I.C., a 1953 mechanical engineering graduate of the Technical University, has joined Canadian Industries (1954) Ltd. in Brownsburg, Que.

**R. G. Nicholls,** S.E.I.C., a graduate this year in mechanical engineering of the University of Manitoba, is junior mechanical engineer with the gas division of the Shell Oil Company in Calgary.

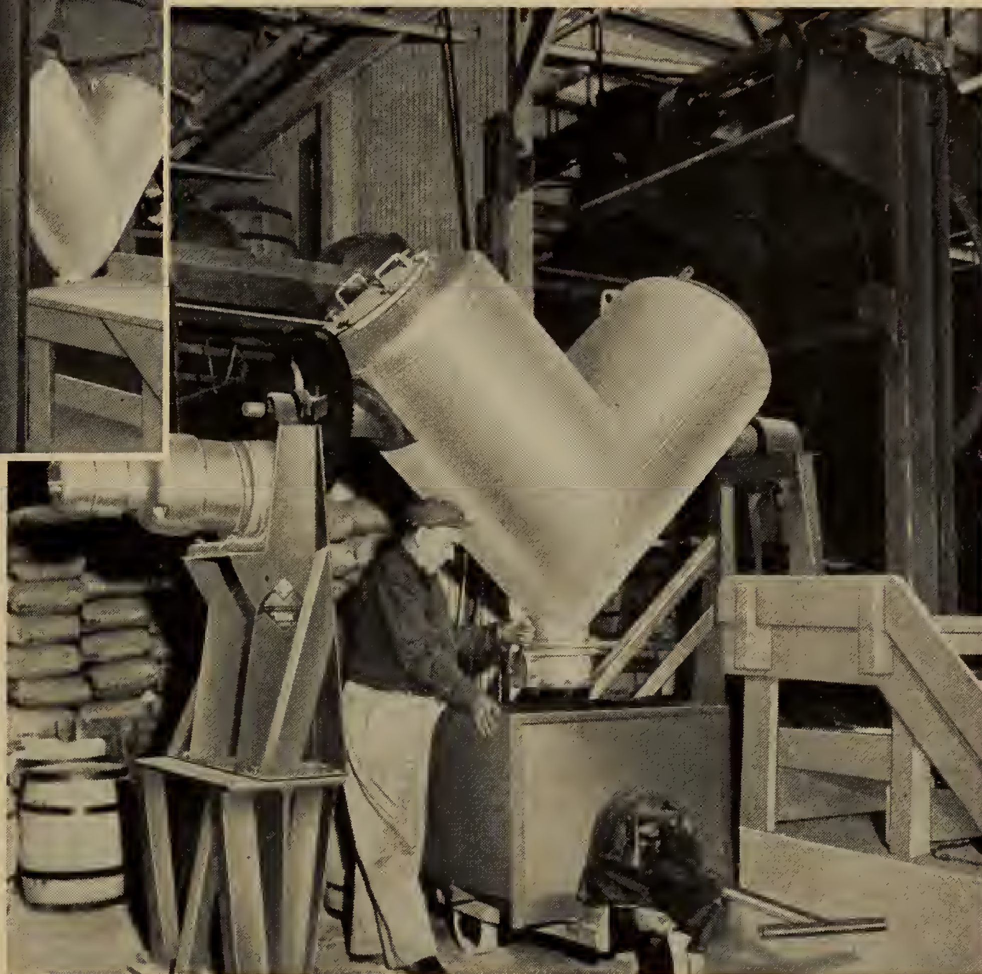
**L. A. Coles,** S.E.I.C., who graduated this year in civil engineering from the University of New Brunswick, has joined M. G. Schurman Co. Ltd., general contractors, Summerside, P.E.I.

**H. M. Tomlinson,** S.E.I.C., has been transferred by Shawinigan Engineering Co. Ltd. from Montreal to Shawinigan Falls as field engineer.

He is a 1954 civil engineering graduate of the Nova Scotia Technical College.

**Frederic Cronn,** S.E.I.C., is junior instrumentman with the Ontario Department of Highways in Toronto.

He was previously inspector with Lucas Rotax in Scarborough.



Loading and unloading a blender can be easy when it's correctly designed. Above, a worker at Precision Grinding Wheel Co., uses a skip hoist to load a p·k twin shell blender of 20 cu. ft. capacity. At right, after mixing, he opens a valve to discharge the perfectly blended mass into a mobile hopper. The smooth interior of p·k blenders are entirely free of obstructions to allow easy discharge and cleaning.

# Obituaries

*The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.*

**Robert Arthur Rankin,** M.E.I.C., president of Rankin Company Limited, consulting engineers of Montreal, passed away on August 14, 1954.

Mr. Rankin was born in Glasgow, Scotland, on November 19, 1902. He received his early education at Bellahouston Academy and the Royal Technical College in Glasgow. In 1925 he obtained his B.Sc. degree in mechanical and electrical engineering from Glasgow University, and after his arrival in Canada he received in 1933 and 1937, respectively, his M.Eng. degree in industrial economics and his M.Sc. degree in metallurgy from McGill University.

Previous to graduation from Glasgow University he was employed by Ferme Colliery, Messrs. John McNeil and Company, the Armstrong Construction Company, and the Naval Dockyard at Dalmuir, Scotland.

Mr. Rankin came to Canada in 1927 and joined the Anglo-Canadian Pulp and Paper Mills in Quebec City as supervisor of mechanical and electrical installations, and later, as supervisor of power plant and general mill operation. In 1930 he was appointed manager of the Morton Engineering and Drydock Company in Quebec.

The following year he became engaged in general industrial consulting work in Montreal, first with Ernest Cormier, architect, on the mechanical and electrical work in *Le Petit Journal* press room and plant, the University of Montreal and the Supreme Court of Canada, as well as other projects. Then, in 1938 he formed his own consulting engineering company under the firm name of Robert A. Rankin and Company in Montreal. The services of his firm were used by the Algonquin Paper Company in Ogdensburg, N.Y., and the St. Lawrence Paper Company in Three Rivers; they were also retained by Ogilvie Flour Mills Company Limited and the Brown Corporation (Canada) in the supervision of all maintenance engineering and development of new projects. The name of the company was subsequently changed to Rankin Company Limited.

Mr. Rankin was a member of the Corporation of Professional Engineers of Quebec.

He joined the Engineering Institute as a Member in 1941.

**William Henry Riehl,** M.E.I.C., city engineer of Stratford, Ont., for the past 26 years, died suddenly in Boston on August 16, 1954, during a holiday motor trip.

Mr. Riehl was born in Sebringville, Perth County, Ont., on April 30, 1897. He received his B.A.Sc. degree from the University of Toronto in 1920. Previous to graduation he was employed as rodman by Canadian Pacific Railways and as transitman by the Grand Trunk Railway.

In 1920 he was appointed assistant engineer for the City of Stratford, and five years later, accepted the position of engineer of the Town of Brampton. He returned to Stratford as city engineer in 1928.

Mr. Riehl joined the Engineering Institute as a Student in 1919, transferring to Associate Member in 1925, and to Member in 1940.

**Lawrence Sulis Cossitt,** M.E.I.C., plant engineer with the Turcot works of Canadian Car and Foundry Co. Ltd. in Montreal, passed away on May 9, 1954.

Mr. Cossitt was born at Smith's Cove, N.S., on May 3, 1899. He attended Acadia University, interrupting his studies to serve during World War I as a lieutenant in the Royal Air Force. He received his B.Sc. degree in mechanical engineering in 1924, but previous to that was employed in machine shop work with Clarke Bros. Ltd. in Bear River, N.S., and as draughtsman with Atlantic Sugar Refineries.

Upon graduation Mr. Cossitt became production clerk with Northern Electric Co. Ltd. In 1926 he joined The Robert Mitchell Company as a mechanical draughtsman, and was promoted to the position of estimator in 1929. In 1930 he joined the Canadian Car and Foundry Company in the master mechanics department. He was subsequently associated with R.C.A. Victor Limited and with Canadian Marconi Limited in Montreal, after which he returned to Canadian Car and Foundry Limited in 1938 as plant engineer.

An outstanding Canadian fencer, Mr Cossitt was a past-president of the Province of Quebec Fencing Association, and a past-chairman of the National Fencing Committee of the A.A.U. of C. Not long ago he voluntarily gave up the opportunity of fencing for Canada in the Olympic and Empire Games.

Mr. Cossitt joined the Engineering Institute of Canada as a Student in 1921, transferring to Junior in 1926, to Associate Member in 1932, and to Member in 1940.

**Archie Menso Allen,** M.E.I.C., former general plant superintendent of Alberta Government Telephones in Edmonton, passed away on August 11, 1953.

Mr. Allen was born at Cameron, New York on July 17, 1883. After receiving his public and high school education and completing private study, he joined the Century Telephone Construction Company as lineman and inspector in 1901. In 1909 he became inspector with the Northwest Telephone and Telegraph Company.

He joined Alberta Government Telephones in 1910 as district foreman and chief inspector, becoming local agent and wire chief in 1914. He was appointed plant chief in 1920 and construction engineer in 1929, and was subsequently named general plant superintendent, which position he held until his superannuation in 1948.

Mr. Allen joined the Engineering Institute as an Associate Member in 1937, and transferred to Member in 1940.

**Alexander Andrew Vorres,** JR.E.I.C., purchasing engineer with Canadian Industries Limited in Montreal, passed away on October 31, 1954.

A native of Athens, Greece, Mr Vorres was born on May 8, 1926. He received his general education at the American High School of Athens, and in 1946 entered Queen's University, Kingston, Ont., where he graduated in chemical engineering in 1950. In the summer of 1947 he served as assistant surveyor for the County of Waterloo

A sports enthusiast, Mr. Vorres was particularly interested in hunting, swimming, tennis, golf, sailing and football. He was also keenly interested in writing and painting, both of which he pursued. While at Queen's he served not only as a member of the staff, but also as editor of the "Tricolor".

Mr. Vorres joined Aluminum Company of Canada, Limited in Arvida in 1951. Two years later he accepted the position of purchasing engineer with Canadian Industries Limited in Montreal. At the time of his death he was preparing to take over a new position with Aluminum Company of Canada, Limited in Jamaica.

Mr. Vorres joined the Engineering Institute as a Student in 1948 and transferred to Junior Member in 1952.

**John Hiebert,** JR.E.I.C., of A. V. Roe (Canada) Limited, lost his life on August 23, 1954, in a crash which occurred during test flight of a CF-100 jet aircraft out of Malton, Ont. Mr. Hiebert had been serving as observer at the time.

Born in Ekatrinaslav, Russia, on November 27, 1920, Mr. Hiebert received his high school education at Arnaud, Man. During World War II he served as navigator with the Royal Canadian Air Force, and upon his discharge, entered the University of Manitoba, graduating with a B.Sc. degree in mechanical engineering in 1950.

Previous to graduation he was employed during the summers as operator with the Hudson Bay Mining and Smelting Company in Flin Flon, and as grade inspector, instrumentman and assistant resident engineer with the Manitoba Department of Highways.

After receiving his degree, Mr. Hiebert joined Universal Contsruction Co. Ltd. as project engineer in Winnipeg, and two years later became associated with the engineering staff of A. V. Roe Canada Limited in Malton.

He joined the Engineering Institute as a Student in 1949, and transferred to Junior Member in 1952.

# Employment Service

**THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.**

**NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.**

**REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.**

**INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.**

## SITUATIONS VACANT

### CHEMICAL

GRADUATE CHEMICAL ENGINEER from Canadian University required by manufacturer of organic chemical products. Attractive opening in new project located in Ontario. Seven years of practical experience production and process development is required. File No. 4900-V.

CHEMICAL SALES OPPORTUNITIES for engineering graduates. Young graduates to develop thru-on-the-job training within sales organization and graduates with sales experience in chemical or allied field. File No. 4964-V.

CHEMICAL ENGINEERS required for refinery located in South America. Must be experienced in process engineering including design, economic studies, and/or scheduling of operating programs Write giving age, education, marital status and complete details of experience. File No. 4970-V.

CHEMIST OR CHEMICAL ENGINEER for control department of a newsprint and specialty mill in P.Q. Preferably some experience in pulp and paper. Duties to include development and mill investigations. Give details of experience and references in initial letter. File No. 4982-V.

CHEMICAL ENGINEER or chemist with experience in analysis of metals. Working knowledge of spectographic techniques and practical physical chemistry preferred. Qualified to set up and operate laboratory for control of foundry analysis. File No. 5026-V.

### CIVIL

AN OUTSTANDING OPPORTUNITY for a qualified graduate engineer. Applicants must have had extensive supervisory experience in the construction of highways, dams, tunnels, bridges and like projects, together with a thorough knowledge of estimating and the preparation of tenders. This is a permanent position with an established firm. Write giving full particulars. File No. 4975-V.

WORLD RENOWNED INSTITUTE requires immediately a research engineer to work full time in the materials field for a highway research project. Work includes as well as practical testing, emphasis at the present time on bituminous pavement problems. Young civil engineer with at least a bachelor's degree. He should be interested in research and be able to work on his own. Experience in the materials field will be helpful. The opportunity is given to take one course per term. The salary is in the range of about $350 to $450 per month depending upon education and experience. File No. 4984-V.

CIVIL ENGINEER required by a municipal corporation in Western Canada. Recent graduate having some experience in railroad maintenance preferred. Other duties will cover the design and construction of water and sewage works. This job offers a good variety of experience in the municipal engineering field. File No. 4991-V.

CIVIL ENGINEER required for power department of large industrial concern. Duties include office duties and occasionally field work not necessarily in Canada, in the field of hydro-electric power investigations and development. Applicants must have had fifteen years previous experience. Fluency in French or Spanish in addition to English essential. File No. 4997-V.

ASSISTANT MUNICIPAL engineer for the Town of Pointe Claire, P.Q. Population 12,000. Preferably with experience in maintenance and construction of streets surface water drainage, sewage and watermains. Applicants will require to state qualifications and salary expected. File No. 4999-V.

YOUNG CIVIL ENGINEER required with 3 years or so experience in construction, to supervise service station construction. Location Ontario. File No. 5003-V.

CONSTRUCTION ENGINEER to act as general superintendent for a rapidly expanding organization of general contractors in Toronto. Minimum 10 years outside experience as general superintendent. Main requisite practical experience. This position is that of assistant to general manager, and carries excellent salary and opportunity for right man. Please reply in confidence stating age, marital status, previous employer and references. File No. 5005-V.

THE CITY OF HAMILTON requires an assistant engineer. Must be a professional engineer holding a degree of civil engineering as recognized under the Professional Engineers Act of Ontario. Applicant should have a minimum of ten years experience in the design, construction and supervision of engineering projects particularly as related to a large municipality. Will be required to assist and to work in close co-ordination with the city engineer. This position offers an attractive salary, future security and an opportunity for advancement. Reply stating age, experience, education, and relevant information. File No. 5009-V.

PROFESSIONAL ENGINEER for position of manager of moderate sized construction company. Broad experience in estimating, construction and installation supervision essential. Age in mid forties to work from Toronto office serving mining and newsprint industries across Canada. File No. 5010-V.

RECENT GRADUATE CIVIL engineer required in the track section of a large transportation company in Montreal. File No. 5011-V.

STRUCTURAL DESIGN ENGINEER, $6,420 to $7,200, department of Public Works, Ottawa. Details and application forms at nearest Civil Service Commission Office, Post Office or National Employment Office. Quote Competition 54-1259. File No. 5015-V.

GRADUATE CIVIL ENGINEER for responsible duties in connection with hydraulic research on a large, outdoor erodible-bed tidal river model of the Fraser River estuary on the campus of the University of British Columbia. Must be able to carry out tests, analyze results and prepare engineering reports. Problems deal mainly with river regulations and the maintenance of navigable channels. Reply stating age, experience education, salary expected. File No. 5017-V.

CHIEF DRAUGHTSMAN required. Thoroughly experienced chief draughtsman for structural steel plant. Complete details of educational and employment background and salary required. File No. 5047-V.

ESTIMATOR REQUIRED with experience in the estimating of the fabrication and erection of structural steel. Location Ontario. File No. 5047-V.

DESIGN ENGINEERS wanted by a rapidly expanding firm specializing in prestressed and precast concrete throughout Canada. Several years experience in reinforced concrete is required. Positions offer salary, participation in company's hospitalization and pension plans. Applicants should give full details including age, education, experience, marital status, salary requirements. Personal interview will be arranged with selected applicants. File No. 5049-V.

ESTIMATOR experienced in industrial buildings, bridges and heavy construction required by expanding firm operating throughout Canada. Position offers salary, participation in company's hospitalization and pension plans. Applicants should give full details, including age, education and background, experience, marital status, salary requirements. File No. 5049-V.

SALES ENGINEER for promotion and sales in professional field with background in structures and construction required by firm specializing in prestressed and precast concrete throughout Canada. Position offers salary and commission, participation in company's hospitalization and pension plans. Applicants should give full details including age, education and background, experience, marital status, salary requirements. File No. 5049-V.

CIVIL ENGINEER required by pulp and paper company situated in the Maritime Provinces. He will be in charge of lay-out in the field and also design and draughting in the office. File No. 5053-V.

### ELECTRICAL

CITY IN WESTERN CANADA requires an electrical engineer. Duties: to prepare reports on problems of electrical distribution and utilization; to consult with large wholesale power customers concerning their electrical supply; to maintain technical records and perform related engineering tasks as required. Salary $335 to $408 per month (graduated scale). Qualifications: graduation in electrical engineering from a recognized university with some experience, preferably in electrical distribution system work. File No. 4976-V.

SENIOR DESIGN ENGINEER with a degree in electrical engineering is required for our rotating machines, direct current design section. Applicants should be between 30-45 years of age, with at least six years experience on design of rotating electrical direct current machines in all sizes, including motors, generators, convertors and rotating regulators. He must possess ability to organize, plan, schedule, promote cost reduction and product improvement in engineering. In addition, he must have a thorough knowledge of direct current machine application, and the ability to promote teamwork. This is a senior appointment with excellent opportunity for promotion. Reply in confidence, giving full personal resume, experience, salary expected. File No. 4980-V.

SENIOR DESIGN ENGINEER required with a degree in electrical engineering for our rotating machines. Small motor design section. Applicants should be between 30-45 years of age, with at least four years experience on design of all types of fractional horsepower motors. He must possess ability to organize, plan schedule, promote cost reduction and product improvement in engineering. In addition he must have a thorough knowledge of small motor application and the ability to promote teamwork. This is a senior appointment with excellent opportunity for promotion. Reply in confidence, giving full personal resume, experience, salary expected. File No. 4980-V.

AN OTTAWA ORGANIZATION requires research engineers to investigate problems in the practical application of electro thermal aircraft de-icing. This will include tests in flight and in icing tunnels, and the development of heater pads, and control in co-operation with aircraft firms. University graduation in electrical engineering with experience in aeronautical engineering and preferably in aircraft electric design and development is required. Flying experience is desirable. Salary up to $5,750. per annum depending on qualifications. Apply by letter and enclose resume of qualifications and experience. File No. 4996-V.



ELECTRICAL ENGINEER required by an Eastern Township paper mill. Recent graduate for layout work, procurement and installation of apparatus for paper mill under supervision of superintendent, apply stating age, qualifications and experience. File No. 5019-V.

GRADUATE ELECTRICAL ENGINEER to work in electrical department of paper mill in the Province of Quebec as assistant to the electrical superintendent. Paper mill experience desirable but not prerequisite. Applicant to write giving age, education, experience and salary requirements. File No. 5027-V.

ELECTRICAL SALES ENGINEER required by manufacturer of switchboards high and low tension, panelboards, bus ways and switches to cover Toronto district. Opportunity for the right man to become district sales manager. File No. 5034-V.

YOUNG ELECTRICAL ENGINEER to be employed as sales engineer in the storage battery division of manufacturer located in Montreal. File No. 5038-V.

TWO COMPETENT EXPERIENCED GRADUATE electrical engineers with approximately 10 years experience U.S. or Canadian public utilities, in design, operation and maintenance of distribution facilities in established rapidly growing utility located South America. Reply giving resume education, experience, and personal data. File No. 5041-V.

ELECTRICAL ENGINEER required as junior or assistant distribution engineer. Graduate with at least 3 years field experience operating U.S. or Canadian public utility. Permanent position with long established consulting organization New York. Some travel Latin America necessary in future. Knowledge of Spanish or Portuguese useful. Salary commensurate with experience. Reply giving age, education, experience and personal particulars. File No. 5042-V.

FIVE JUNIOR ELECTRIC ENGINEERS required by Western Utility. Two engineers for hydro-generating stations, one engineer for communications and relay and plant metering, one engineer for sub-station and local distribution systems, and one engineer for system planning and design division. File No. 5044-V.

ELECTRICAL ENGINEER required by transformer manufacturing company in Manitoba. Applicants should have a degree in electrical engineering preferably from a Canadian university, be interested in design work and have worked for a utility or manufacturing company for one or two years. Reply giving details of experience, age, qualifications and proposed salary. File No. 5046-V.

AN ELECTRICAL ENGINEER required to design telephone cable. Prefer an experienced man but will be pleased to review applications from anyone interested in learning this field. Permanent position and salary will depend upon experience and qualifications. Location Ontario. File No. 5052-V.

### MECHANICAL

MECHANICAL ENGINEERS REQUIRED for refinery located in South America. Must be thoroughly qualified and experienced in design of refinery or chemical plant equipment including piping, pressure vessels heat exchangers, etc. Write giving age, education, marital status and complete details of experience. File No. 4970-V.

MECHANICAL ENGINEER required by paper mill located in Province of Quebec with head offices in Montreal. Applicant should have some paper mill experience or interest to be trained for such a position. File No. 4972-V.

YOUNG MECHANICAL ENGINEER required for sales work. Must be energetic with a good personality and the ability or a real desire to sell. Some knowledge of heating and pumping equipment and their applications desirable. Location, Toronto. Good opportunity with long established business concern. Write giving full particulars including training, experience, age and marital status. File No. 4981-V.



MECHANICAL ENGINEERS required for sales positions with prominent Canadian manufacturer. Experience in gear and mechanical power transmisison field would be an asset. Will be located in Ontario or Quebec. Write giving full details of training, experience and salary desired. File No. 4988-V.

JUNIOR DESIGN ENGINEER to be a graduate mechanical engineer, required for designing and making layouts of piping and equipment installations in a chemical engineering plant. Two years experience essential. Location Ontario. File No. 4990-V.

SENIOR MECHANICAL ENGINEER. Salary up to $8,200. Department of Public Works Ottawa. Details and application forms at nearest Civil Service Commission Office, Post Office or National Employment Office. Quote No. 54-1211. File No. 4993-V.

RECENT MECHANICAL GRADUATE or one with evidence or interest in mechanical or technical problems and experience or aptitude for sales. He should be bilingual and able to deal with all levels of personnel and management. The work involves study of actual conditions related to the use of tires and formulation of procedure and policies which must be sold at the level of top management. This offers an excellent opportunity to develop a highly interesting field of customer contact and product research. For the right person a car will be provided. File No. 4995-V.

GRADUATE MECHANICAL ENGINEER interested in a career in Latin America with a Canadian owned electric light and power utility company located Maracaibo, Venezuela. Age limit 30 years and should have 5 years experience in a steam electric generating station. Immediate prospects for promotion to assistant production superintendent and ultimately to executive position if qualified. File No. 5013-V.

SALES ENGINEER with steam plant experience wanted as executive of a new Canadian company to sell, service and assemble combustion controls and industrial instruments in Ontario and Quebec, for well known American manufacturer. Must be native Canadian and a graduate of a Canadian engineering university. File No. 5018-V.

# MECHANICAL ENGINEER to be SERVICES ENGINEER for

**Large manufacturing plant in Eastern Ontario. Work will involve supply, distribution, and use of plant services including: steam, water refrigeration, compressed air, vacuum, ventilation and air conditioning.**

**Duties will include control of all services departments and distribution systems, supervision of maintenance of services equipment, and studies, estimates, and reports on services distribution and consumptions.**

**Must be graduate engineer, age 28 to 35, with several years of practical experience with supply of plant services. Must have the ability to take over leadership of a group and be prepared to make his own decisions and be responsible for them. Preferably should also have first class stationary engineer's certificate. Position will be permanent and offers excellent opportunity for advancement to the right man.**

**Applications should contain all necessary personal data, and full information about previous engineering experience. Reply stating experience and other relevant information to File No. 5062-V.**

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GRADUATE MECHANICAL engineer to eventually take over as production manager. Company manufactures industrial and construction products from sheet metal, plate and light structurals, including material handling products, fluorescent fixtures, special fabricated sections and weldments, plus a full line of construction products. Due to rapid growth, unlimited opportunity offered. File No. 5021-V.

MECHANICAL ENGINEER required by long established Montreal manufacturing firm to take over duties of plant engineer. Duties involve usual plant maintenance, machine shop, etc., also product development and tool design. Applicant must be English speaking and preferably between the ages of 25-35. Position offers good future and carries usual benefits including pension plan. Please reply in detail stating experience, education, etc. All replies received will be kept in confidence. File No. 5036-V.

GRADUATE MECHANICAL ENGINEER required to work on steam power plant design. Applicant must have at least five years experience on the design and layout of modern high pressure, high temperature control stations. The company is now actively engaged in extensive plant extensions of 25 and 45 MW size, the latter 900 lbs. 900°F on a long term basis, opportunity is offered for advancement in both technical and executive lines of public utility work. Salary paid will be according to ability, academic qualifications and experience. Apply giving age, training experience and approximate salary required. Location Maritime Provinces. File No. 5037-V.

MECHANICAL PLANT ENGINEER required by operating division of service organization. University graduate preferred having 5 to 10 years experience in operation and betterment of steam plants operated by U.S. or Canadian public utilities. Location New York, some travel, Spanish desirable but not essential. Reply by letter giving age, education, experience, personal data and minimum salary acceptable. File No. 5043-V.

MECHANICAL ENGINEER required by manufacturer of wire and cables located in Ontario, for plant engineering department. Preferably one who can do machine design work. Permanent position and salaries will depend upon experience and qualifications. File No. 5052-V.

MECHANICAL ENGINEER required in Edmonton, Alberta, who has graduated from a recognized Canadian University, and who has about 3-5 years experience in a chemical plant or refinery. He will deal mostly in equipment used in the manufacture of petro-chemicals and synthetic fibres. Duties will consist of general engineering, which will include design, layout and estimating. File No. 5055-V.



### MISCELLANEOUS

DIRECTOR ENGINEERING and water resources Branch. Salary up to $11,000 depending upon qualifications. Department of Northern Affairs and National Resources, Ottawa. Details and application forms at Office of the Civil Service Commission, Post Office or National Employment Office. Quote No. 54-685. File No. 4965-V.

VEHICLE EXPERIMENTAL and Proving Officer. $5,100 to $5,820. Department of National Defence, Orleans, Ontario. Details and application forms at nearest office of the Civil Service Commission, Post Office or National Employment Office. Quote No. 54-1210. File No. 4971-V.

ELECTRO CHEMICAL ENGINEER for plant operating electric arc furnaces. College graduate or equivalent with two years plant experience to carry out technical investigations and process studies. Ability to picture ideas by drawings essential. A working knowledge of French, mechanically inclined, have initiative and able to work with other members of our staff are all necessary qualities. File No. 4989-V.

DESIGN DRAUGHTSMAN required for designing and making layouts of piping and equipment installations in a chemical engineering plant. Five years experience essential. Age 24 to 30. File No. 4990-V.

CONTROL ENGINEER for paper mill and pulp mills situated in urban area in the Province of Quebec. Applicants must be university graduates with a minimum of 3 to 5 years experience. Opportunity for advancement excellent. Salary commensurate with experience. File No. 4992-V.

MECHANICAL OR CIVIL ENGINEER required by large mining and milling firm in Eastern Townships for design of plant mechanical installations under supervision of a senior engineer. Will be responsible for layout, specifications, scheduling and engineering supervision of installations. Blue Cross, group life and pension plans available. Personal interview will be arranged at company's expense for suitable applicants. Reply giving full particulars including salary requirements. File No. 4993-V.

SENIOR GUN INSPECTOR with salary up to $5,500.00 per annum depending upon qualifications required by inspection service department of National Defence Ottawa. To supervise inspection and proof of light and heavy ordnance equipment in Canada. Details and application forms at Post Office, National Employment Office or Civil Service Commission. Competition No. 54-1212. File No. 4994-V.

SALES ENGINEER wanted by established transformer manufacturer, for Montreal district. Bilingual preferred. Excellent future prospects. State age, education and experience. File No. 4998-V.

AN OTTAWA ORGANIZATION requires hydraulic engineers to undertake in the hydraulics laboratory research work in either fundamental or applied studies. Fundamental work is in the field of open channel flow, wave motion, sediment transport and allied subjects. Applied studies include the development work of river regulation, harbour development and hydraulic structures-locks, dams, breakwaters and similar installations. A master of science degree with specialization in hydraulics of fluid mechanics is required. Hydraulic laboratory work is desirable but not essential. Salary up to $5,750 per annum depending on qualifications. Apply by letter and enclose a resume of qualifications and experience. File No. 5006-V.

RESEARCH CHEMICAL OR MECHANICAL ENGINEER required by pulp and paper research institute of Canada for research in unit operation and chemical reactions involved in new processes for pulp and paper manufacture. Necessary qualifications include a Bachelor's (or higher) degree in chemical or mechanical engineering and 1-5 years of pertinent experience. This offers an opportunity to gain experience in the planning, executing and reporting of engineering research projects. Salary will be commensurate with previous training and experience. Applicants should address a comprehensive resume of qualifications and career. File No. 5007-V.

THE DEFENCE RESEARCH BOARD requires electronics engineers and physicists for employment in Ottawa, Ontario. Duties: for the electronics engineers the work will be in connection with the technical administration of a development programme. The duties will include secretarial committee work contractual negotiations, liaison work, etc. There are vacancies for physicists interested in research and development on the more fundamental aspects of electronic components, e.g. dielectrics and magnetic materials. Qualifications: electronics engineers should have technical experience in the field of electronic components. Salary: starting salaries will be in the range of $3,600-$5,750 depending upon qualifications and experience. Employee benefits: there is generous provision for vacation and sick leave, superannuation and group hospital medical insurance plans, and a five day week. How to apply: application forms will be sent to qualified applicants on receipt of letters outlining qualifications and experience. Please write mentioning 54-DRP-4 to File No. 5008-V.

TWO GRADUATE MECHANICAL or electrical engineers. One as plant engineer in a small Ontario town. The other for technical and administrative work in the office of the chief engineer of the company in Montreal. File No. 5012-V.

ASSISTANT PROFESSOR of draughting. Royal Military College of Canada, Kingston, Ontario. Salary up to $5400 per annum. Civil or mechanical engineer preferred. Further information may be obtained by writing the Civil Service Commission, Ottawa. Quote Competition 54-2008. File No. 5014-V.

DESIGN AND DEVELOPMENT engineer required for modern materials handling equipment plant in Western Ontario. Must be prepared to take charge of drawing office and to deal with all matters of design and development appertaining to materials handling equipment. Salary commensurate with responsibility and experience. File No. 5016-V.

FIRM IN MONTREAL requires high calibre personnel to fill the following executive positions. Sales manager with sound engineering background and experience in the conveyor industry. Ability to negotiate at high level. Chief engineer with wide experience on design and layout of all types of heavy material handling plant. First class knowledge of bulk handling necessary. Generous salary and commission in both cases. File No. 5020-V.

AGRICULTURAL FIRM Eastern Townships required graduated and/or practical engineer to assume gradually responsibility for all plant mechanical, electrical, heating and construction problems. This is a good opportunity for a young man, preferably not over 35 years of age and which can lead to plant engineer within 3 years at a minimum salary of $5,000. The man we are looking for must have administrative ability and good personal characteristics to work up to management level Starting salary commensurate with qualifications. File No. 5022-V.

PERMANENT STAFF POSITIONS ARE available for 3 graduate engineers in layout and design, maintenance and operating department. Minimum qualifications include graduation from recognized university and 3-10 years experience preferably including alkaline pulping or paper mill design or maintenance. Salary commensurate with experience. Write giving full details of education, age, experience, marital status and references. Location Ontario File No. 5024-V.

SALES ENGINEER location Montreal required by large Canadian manufacturer for technical sales promotion of building products. Applications are invited from graduate engineers with civil or mechanical background and an aptitude for sales work. Age preferred 30 to 45. Address full details of education and experience to file No. 5023-V.

VENTILATING SALES ENGINEER required. Young man with experience in ventilation work to manage Montreal office of Fan manufacturing company. Unique opportunity for right man. Car supplied. Advise age, experience and particulars. File No. 5028-V.

CHEMICAL OR METALLURGICAL ENGINEER, class '48-'52, sales experience preferred for technical sales with growing industrial division of worldwide organization manufacturing centifuges, heat exchangers, pumps, vibrating screens for use throughout industry. Location, Ontario or Quebec File No. 5029-V.

DETAIL AND ASSEMBLY tool designers required for extensive aircraft program. Experience desired: 10 years experience in sheet metal fabrication industry with five years on aircraft tool design. Location Ontario. File No. 5031-V.

WELL KNOWN MANUFACTURING FIRM requires the services of a fully qualified industrial engineer to survey and report on manufacturing processes. Must have knowledge and experience of production methods. Knowledge and experience of the modern concept of quality control methods. Apply stating both qualifications and experience in full to File No. 5032-V.

YOUNG GRADUATE MECHANICAL engineer, age 21, to 25 to work in the Toronto area under the supervision of the chief engineer of the pump manufacturing plant. He will act in the capacity of job process engineer, prepare all bills of material, test pumping units and as experience gained, opportunity to learn design. File No. 5033-V.

ASSISTANT PLANT ENGINEER required for manufacturing plant located on the lower mainland of B.C. Good opportunity for an aggressive man. Duties to consist of plant layout, process improvement, materials handling, machinery and equipment replacement and related duties. Prefer applicant with one or two years experience after graduation. All replies will be kept in strict confidence. File No. 5035-V.

CIVIL OR ELECTRICAL ENGINEER, university graduate of two or three years' experience in civil or electrical fields and above average literary ability. Permanent employment in Ottawa with well known industrial association. Pension plan. File No. 5039-V.

SALES ENGINEER not over fifty years of age, living in Montreal area and to be responsible for the province of Quebec. Required to contact industrial, utility, and contracting companies, liberal salary for satisfactory man and excellent opportunity for advancement to executive responsibility. Only highest grade, responsible man of experience, will satisfy our requirement. Montreal interview will be promptly arranged. File No. 5040-V.

SOIL MECHANICS ENGINEER required by Vancouver engineering firm. Post graduate training essential. Two to four years practical experience preferred but not absolutely necessary. Excellent opportunity leading to responsible position for engineer with initiative and personality. Reply stating age, education and experience. File No. 5045-V.

TWO MECHANICAL OR ELECTRICAL ENGINEERS required by elevator manufacturer located in Montreal to act as sales and or service engineer. Applicants should be recent graduates, no previous experience necessary. Must be bilingual. Age 30 years or under. File No. 5050-V.

YOUNG ENGINEER or metallurgist with experience in the light metals field, either in a light metals development laboratory or as a technical service representative for a base producer of light metals. Required by large Canadian organization establishing a market for magnesium in Canada to work out of Toronto. After suitable training with parent company he will be given full responsibility and authority to increase the market. Top salary open. File No. 5056-V.

# SITUATIONS WANTED

MECHANICAL ENGINEER, age 32, Polytechnique 1945, bilingual. Employed as combustion engineer with large distributer of coal and fuel oil in Montreal. Extensive field experience on all aspects of fuel utilization, sales and service. Seeks employment with oil company or equipment manufacturers related to power engineering as combustion and/or sales engineer. File No. 2554-W.

ELECTRICAL ENGINEER, P.Eng., M.E.I.C., B.Sc. (U.N.B., 1937) age 42, married, 1 child, 7 years with large Canadian Electrical Manufacturer including test course, 2 years switchboard design and 3 years apparatus correspondence sales. Hold technical secondary school teacher's certificate with university and school teaching experience. Heating engineering experience (2 years) in the design of hot water heating systems and service of automatic steam generators. Am seeking a responsible position as industrial training supervisor, power plant engineer or other responsible position. Residing in Toronto and free to accept immediate employment anywhere. File No. 2878-W.

ELECTRICAL ENGINEER, B.Sc. (E.E.) 1950, Jr.E.I.C., age 33, married. Presently employed managerial capacity in sales and sales promotion, directing small sales staff. Present earnings in excess $5,000.00. Varied experience in sales, sales promotion, office management and with Public Utilities. Desires responsible position in sales, sales representative or in line with experience. Details of education, experience and reference upon request. File No. 3375-W.

MECHANICAL ENGINEER, Jr.E.I.C., U. of S. 1950, age 27, single. Four years experience in design and layout of steam boiler plants. Have also acted as residential engineer on some installations. Seeking interesting position with possibilities in mechanical or power field. File No. 3495-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950 graduate University of Saskatchewan. Excellent practical background combined with sales and administrative ability. Thoroughly familiar with the pulp and paper, automotive and farm implement industries. Able to work well with others. No objection to travel and will accept a position anywhere in Canada or U.S.A. Please reply to File No. 3536-W.

CIVIL ENGINEER, M.E.I.C., 1944 graduate, now residing Toronto, desires position in commerce or industry. Experienced in heavy construction, consulting, contract negotiation, administration and personnel fields. File No. 3796-W.

ELECTRICAL ENGINEER, B.Eng., McGill, 1950, P.Eng., Jr.E.I.C. C.G.E. Test Course. Experience: design; polyphase motor design and application ½ to 600 h.p., industrial; design and construction of distribution, lighting and power installations, power factor correction, frequency conversion, system control, air conditioning and plant engineering work, general; artillery officer overseas in World War II, working knowledge of French, age 35, married, three children. File No. 3859-W.

MECHANICAL ENGINEER, P.Eng., Jr. E.I.C., experienced in machine design and mechanical drafting seeks part time employment in Calgary, Alberta area. File No. 3902-W.

METALLURGICAL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (Chemistry), B.E., Nova Scotia T.C. 1952. Married, age 32. Experience includes one year as metallurgical chemist in a control lab., one year as assistant welding engineer with a steel fabricator and about one year with a research firm on ore preparation and reduction of ores. Desires technical position with firm located in Toronto area. Available on short notice. File No. 4128-W.

CIVIL ENGINEER, M.Sc., M.E.I.C., P.Eng. (Ont.), graduate 1947, is available. First class designer of all types of modern structures, inventive, enterprising and with flair for structures involving complex statical problems. File No. 4173-W.

ELECTRICAL ENGINEER, age 29, with 3 years experience in heavy industry, 2 years in communications, test course graduate, desires responsible work in West, preferably Edmonton area. File No. 4349-W.

MECHANICAL ENGINEER Jr.E.I.C., P. Eng. (Ont.), B.Eng. 1952, age 30, married, with two years of experience on plant maintenance in a chemical plant, also one year's experience in industrial engineering, 3 summers general workshop practice including overhaul of diesel engines. Desires work on plant maintenance or production. File No. 4453-W.

YOUNG ELECTRICAL ENGINEER interested in learning the generation and distribution field with a consulting engineer, contractor or utility. Presently working in a large petrochemical plant on all phases of the electrical system. Will send resume on request. File No. 4510-W.

ELECTRICAL ENGINEER B.A.Sc. Toronto, 1950, P.Eng. (Ont.), Jr.E.I.C., age 30, married, experience in industrial construction, field supervision, electrical generation and distribution, paper mill operation and maintenance. Desires position offering opportunity. Will locate anywhere. File No. 4545-W.

ELECTRICAL ENGINEER, Power, McGill 1953, S.E.I.C., age 26, married, presently employed. Experience includes Westinghouse Training Course; small motors, switchgear, household appliances. Interested in a permanent position with an opportunity for further professional development in electrical engineering field. Good references. Location Montreal only. File No. 4553-W.

MECHANICAL ENGINEER, London University 1948. Experience includes 6 years, project and plant engineering in chemical industry, U.K. and Argentina. Presently employed in Canada in non-technical capacity. Desire position in line with previous experience. Location immaterial. File No. 4596-W.

CIVIL ENGINEER B.Sc. Manitoba, M.E.I.C., ten years varied experience as designer and field engineer on plant construction and maintenance. Supervised structural and mechanical installations in Canada's largest pulp and paper, foundry, and automotive industries. Seeks position as assistant to resident or plant engineer with progressive company. Highest references and executive evaluation reports. File No. 4597-W.

PROFESSIONAL ENGINEER with master's degree in business administration, bachelor's degree engineering, 3½ years utility, 6 years manufacturing and sales, test course. Author technical papers. Accustomed to responsibility. Age 30. Seeks position with future. File No. 4599-V.

MUNICIPAL ENGINEER, M.E.I.C., age 46, bilingual, seeks managerial or senior engineering position with an expanding municipality. Also would consider work for a consulting firm specialising in town planning, design of subdivisions and municipal services. The advertiser would require some 2 or 3 months notice from his present position of project engineer for a large urban subdivision. File No. 4600-W.

MECHANICAL ENGINEER Jr.E.I.C., P. Eng., married. 7 years design experience in pulp and paper equipment, heavy industrial and marine equipment. 4 years research and development in combustion engines mainly diesel. File No. 4601-W.

MECHANICAL ENGINEER, M.E.I.C., P. Eng., grad. U. Riga, Latvia, age 43, family, 8 years preliminary and 14 years responsible practice. Latter includes: heating and plumbing, design and installation; industrial engineering, process, research, production, maintenance, design and supervising of plant expansions; construction engineering; roads—survey, design, construction. Four years of this experience in Canada and five under U.S. army in Germany. Available for an engineering appointment in Montreal area, end of April 1955. Interview—Jan. 1955. File No. 4602-W.

ELECTRICAL ENGINEER, B.Sc.E.E., Man. 1950, Jr.E.I.C., age 26 married, 1 child. Four years with public electric power utility, including supervision of transformer repair dept., supervision of recloser servicing, experience in metering installations and meter testing, and experience in various operational problems of power lines and associated equipment. Seeks position in work related to experience, preferably design, with manufacturer, power utility, or industrial concern where conscientious work and ability result in opportunity for advancement. Available on suitable notice to present employer. File No. 4603-W.

MECHANICAL ENGINEER, age 33, married, no children, university of Toronto 1943, veteran. Ten years industrial experience, four years design, engineering, manufacturing, production and purchasing, six years application, marketing, sales and service. Experience covers power plant equipment, pumps, feed water conditioning apparatus, boiler controls, materials handling equipment, electrical, hydraulic and pneumatic control systems, petroleum products, mining machinery and power transmission machinery. Presently employed but desires challenging work for aggressive firm with opportunity for administrative and/or management career in sales, service or manufacturing. Would prefer Ontario, Alberta, or British Columbia. Particulars willingly supplied to interested employers. File No. 4604-W.

MECHANICAL ENGINEER, Australian Graduated 1943. A.M.I.E. Australia, 32, married. No children. Experience includes field installation of mechanical or electrical plant, army workshop. Supervision large scale refrigeration unit. Design development and manufacture of welded steel pipe plant. Physical testing, instrument calibration, materials investigation, lecturing in mechanical engineering and laboratory supervision. Factory management. Consultant on steel fabrication factory design and layout. Recently arrived Canada. Desires position in or near Montreal. Available immediately. References. File No. 4605-W.

CIVIL ENGINEER, B.Sc., P.Eng., M.E.I.C., age 30, family. Desires to become permanently established in large city, preferably in Western Canada. Three years experience as city engineer in charge of public works and utilities. Experienced in sewer and water main installation, sidewalk and curb construction, drainage, paving. Four years experience as resident engineer on highway construction, four summers on federal government geodetic and irrigation surveys. Further particulars will gladly be forwarded to interested employers. File No. 4606-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., age 36, married, wide experience in plant engineering, maintenance, plant layout, design and development in industrial and aeronautical field. Proven executive ability. Presently employed in managerial capacity. Wishes permanent position in progressive organization requiring initiative and abilty. Montreal area preferred. Resume on request. File No. 4607-W.

MECHANICAL ENGINEER, P.Eng., Jr. E.I.C., veteran 4 years R.C.N. B.Sc. mechanical engineering, Queen's 1950. Age 34, married, 2 children. Administrative experience obtained in a large chemical plant, engineering and maintenance department, which included 3 years supervising maintenance and 1½ years engineering work on material handling, corrosion piping, and packaging problems. Sound practical experience gained when obtaining machinist fitter's Journeyman's papers. Desires a challenging responsible position with good opportunities situated in Ontario. File No. 4613-W.

MECHANICAL AND INDUSTRIAL ENGINEER, Jr.E.I.C., P.Eng. (Ont.). 5 years experience in plant engineering and layout, structural steel design, foundations, buildings, heavy machinery installation, piping, and process investigations. Above included drafting, detailing, cost estimation, and construction supervision. Have also had 2 years experience in townside engineering and development, lot surveys and related work. Desires part time work with construction or engineering firm or private individuals in Montreal, Ottawa, Cornwall area. Free to travel. File No. 4614-W.

ELECTRICAL ENGINEER, M.Sc., graduate Delft Technological University, Holland, 25 years old, married, specialized in the power side: electric and diesel electric traction, generators, motors, transformers, high and low tension cables and lines, control and protective equipment, experience 8 months. Fluent English, German, French and Dutch. Seeks position in line with his education. Available in 2 weeks anywhere. File No. 4615-W.

CIVIL ENGINEER, Jr.E.I.C., Polytechnique '51, 26, single, 4 years experience with the R.C.A.F. construction engineering branch, supervision of roads and runways construction, reconstruction of various buildings, experience with all construction trades, inspection of construction sites. One year as resident engineering officer at R.C.A.F. unit requiring knowledge of maintenance and operation of diesel engines, air conditioning equipment, refrigeration, municipal engineering and related subjects. Will be ready for employment in April '55. Administration experience, perfectly bilingual, would feel capable of handling assistant town engineer position for medium size community. Will travel if necessary. File No. 4616-W.

CIVIL ENGINEER, Jr.E.I.C., graduate N.S.T.C. 1952, age 31, married with children, desires position in Maritimes with firm engaged in residential construction and/or community planning. Also interested in inspection services related to the above. Presently employed by research organization in Ontario. Available on reasonable notice to present employer. File No. 4617-W.

ELECTRICAL ENGINEER, (Belfast, N. Ireland, 1949) P. Eng., Jr.E.I.C., graduate I.E.E., age 26, married with 2 children, desires position in Montreal. Experience includes 5 years indentured electrical engineering apprenticeship, 2 years test and inspection engineer, 2 years electrical machine design, 3 years Canadian experience in power lighting and distribution. Available on one month's notice to present employer. File No. 4619-W.

MECHANICAL ENGINEER, M.E.I.C., age 36, British 2½ years in Canada, seeks immediate employment. 12 years experience in the army and civilian life in mechanical handling and construction equipment. Since arrival in Canada employed as lubrication and maintenance engineer in the pulp and paper industry. Will consider work in any field of mechanical engineering. File No. 4620-W.

MECHANICAL ENGINEER Swedish Technical Institute, age 38, married. Experience includes 15 years in the oil industry, as project engineer and on the construction of oil plants which includes installation of pipelines, production and methods planning; design and service of burners and equipment for gasoline, fuel oil, butane-propane gas and petroleum industries. One and half years in Canada employed as oil burner mechanic and draughtsman. Seeks opportunity where former experience can be best utilized. Location immaterial. Available immediately. File No. 4625-W.

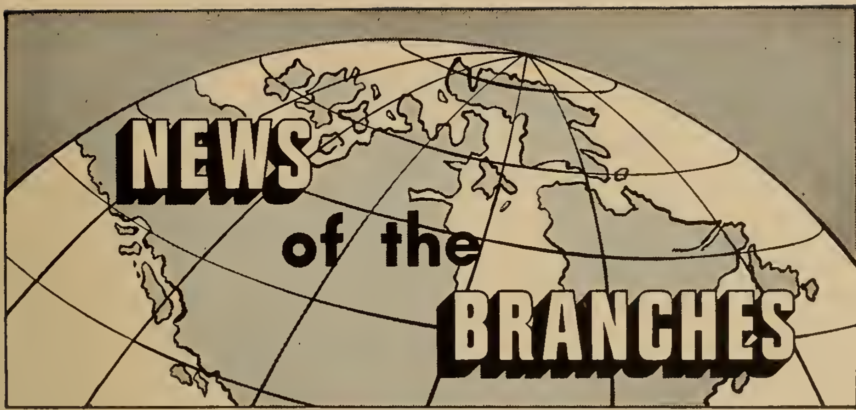
CIVIL ENGINEER, P.Eng., Jr.E.I.C., 1951 graduate. Seeks part time employment in Montreal. Experience in design of R.C. structures, field work in construction and general maintenance in chemical processing industry. Some draughting. File No. 4627-W.

ELECTRICAL ENGINEER, M.E.I.C., McGill 1943, married. Experience in electronic communication and power principally in sub-station design. Desire position with responsibility. Speaks French and English fluently. File No. 4628-W.

GRADUATE ENGINEER 1941 Civil M.E.I.C., age 25, married with family. Considerable experience as job engineer and superintendent. Have a responsible position in a growing construction firm, seeking similar position preferably in Ontario. Particulars willingly supplied. File No. 4629-W.

MECHANICAL AND METALLURGICAL ENGINEER, Jr.E.I.C., P.Eng. Dipl. Ing. age 39, married, no children. 10 years experience in various phases of metal fabricating processes: machining, stamping, deep drawing, forging, casting, heat treating etc. Desires position with a progressive company to take care of all technical problems combined with supervision, cost reduction program, methods improvement and general development of plant facilities. File No. 4632-W.

MECHANICAL ENGINEER S.E.I.C., B. Engineer with honours McGill 1953. Presently located in Montreal. Thorough background of machine shop experience, production planning and allied engineering office problems. Some experience also in surveying field work. Desires part time employment evenings and Saturdays in draughting, calculating, surveying, tutoring mathematics and sciences or as consultant in production planning and control problems. File No. 4634-W.




**Activities of the Forty-seven Branches of the Institute and abstracts of papers presented at their meetings**

## Hamilton

N. A. Parry, Jr.E.I.C.,
*Secretary-Treasurer*

F. S. Gue, Jr.E.I.C.,
*Branch News Editor*

***Annual Ball***

Hamilton engineers enjoyed another highly successful Annual Ball on Friday evening, October 16, despite the worst efforts of Hurricane Hazel. With excellent music supplied by Chris Lovett and his orchestra, prizes donated by local business firms, an appetizing buffet lunch and refreshments provided by Fischer's Hotel, the Ball once more proved a popular fall-season rendezvous for members of the profession and their friends.

Responsible for this year's ball was a committee consisting of Mike McAuliffe, chairman, Frank Barnard, secretary, Norm Parry, treasurer; Andy Frame, arrangements; Jack Skinner, prizes and favors; Charlie Kain, vice chairman and ticket sales; Joe Harbell, promotion and advertising; and Hugh Seely, publicity.

Patrons of the function were Mr. and Mrs. L. C. Sentance. Mr. Sentance is a past chairman of the Hamilton Branch. Guests were Mr. D. Switzer, chairman, Hamilton Section, Chemical Institute of Canada, and Mrs. Switzer; Mr. W. A. Wheten, chairman, Hamilton Branch, E.I.C., and Mr. N. A. Parry, secretary-treasurer, Hamilton Branch, E.I.C.

***October Meeting***

The regular October meeting took place Oct. 21, when Mr. C. P. Monteith, of the Aluminum Company of Canada, presented an up to date report on Alcan's vast Kitimat-Kemano project. Accompanied by an excellently narrated movie "The Man with a Thousand Hands", Mr. Monteith's address threw fresh light on some of the less familiar details of this fantastic undertaking, a project having more than its share of "firsts". The audience was treated to a glimpse into the future of a vast region in northern British Columbia, destined to become the cradle of new cities and a new industrial empire.

## Huronia

L. Morgante, Jr.E.I.C.,
*Secretary-Treasurer*

***Dr. A. E. Berry, Guest Speaker***

The Huronia Branch held a meeting in Owen Sound on October 1. The speaker was Dr. A. E. Berry, chief sanitary engineer of the Ontario Department of Health. He talked on pollution generally.

This is a timely subject in Owen Sound where there may be a sewage disposal problem. The sewage now is dumped into the harbour and has created conditions which must be corrected before very long.

The Hon. Dr. MacKinnon Phillips, Minister of Health for the Province, was to have introduced the speaker, but unfortunately was late due to very

**At the Hamilton Branch Engineers' Ball. Upper left, an unidentified, but happy engineer receives a prize from Chairman W. A. Wheten. Right, Mrs. A. P. Delaney is presented with a prize by Mr. J. Skinner. Mr. Delaney looks on. Lower left, Mrs. and Mr. Don Switzer, Mr. and Mrs. L. O. Sentance (patrons), and Mr. and Mrs. J. A. Tyerman. Lower right, around a table, Art Reid, Ona and Herb Houston, Rosemary and Marsh Rasberry, Joan Reid, Al and Glenora Tite, Ross and Dot Northrup.**

heavy traffic. He spoke after Dr. Berry and gave us some very interesting sidelights on different phases of prevention of disease by cleaning up polluted areas. He covered the case of fluoridization of water supplies to prevent tooth decay. He said the Medical Association has not yet given the addition of fluorine its blessing probably due to the fact that one of the salts of fluorine is a deadly poison; also because fluorine does not appear to be the complete answer.

After the speakers had given their addresses, there was a "question and answer" period which was most interesting.

The meeting finally broke up at about 12.30 a.m.

## Edmonton

R. B. Kerr, Jr.E.I.C.,
*Secretary-Treasurer*

P. H. Buckland, M.E.I.C.,
*Branch News Editor*

**M. Coyne Is Guest Speaker**

On the evening of October 12, the Edmonton Branch of the Engineering Institute held its regular dinner meeting. The speaker for the evening was Monsieur André Coyne a prominent French consulting engineer, and inspecteur général des ponts et chaussées; he was introduced by Dean R. M. Hardy of the University of Alberta.

M. Coyne's topic for the evening was "Twenty-five Years Designing and Building Dams". This outlined various projects the speaker had worked on over the past twenty-five years. The speaker is well qualified to speak on this topic because he is one of the leading dam designers in Europe.

M. Coyne was born in Paris and served in the French Air Force during the first World War. After graduating from university and serving with the French Civil Service, M. Coyne started on his career as a dam designer. He has worked on seventy different dam projects, not only in France, but in Spain, Africa and as far off as India; and was prominent in the designing of Europe's highest dam. M. Coyne is a past president of both the French Committee on Large Dams and the International Committee on Large Dams.

**Two Specialities**

M. Coyne has two specialities in dam design; namely, arch shaped dams which due to their structural shape require a minimum of concrete, and ski-jump spillways. Slides were shown illustrating both these specialities. M. Coyne pointed out that the arch type dam required much less concrete than the common gravity type dam, and is therefore cheaper where material costs are the major consideration. However, the speaker pointed out that in Canada and the United States gravity dams are most commonly used and most economical because they require much less labour than arch type dams. On the North American Continent labor is relatively expensive, and material plentiful and relatively less expensive.

The principle of ski-jump spillways, the speaker's second favorite, was illustrated with a motion picture and several slides. As the name implies, the spillway directs excess water down stream from the dam, and thus prevents progressive erosion near the down stream face of the dam.

M. Coyne also illustrated the principle of prestressing concrete dams. He pointed out that this principle is not only applied in new dams, but is also used to increase the capacity of existing concrete dams.

After the speaker had finished, questions were directed to him from the floor. M. Coyne was thanked for his very interesting talk by Mr. L. Jehn of the Edmonton Branch.

## Niagara Falls

C. E. Williamson, Jr.E.I.C.,
*Secretary-Treasurer*

J. H. Saldat, M.E.I.C.,
*Branch News Editor*

**Problems Of Lightning**

On October 21, 1954, members of the Niagara Peninsula Branch met for a dinner meeting at the Queensway Hotel, St. Catharines.

C. Killoran introduced the guest speaker, C. Stairs of General Electric Company. Mr. Stairs, with the aid of slides, gave a vivid account of the problems of lightning with regard to insulation and co-ordination.

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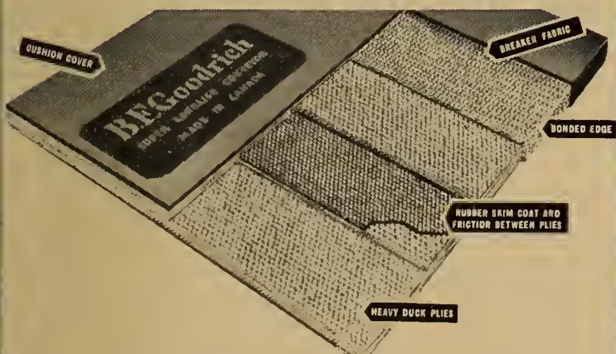


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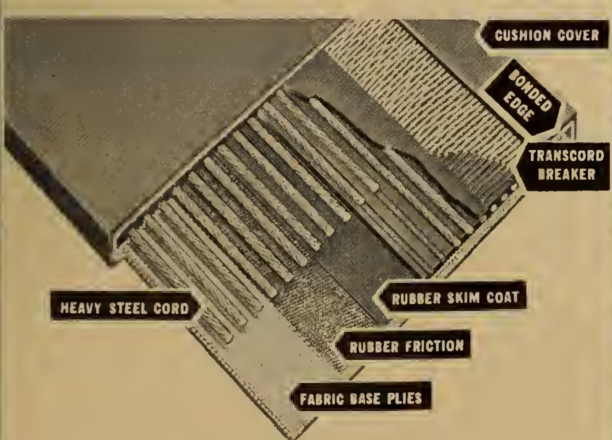


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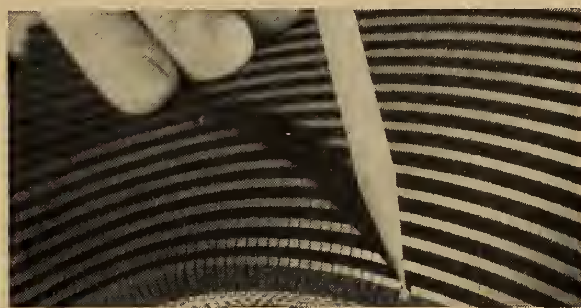

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**The head table at Ottawa's luncheon meeting on the occasion of the president's visit. Left to right, W. R. Pennock, Dr. L. A. Wright, President D. M. Stephens, R. Hayes, A. H. Graves, B. G. Ballard, Dr. O. M. Solandt, Hon.M.E.I.C., and Rev. Arthur Leaker.**

the theory of lightning and how it is formed. It has been accepted that in order to create lightning there must be currents of air and the presence of moisture, and a way of ionizing the air. Much of this information has been recorded on instruments sent up into clouds by means of balloons.

#### Accepted Theory

The accepted theory for lightning indicates the presence of air currents, or winds, entering the bottom of a cloud bank. The moisture in this rising air condenses and on colliding with the cloud moisture produces rain drops. These drops increase in size as they fall.

Meanwhile, the light negative ions are swept upward toward the cloud. Positive ions of moisture collect at the bottom of the cloud while positive ions at the top of the cloud form into frozen particles of moisture. As a result of the upward currents the cloud soon becomes stratified: with negative charges at the bottom and positive at the top. This buildup of potential is relieved by a lightning step-ladder which zig-zags down to the earth and sets up a return flash which is the lightning as we see it. There may be as many as 20 return flashes in a fraction of a second, but to the human eye it appears as one bright flash.

#### Lightning Protection

The presence of lightning creates a major problem for the electrical distribution systems in all the world. The earliest protection from lightning was in the form of choke coils. The trend then seemed to switch to lightning arrestors, but the solution did not seem complete.

In order to be able to arrest the lightning, and its effects, a study of lightning on the clydonograph revealed its intensity by measurement. An accurate measurement for lightning charges had to be made before the magnitude of voltage and current surges could be established. Having established a basis of calibration for such surges it soon followed as to what the insulation requirements would be for electrical transmission circuits.

#### Insulation

The problem was to establish a relationship between insulation and a set of standard operating voltages. This resulted in a test set-up for 115 volt systems wherein normal frequency 230 volts is applied for one minute. A standard wave was thus set up, where, in 1.5 microseconds a critical flashover occurred at crest voltage. With the average lightning current being approximately 10,000 amps, it becomes obvious that ungrounded structures are subject to an overvoltage of 70 per cent, and for grounded structures 30 per cent.

The problem of lightning has instigated the wide use of the thyrite Magne-valve Station-type arrestors. This harnessing of wild lightning has lead to the recent developments of insulation and lightning co-ordination methods of today.

H. D. Davison, chairman, moved a vote of thanks to Mr. Stairs for his fine address.

## Ottawa

G. A. Sutherland, M.E.I.C.,
*Secretary-Treasurer*

C. E. Howard, M.E.I.C.,
*Branch News Editor*

#### President's Visit

The President's visit to the Ottawa Branch took place on October 4, 1954, at a luncheon meeting held in Lauder Hall. R. E. Hayes was in the chair.

Mr. D. M. Stephens spoke on "The Engineer in the Civil Service", a mes-

sage addressed to the young engineers. He said, in essence, that it was maintained in some circles that first class engineers should not join the public service and pointed out that this was a very wrong point of view. He said that the civil service has and needs the very finest types of engineers and can offer ample scope for the most talented. W. B. Pennock thanked the president.

##### *Honorary Membership*

At the meeting Dr. O. N. Solandt, chairman of the Defence Research Board was presented with an Honorary Membership in the Institute by President Stephens. He is the youngest member ever to receive this award. In the evening a very pleasant reception was held for Mr. and Mrs. Stephens at the R.C.A.F. Gloucester St. Mess where guests, Branch members, and their wives mingled for a social evening.

##### *"Health, Happiness, and Hospitals"*

The opening meeting of the Branch was held on Thursday, September 23, 1954, when Gordon Hughes, F.R.A.I.C., chief of the hospital design division, Department of National Health and Welfare spoke on "Health, Happiness, and Hospitals." He said, "hospitals more and more are concerned with the community hospital as a health center. Dealing with the health of the people they are actually working to keep people out of hospitals rather than seek patients." Mr. Hughes traced the development of hospitals from the early days of the Egyptians and the Hindus to the present days.

Canada's oldest hospital is the Hotel Dieu of Quebec, established in 1634. But in Mexico Cortez established hospitals as long as 435 years ago, he said. The past 50 years have been, however, the golden age of advancement in medicine and science in the treatment of disease.

##### *Vertical Development*

Hospital design was described by the architect as the most complex of designing endeavor. In recent years the plan has been the vertical development of hospitals, rather than the horizontal. This permits a more efficient operation system though it gives an additional difficulty in expansion.

Fees paid to hospitals for scientific diagnosis are an insurance against longer life, the speaker said. The aim of modern hospital design is to increase its efficiency of operation. The ideal plan is that beds in a ward should be no more than 80 feet from the central facilities of the ward.

##### *Modern Developments*

Many modern developments were revealed. There are in some hospitals pneumatic tubes to speed blood and other samples to the laboratory. There are intercommunication devices which permit conversation with patients, and an audible check on their welfare. One of the most remarkable modern devices is a radio type of apparatus which is carried by the doctor on duty and permits him to be summoned by a "buzz" whenever he is required. This buzzer when it first operates can be shut off. But if there is no answer and it is put in operation again it cannot be stopped until the doctor returns to the central office. It can be effective for a distance of 10 miles from the hospital to summon a doctor to a telephone.

The speaker was introduced by R. E. Hayes, chairman of the Ottawa Branch, and thanked by Claude Howard.

## Montreal

R. J. HARVEY, M.E.I.C.,
*Secretary-Treasurer*
J. A. PAGET, M.E.I.C.,
*Branch News Editor*

##### *Annual Golf Tournament*

The golfing members of the Montreal Junior Section held their annual tournament on September 11 at the Ste. Hyacinthe Golf Club at Ste. Hyacinthe, Que.

Although the weather was on the wet side, it did not dampen the spirits of the enthusiasts. Net scores were based on the Atlantic Handicap System and nearly everyone managed to obtain at least one prize. The renovated Layton Trophy was won for a second time by Graham Cunningham with a low gross score of 78. Julien St. Pierre ran a close second with a gross score of 80. The low net scores were also very competitive, C. G. Kerr taking first place with 73½ and K. W. Davies in second place with 74.

Following the dinner the presentation of the Layton Trophy was made by Leo J. Hammerschmid and prizes distributed by John Gratton who was in charge of the tournament.

##### *Extra High Voltage Systems*

The fall season of the Montreal Branch was opened on October 4, 1954, with a joint meeting of the Engineering

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*Left*—Four men averaged less than four hours making bottle-tight joint . . . 975 psi working pressure, 1500 psi shop test on couplings.

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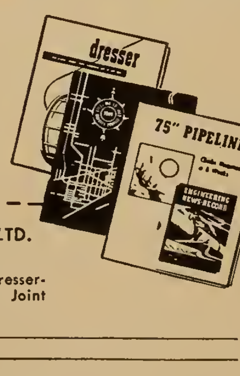


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**Graham Cunningham (left) receives the Layton Trophy from Leo J. Hammerschmid.**

Institute and the American Institute of Electrical Engineers. The meeting, under the chairmanship of W. R. Way heard an interesting paper by B. G. Rathsman of the Swedish State Power Commission on the Swedish 400 k.v. power system.

Mr. Rathsman stated that the decision of the Swedish State Power Commission to develop a 400 k.v. system was made in 1946 after investigation had shown that this voltage would be the most economical to transmit the large amount of power required in the populous south from the large undeveloped water power sources of the north.

The 400 k.v. system was designed for an impulse level of 1775 k.v. at the stations and 1600 k.v. on the transmission lines. Lightning arresters are used to limit the impulse levels at the stations to safe values. Impulse levels have now been reduced to 1500 k.v. on all station apparatus and lines with the exception of instrument transformers and circuit breakers. The reduction has resulted in considerable saving in station cost.

The experience of the Swedish State Commission has shown that the largest transformer units capable of being transported to the sites are the most economical.

The transmission lines use multiple or bundle conductors which at present consist of 2 x 1,170,000 C.M., A.C.S.R. conductors per phase and can easily be increased to 3 x 1,170,000 C.M. cables. Towers are of gantry type and are constructed of high grade steel. Two overhead ground wires are run and since good grounding is difficult to obtain in Sweden, a counterpoise of 50 M.C.M. copper cable is now run the length of the lines, except where the ground resistance is 30 ohms or less.

Series capacitors are being added to the system and increase transmission capacity from 400,000 k.w. to 650,000 k.w. for a 300 to 400 miles single circuit line.

Radio disturbance was overcome in areas of weak reception by connecting small transmitters to the lines and using the lines as antennae. This often resulted in better reception than had previously prevailed.

Mr. Rathsman stated that the 400 k.v. system had proved very satisfactory and had resulted in considerable gain in power transmission for Sweden.

Mr. Rathsman also gave a brief talk on the 100 k.v. d-c. system between the Swedish mainland and the Island of Gotland. This system was the result of experiments in high voltage direct current by Swedish manufacturers and the Power Commission.

A rectifier station on the mainland is connected by a single conductor cable to an inverter station on the island. The length of this cable is about 60 miles. The return path of the high voltage d-c. current utilizes the ocean with suitable grounding electrodes at each end.

Although the installation is experimental in scope, a large amount of power is being economically transmitted to the island.

A film was shown which described the d-c. system in detail.

A large number of questions were answered by Mr. Rathsman after which D. M. Farnham thanked the speaker on behalf of the meeting.

Refreshments were served to complete a very enjoyable and instructive evening.

***Plant Tour***

The mechanical section of the Montreal Branch visited the Angus Shops of the Canadian Pacific Railway on Tuesday evening, October 5.

The shops comprise, as a unit, the largest railway building and repair shop on this continent. The plant occupies an area of 200 acres and consists of 31 main buildings and as many smaller structures. At present they employ 6,500 persons who are engaged in such diversified fields as repair and maintenance of diesel and steam motive power units, the building and maintenance of all types of passenger and freight rolling stock, a cast iron wheel foundry, a bolt and nut shop, etc.

The comprehensive tour included almost every department in the works, and made it possible for the visitors to gain valuable information about railroad equipment and its maintenance. Perhaps the most outstanding feature due to the recent dieselization program, was the greatly decreased amount of work being done on steam engines, and the corresponding increase in the amount of diesel engine maintenance. The unique production and maintenance machine tools used by the railways were of much interest to those from other industries and many of the visitors must certainly have gone home with a wealth of new ideas applicable to their own particular line of work.

A group of approximately two hundred attended. The meeting chairman was P. J. Kunstler and arrangements were made by R. M. Freeman.

***Plant Tour***

October 12, 1954, was the day the chemical section of the Montreal Branch was treated to an outstanding plant tour by the chemical division of the Montreal East Refinery of the Shell Oil Company of Canada Ltd.

The refinery chemical plant, which has the unique distinction of being the first petro-chemical plant owned by an oil company in Canada, went on "steam" in April, 1953. The two principal products are acetone and and isopropyl alcohol, and raw materials consist essentially of a propane-propylene mixture fed from the oil refinery.

Just as isopropyl alcohol is used as a raw material in making acetone, acetone, in turn, is the starting point for another chemical diacetone alcohol. This is the source of a whole line of important chemicals: mesityl oxide, methyl isobutyl ketone, methyl isobutyl carbinol, hexylene glycol. All of these chemicals have different properties and they are put to many uses, yet they all come from one material—the propylene in the gas from the petroleum cracking process. All these products, plus secondary butyl alcohol and methyl ethyl ketone, are being produced today in Shell plants in several countries of the world. Now that the initial step of making isopropyl alcohol and acetone has been taken in Canada, they could be made here as well.

After a complete description of the chemical plant's technology and operation by Stan Williamson, plant manager, the 100 members present were broken up into groups of about 10 and conducted on a detailed tour by Shell engineers.

The plant which was built by C. F.

# E.I.C. ANNUAL MEETING

**May 11-12-13**
**1955**
**Royal York Hotel,**
**Toronto, Ont.**

•

**May 23-24-25**
**1956**
**Montreal, Que.**

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Braun and Co. of California, consists essentially of a reaction and hydrolysis unit into which the raw propane-propylene is fed, a stripping and distillation unit, an acid converter and an acid concentrator, an isopropyl alcohol dehydrater and a distillation unit for each of the products.

Interesting mechanical and other features were the abundant use of lead and silicon-iron in pipes and tank linings, etc., the heavy duty pumps and compressors necessary in this kind of industry and the unique heat exchangers.

The tour lasted for approximately two hours and refreshments were served in the plant cafeteria afterwards.

Meeting chairman was L. A. Phillips and arrangements were made by E. W. Codère.

#### "Modern Crawler Tractors for Construction"

A three-man panel, R. Hewitt, Hewitt Equipment Ltd.; L. L. Goddard, Chas Cusson Ltd.; and J. S. Newman, Beaver Construction Ltd., discussed "Modern Crawler Tractors for Construction" on Oct. 14.

#### Development

The first speaker, Mr. Hewitt, presented a very informative outline of the development of the crawler tractor since the beginning of the century. He illustrated, by means of slides, the changing trends over the years, and the versatility afforded by the introduction of rear end or trailing equipment such as logging winches, compaction rollers, scrapers and track type wagons to mention but a few. Although the prime role of the crawler tractor is in earth moving, examples were shown of tractors rigged as cranes, or as mobile air compressors, or capable of hauling heavy loads in difficult locations by means of a power winch at the rear. Mr. Hewitt also showed colour movies of operating details of scrapers and similar equipment.

#### Equipment

Mr. Goddard continued with remarks on "front end" equipment, design features of crawler tractors, and economic considerations. He discussed blade types and their uses, the high productivity of machines employing the overhead rear dump loader, various aspects of tractor transmissions, steering, pros and cons of cable versus hydraulic control, and presented comparative performance and economic data on some of the equipment mentioned. A coloured film of earth-moving operations of the Alcan Kitimat project served to further illustrate comments by both Mr. Hewitt and Mr. Goddard.

The first two members of the panel, having expressed their views as suppliers, J. S. Newman addressed the meeting as a user of the crawler tractor. He described the successful development by his firm of a front end drill rig permitting rapid drilling of holes of twenty foot depth within a large radius of the tractor—another example of versatility. Mr. Newman mentioned the usefulness of the crawler tractor in hauling other heavy equipment unable to negotiate grades without assistance. In this day of rapidly expanding communities, he mentioned that the accompanying problem of garbage disposal can be economically solved with the help of the crawler tractor, using the method of sanitary land fill.

A short question and answer period concluded the evening, and the panel members were thanked by J. H. Leitch.

Meeting arrangements were made by R. J. Kane.

#### Micro-techniques in Research

A special meeting was held on Thursday, October 21, at 5.30 p.m., sponsored by Dr. W. H. Gauvin.

A small group of members gathered at the Mansfield Street Headquarters where refreshments were served before the meeting, giving a good opportunity for the attendants to get acquainted. The meeting was over early and the evening was still young. Although the attendance was small, everybody appreciated the first meeting of a very promising series.

Philip B. French presented the speaker, Harold Green, who has been working at the Pulp and Paper Research Institute of Canada for over 20 years, and who is now in charge of the Photography-Microscopy Section at the Institute.

#### Microscope and Camera

Mr. Green made mention of the fact that, of recent years, there has been increasing recognition, both in the Institute and in the pulp and paper industry, that the microscope and the camera are exceedingly valuable research tools, not only for studies of fibres and pulps but also for examination of wood in various stages of processing, for visual recording of research results and for presentation of data in reports.

He then went on to describe the design and construction of a unique micro-digester and auxiliary equipment. The micro-digester was designed to conform to an optical working distance, and is of such a size as to fit on the stage of a microscope. Light is passed into the tiny digester through a glass port in the bottom, and the thin wood section being subjected to chemical treatment is observed and photographed through a similar port in the top. The glass used in these ports is surface-tempered pyrex capable of withstanding pressures up to 1,000 p.s.i. The accumulator is electrically heated, the rate being controlled by a large Powerstat transformer. Stainless steel was used throughout for the construction of this equipment.

Mounted above the micro-digester is a motion picture camera and time-lapse mechanism by means of which cinephotomicrographic records of the pulping process may be produced. If completely successful, this will represent the first time continuous direct observation of the chemical pulping process has been accomplished.

#### Chemical and Mechanical Treatments

Mr. Green next made mention of the effects produced by chemical and mechanical treatments on the surface structures of fibres. He pointed out that, in order to better study these surface structures, the Institute had developed methods of metallizing fibres and thin wood sections. Photomicrographs taken of fibres and sections so treated and illuminated with a low-angle beam of light showed up surface detail which was difficult or even impossible to depict by the usual microscopical methods. Indeed, some of the micrographs so produced appeared to be almost third-dimensional.

Brief mention was made of an interesting device for observing and studying the rotations and interactions of model particles and fibres in a field of liquid shear. Mr. Green then described the part that cinephoto-micrography was playing in recording these complex rotations and collisions. He said that so far one complete reel of motion pictures had been produced using this interesting Couette Apparatus.

Slides, both monochrome and colour were shown during this talk. After a short discussion period, members were invited to examine a group of colour photomicrographs of fibres and wood sections.

Mr. Green was heartily congratulated by O. R. Brumell for having presented a very fascinating talk on subjects which were little publicized.

#### Designing and Building of Dams

On October the 26, 1954, a meeting was held sponsored by R. J. Kane, Raymond Boucher, of l'Ecole Polytechnique of Montreal, acting as chairman, introduced André Coyne, the guest speaker of the evening.

Mr. Coyne was born in Paris in 1891. He started his professional education at "Ecole Polytechnique" de Paris and graduated from "Ecole Nationale des Ponts et Chausées" in Paris, France. He is a veteran of World War I in which he served with distinction in the Engineering Corps and subsequently joined the Air Force.

At the age of 63, Mr. Coyne has behind him a full life of practical experience. He started his career in the "Département des Ports Nationaux" in France, and for eight years was engineer for the port of Brest. He then became chief engineer of the "Département des Travaux Publics" for the section of "Haute Dardogne". His career as dams builder started in that position; his efforts were turned towards the perfection of arch-dams.

Mr. Coyne held the senior post in the "Service des Travaux Publics Français" and is now a consulting engineer of international reputation. In twenty-five years of work, he has built 70 dams. From 1946 to 1952 he was president of the International Commission of big dams and has been for many years the chairman of "l'Ecole Nationale des Ponts et Chaussées" and also, of the "Ecole Supérieure d'Electricité" of France.

In 1952 he was made an honorary member of the American Society of Civil Engineers and this year received additional honor in getting the Grand Prix d'Architecture given by the French Society for Architectural Study.

#### Arch-dams

In his speech, Mr. Coyne talked about arch-dams. He explained the calculations and applications of dams arched in the horizontal plans only, and also the special design of dams arched in two plans as used in Africa and Europe in the last few years.

He is the designer of a new kind of spillway which is made like a ski-jump and projects water 300-400 feet to avoid erosion of the foundations. He noted that this kind of spillway should be used at Niagara Falls to protect the natural foundation of the rock which regularly caves in and causes damage to their natural beauty.

Mr. Coyne is now doing special studies in the application of prestressed concrete to dams. He intends to use this new theory in India and in Pakistan.

It is interesting to note that Mr. Coyne delivered his speech in English although French is his native tongue.

F. L. Lawton, chief engineer of Aluminum Laboratory Ltd. congratulated the speaker for his highly interesting speech.

#### Trends in Motor Car Design

On Thursday, October 28, a general meeting was held, sponsored by the mechanical section under the chairmanship of P. J. Kunstler, at the E.I.C. headquarters on Mansfield Street. The speaker, H. Richard Steding, chief engineer, executive staff of the Chrysler Corporation, was introduced by the meeting chairman, H. S. Marmoock.

Mr. Steding gave a talk on the "whys" of motor car design and included a few anecdotes by way of illustration. He discussed body dies made of plastic; the economic difficulties of using plastic as a body material; Chrysler's gas turbine powered automobile experiments and the difficulties both economic and technical prohibiting production of such a unit at this time; horsepower, its attractive aspects and its relation to safety; general safety considerations; and styling trends.

#### Proving Ground

A film was then shown of the opening of Chrysler's new multi-million dollar proving ground in Michigan which included some interesting shots of many cars going "flat-out" around the high-speed oval, including some Indianapolis racers and some of Chrysler's "ideal" cars; other shots of cars undergoing abusive high speed treatment on rough gravel roads; still others receiving a thorough soaking in two to three feet of water at moderate speed, steering pad tests; and many other interesting pictures.

A question period followed. Many interesting questions were asked from the floor, which Mr. Steding answered quite well, considering the fact that some tended to put him "on the spot". Answers to questions concerning better winter traction and cheaper simpler automobiles were a little evasive. Disc brakes were reported expensive at present. Fuel injection was reported to be undergoing study. There were also questions and answers concerning horsepower, torque, compression ratios, gas turbines, automatic transmissions, front wheel drive, rear engines, steam power, electric drives and engine octane requirements.

The speaker was thanked by Prof. P P. Vinet, of l'Ecole Polytechnique, and the meeting adjourned.

## Peterborough

R. A. Blount, jr.e.i.c.,
*Secretary-Treasurer*

G. T. Davis, jr.e.i.c.,
*Branch News Editor*

#### "Canada and International Trade"

The first meeting of the fall season was held at The Kawartha Club on Sept. 24. Guest speaker was S. A. Shepherd, manager of the Mortgage Lending Department of the Bank of Montreal. His subject was "Canada and International Trade".

Mr. Shepherd's banking experience included service with the National Bank of South Africa, and Barclays Bank, London, before joining the Bank of Montreal in 1929. He was on loan to the Wartime Prices and Trade Board during the war, and when recalled to The Bank of Montreal in 1947, became manager of the Foreign Exchange Department. He will be conducting a series of lectures on "International Trade and Finance" for McGill University Extension this year.

#### Free Trade

The speaker explained the desirability of free trade, from the point of view that production would be thus limited to those who could produce most efficiently. This would result in the highest standard of living for the world as a whole.

The utopia of free trade presently does not exist due to the need or desire of various nations to maintain control over the manufacture of certain products. Mr. Shepherd emphasized that he did not believe that tariff barriers or subsidies should be used to protect inefficient industries. Some industries however, should be protected to a certain extent to allow them to streamline their operations and become more competitive with other sources. Protection may be justified to safeguard either investments or employment of large numbers of people. He felt that the answer to the problem did not lie in increased protection but rather in a "reappraisal of production costs and marketing methods".

The speaker was introduced and thanked by John Lucas.

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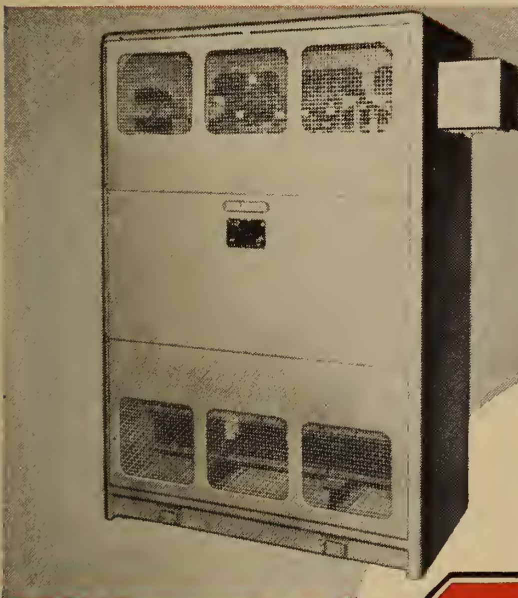

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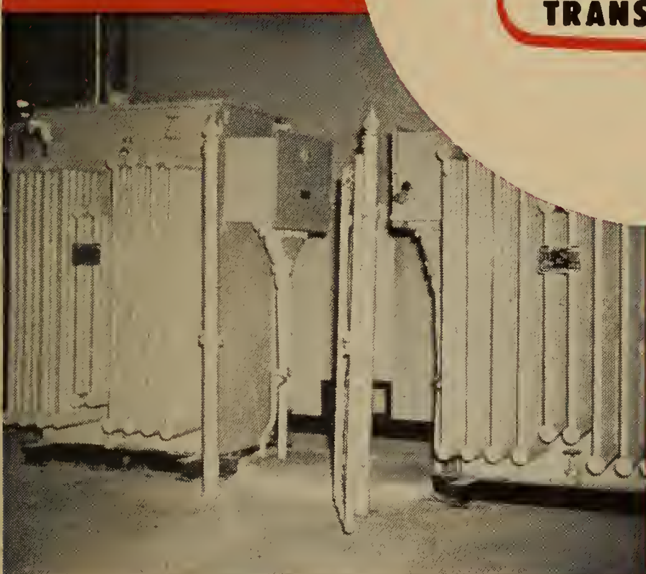

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## St. Maurice Valley

L. A. Pattison, Jr.E.I.C.,
*Secretary*

J. K. Murphy, Jr.E.I.C.,
*Branch News Editor*

**Canadian Aviation**

"Canada ranks high in the scale of free nations which design and build aircraft," members of the Three Rivers group of the Engineering Institute of Canada district Branch, were told on October 6. The speaker was R. D. Richmond, chief engineer in charge of aeronautical design at Montreal's Canadair Ltd. plant, and the occasion was the local group monthly meeting in the St. Maurice Hotel.

Continuing, Mr. Richmond, who spoke on "Canadian Aviation Past, Present and Future", pointed out that the aircraft industry depends a great deal upon military contracts from government but that they are continuously striving to broaden their interests in the commercial field. Mr. Richmond's address dealt with both airplanes and guided missiles.

"Ever increasing speeds are required for military aircraft in order to strike quickly at the enemy and to present a small target," he stated. "The importance of operating economy of such aircraft is not as great as in commercial planes."

The types of motors and equipment may therefore be quite different. Ram jets, for example, the speaker said, are very expensive to operate and it will probaly be quite some time before they are in commercial use.

**Development**

Touching on development, Mr. Richmond mentioned that development of a new aircraft is a very exacting job, requiring many thousands of engineering hours. Basic scientific facts are often supplied by government agencies, but much work is required to apply them. This requires large engineering staffs which include many specialties.

**"Human Relations in Industry"**

On Wednesday, October 20 a meeting of the St. Maurice Valley Branch was held at the Cascade Inn, Shawinigan Falls. The guest speaker for the evening was R. A. Fortier of the Public Relations Department of the Aluminum Company of Canada, Limited. His topic, one of considerable interest to engineers today, was "Human Relations in Industry".

Mr. Fortier stated that the failure to recognize the fact that another point of view can exist in a crucial situation is one of the primary blocks to better understanding in industry. The ultimately successful administrator is the one who can do two things in a crucial situation: 1) accept the fact that another point of view can exist, and 2) withhold action until this other viewpoint has been evaluated.

For most of us that is not a natural thing, especially when dealing with a subordinate. Invariably, the superior in such a situation feels that he has sufficient reasons for his contemplated course of action and acceptance of new ideas can be a painful process. It is not, however, an intellectual exercise. The ability and willingness to see and evaluate a point of view different from one's own involves an emotional as well as an intellectual achievement.

**Listen**

The biggest block to successful communication in industry is the inability or refusal to listen intelligently and understandingly to another person. Only too often do we recognize this inability in others, but perhaps too seldom do we recognize this same limitation in ourselves. Mr. Fortier stated, the way we have been conditioned by past experience will materially affect the way we perceive the present situation.

Mr. Fortier concluded his talk with perception demonstrations which served to give visual evidence to the remarks he had made during the evening.

## Saint John

J. A. B. Brenan Jr.,
*Secretary-Treasurer*

H. S. McCleave,
*Branch News Editor*

**Industrial Development Of Saint John**

The Saint John Branch held their first meeting of the 1954-55 season at the Admiral Beatty Hotel, Oct. 14. 1954. The speaker for the evening was H. H. Smith, newly appointed industrial commissioner for the city whose topic for the evening was "The Industrial Development of Saint John".

Mr. Smith believes that, while the long range picture of the economy of the country is bright, not enough attention is being paid to the next few years The influx of foreign goods which captured ¼ of the home market last year was a bad sign considering the fact that our export had not kept pace, and the situation is not improving.

"In the face of these facts it is somewhat surprising that many Canadian manufacturers have not paid sufficient attention to the proper promotion of their goods in foreign markets. Our government, so far, does not seem to have taken particular trouble to exhibit our goods at foreign points of sale. If it would be argued that this is a job for individual manufacturers rather than for the government, we should reply that several European countries have arranged exhibitions of their products in foreign countries and apparently are more than satisfied about the results.

**Foreign Affairs**

"Very recently, I am happy to report, I have learned that in Ottawa several officials are promoting this idea of 'foreign affairs'. Let us hope that this promotion will bear fruit in the very near future." Also Canadian companies have not followed the lead of American manufacturers in establishing factories in foreign countries, thus missing a chance of capturing more markets. Attention to these matters might provide our Canadian manufacturers with badly needed markets.

**It Can Be Done**

Mr. Smith then went on to matters directly concerning the port of Saint John and pointed out that our port has not been making any headway. By increasing facilities for the handling of certain types of goods and establishing small manufacturing plants here the economy of the Maritimes could be much brighter.

In closing, Mr. Smith stated, "our real job, gentlemen, is to get rid of any old conception we might harbour that it can not be done. The job of making a port work and of attracting industries to a certain area is by no means impossible; all it requires is good hard work, experience, and the will to win. To you who are active in all the different fields of engineering, goes a large part of this job.

## Toronto

L. F. Bresolin, Jr.E.I.C.,
*Secretary-Treasurer*

H. Fealdman, Jr.E.I.C.,
*Branch News Editor*

**Dupont's Nylon Intermediates Plant**

A very enjoyable meeting was held on Thursday, October 21 last, in conjunction with the Toronto branch of the Chemical Institute of Canada, when Dr. H. R. Lyle Streight of the Dupont Company of Canada, gave a description of the new Nylon Intermediates Plant at Maitland, Ontario.

Although it was not possible to discuss the process in detail, the meeting enjoyed hearing a very detailed description of the considerable planning work (including some scale models) that was carried on previous to construction. All the designers and operators in this plant had no previous experience on anything similar, and considerable training programs had to be carried out whilst the plant was being designed and built. One item which should be taken note of by all members of similar plants, is that wherever possible, the materials were Canadian-made. It is also of interest to note that out of the total staff of approximately 570 operating this plant, 150 or one-fifth of them are university graduates.

## Winnipeg

C. S. Landon, M.E.I.C.,
*Secretary-Treasurer*

B. F. Webster, M.E.I.C.,
*Reporter—Electrical Section*

**Imperial Oil Refinery Visit**

Approximately 55 members of the Electrical Section of the Winnipeg Branch were guests of the Imperial Oil Limited on October 7, when a visit to the East St. Paul Refinery was arranged from 4.30 p.m. to 7.00 p.m. The group was welcomed at the refinery by G. H. Dyer, assistant general superintendent, and then the party was split in two with the first half touring the refinery while the second half was introduced to the art of refining by lectures and a movie. Mr. Maurice Magnoin, mechanical superintendent, in a short talk pointed out the pertinent features of the electrical distribution of the refinery itself.

Mr. Magnoin's talk was followed by a movie entitled "What Makes Gasoline Good", which in humorous manner gave a brief and lucid explanation of the techniques involved in making gasoline.

This movie served as an introduction to an explanation of the refinery flow chart by T. C. Elliott, chief chemist. Mr. Elliott by means of a pictorial presentation showed how Redwater crude from the Interprovincial Pipe Line was refined to finished products.

The groups then were conducted through the refinery by Mr. T. Cowtan, Mr. J. Townsend, Mr. C. G. Elder, Mr. E. A. Martin and were able to see first hand the features previously pointed out.

# LIBRARY NOTES

## Additions to the Institute Library

**Reviews — Book Notes — Abstracts**

## BOOK REVIEW

**Inventions and patents in Canadian practice.** A. E. MacRae, M.E.I.C. Toronto, Canada Law Book, 1954. 127 pp., $4.50.

It was a pleasure to receive this book devoted to the subject of inventions and patents in Canada, both because there is little available information on this subject, and because it is written by a well-known Canadian engineer who is also a long-standing member of the Engineering Institute.

Mr. MacRae's purpose in writing this book was to give the inventor-scientist, the engineer and the industrialist information on inventions and patents which would enable them to obtain the most profit from new, useful, ideas, as envisioned by the Patent Act.

The book commences with a definition of the word "invention" as used in the Patent Act, and from this passes to the definition of "patent", and the purpose of patent legislation. These problems solved, the author discusses the methods of obtaining patents, and various special problems connected with this. Another chapter is devoted to the Patent office, the Patent Institute and the Patent Agent. The last chapter is concerned with a comparison of Canadian and United States practices, which should prove of great benefit to those concerned with patents in the two countries.

In writing this book the author has drawn on his wide experience in the patent field, and puts forward the suggestion that patents provide the incentive for the invention of new products and that agriculture, lacking this incentive, lags behind industry. The volume should prove of great interest to all those who may have an idea they wish to patent but are not sure of the steps to take. Throughout, the language is kept simple, and there is a useful index. S.C.

## BOOK NOTES

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*Book notes marked by an asterisk have been provided through the courtesy of the Engineering Societies Library in New York.

***Alternating-current machines,** 3rd ed. A. F. Puchstein, T. C. Lloyd and A. G. Conrad. New York, Wiley, 1954. 721 pp., illus., $8.50.

This revision is similar in scope and character to previous editions, with consideration of only steady-state phenomena, and with the following topics treated for the various types of machines: construction, operating characteristics and their calculation from tests, and discussion and analysis of related phenomena. Principal changes are new methods of approach to theory and additional material on adjustable-speed drives, rectifiers, and self-synchronous machines.

**Bibliography on prestressed concrete.** Detroit, American concrete institute, 1954. 83 pp., $2.00 (U.S.).

Prepared by a joint American Concrete Institute—American Society of Civil Engineers committee on prestressed concrete, this bibliography lists some two thousand references on the subject.

Both American and foreign literature is included, the period covered being 1896 to 1953. The references are listed chronologically, and unfortunately there are neither author nor subject indices, but in spite of this, the bibliography will be very useful to all those interested in prestressed concrete.

A separate section lists sixty American, British, German and French patents.

**Chemical engineering in practice.** J. I. Harper, ed. New York, Reinhold, 1954. 140 pp., $3.00 (U.S.).

A symposium on "Chemical engineering in the process industries", sponsored by the American Institute of Chemical Engineers and the Department of Chemical Engineering, University of Pennsylvania, produced this collection of papers.

The subject of the discussions are the varied roles of the chemical engineer in industry. These roles include participation in process research, development and engineering; economic analysis; project, construction, operational and market research engineering. The coordination of research and activities to produce the best overall result is stressed.

The authors are all successful engineers and their articles, which are the outcome of practical experience, will be useful to students and to all chemical engineers.

**Chemical engineering materials.** Frank Rumford. Toronto, Longmans, 1954. 380 pp., illus., $5.75.

Specifically this book deals with the essential properties and limitations of the materials from which chemical plant is constructed. It describes the general mechanism of chemical attack and the methods of material testing. In a more detailed manner the range of available material is then covered, from cast iron to nickel, cements and wood, and the method of making them up into chemical plant is discussed.

The appendices provide corrosion-resistance data and the mechanical properties of metals, and some relative costs are suggested, although, in this field of construction, strength and economy are second in importance to the corrosion resistance of materials.

**The dam.** Murray Morgan. Toronto, Macmillan, 1954. 162 pp., illus., $4.00.

Many readers will have read an excerpt from this book in a recent issue of the Readers' Digest and will welcome an opportunity to complete this interesting account of a near-disaster. The author, who won renown with his "Skid Road", tells of the human mistake which almost brought to a halt the operations of the Grand Coulee powerhouse, and uses the skill of a dramatist to do so.

## LIBRARY REGULATIONS

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While this section of the book will keep the reader in a state of suspense and admiration there is much more that will also hold his attention. He will find an absorbing story of the background of the Grand Coulee dam, including facts and figures, with a description of the use made of the power in the Northwest, and of the government town of Coulee Dam. There is also an interesting sidelight on the Hanford Atomic Works. In all this Mr. Morgan displays his ability to discover and portray the feelings and attitudes of the common man affected by the gigantic power development.

A series of photographs shows exterior and interior views of the dam and power-house.

**Dielectric materials and applications.** A. R. Von Hippel, ed. Cambridge, Technology Press, New York, Wiley, 1954. 438 pp., illus., $17.50.

As a companion volume to "Dielectrics and Waves", this collection of papers by twenty-two contributors is directed to the research worker, development engineer, manufacturer, and field engineer. The five divisions include a section on dielectric theory, covering the macroscopic properties of dielectrics followed by the molecular properties. The next chapter describes methods and techniques for measuring permittivity and permeability. In the third section, dealing with dielectric materials and their applications, consideration is given to gases and vacuums, liquids, plastics and ceramics, with their use in a variety of fields: power, distribution and electronics equipment; as rectifiers, magnetic and dielectric amplifiers and memory devices. Section IV is entitled "Dielectric requirements of the armed services," and the last chapter contains the tables of dielectric materials of the Laboratory for Insulation Research at the Massachusetts Institute of Technology.

**Dielectrics and waves.** A. R. von Hippel. New York, Wiley, 1954. 284 pp., illus., $16.00.

Written for physicists, chemists and electrical engineers, the subject of this book "dielectrics" covers not only a narrow class of so-called insulators, but any nonmetal, and even metals, where their interaction with electric, magnetic, or electromagnetic fields is considered. It progresses beyond the subject of dielectric analysis to that of dielectric synthesis, in which the properties of materials are made to order.

The work is divided into two parts having, first, the macroscopic and, second, the molecular approach. Part I deals with the complex permittivity and permeability as the basic parameters and derives the macroscopic theory in a unified manner for the electrical and optical frequency spectrum from the field and circuit aspect. Part II re-interprets this by considering the action of induced and permanent moments and of mobile charge carriers in gases, liquids and solids. Many valuable problems, tables and references are found in the appendices.

***Electroacoustics.** F. V. Hunt. Cambridge, Harvard University Press, and New York, Wiley, 1954. 260 pp., diagrs., $6.00 (Harvard Monographs in Applied Science, No. 5).

Includes an historical account of electroacoustical transduction, a new method for the analysis of electrostatic and electromagnetic systems of electromechanical coupling, and examples of this method as applied to moving-conductor (dynamic), electrostatic, and moving-armature (magnetic) transducer systems. There are bibliographical footnotes.

***Data book for civil engineers. Volume III: Field Practice,** 2nd ed. E. E. Seelye. New York, Wiley, 1954. 394 pp., illus., $7.50.

Provides the field engineer with essential data for inspection and supervision of virtually all types of civil engineering work. It contains check-lists and procedures for inspection for concrete, masonry, structural steel, welding, bridges, soils, pipe laying, etc. A section on construction surveying has been added, tables and other data have been brought up to date, and considerable new material is included in this revision.

**Farm buildings,** 4th ed. D. G. Carter. New York, Wiley, 1954. 291 pp., illus., $5.50.

Agricultural engineers and students will welcome this new and almost completely revised edition on the subject of farm buildings. A scientific approach is maintained throughout, and the author deals with buildings as a phase of the broader subject of farm improvement. Building objectives, planning resources, functional aspects, and environment are considered instead of specific materials and requirements, which are soon out of date.

Different types of buildings, housing beef cattle, hogs, sheep, poultry, grain and machinery, are described as well as the farmhouse. The appraisal of farm buildings, for income tax purposes, etc., is covered in one chapter, followed by another on farm-building management.

**Guide for safety in the chemical laboratory.** General safety committee of the Manufacturing chemists' association. Toronto, Van Nostrand, 1954. 234 pp., illus., $4.75.

"This book should be kept as a guide and ready reference wherever chemicals are used." This claim is substantiated by the contents of this manual which covers a variety of important subjects ranging from general rules for laboratory safety, handling glassware and containers, flammability, and toxicity, to radiation safety, pressure vessel hazards, protective equipment, and first aid. The last chapter discusses the packaging and transportation of chemicals. Several chapters apply to high schools and elementary technical schools although the manual is primarily for those working in college, university, and industrial chemical laboratories.

**Highway engineering.** L. I. Hewes and C. H. Oglesby. New York, Wiley, 1954. 628 pp., illus., $8.00.

While quite a number of books have recently appeared on the subject of highway engineering, this stands somewhat apart because of its authors' qualifications and also because of the emphasis placed on design and principles rather than on construction practices.

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Subjects which have legal or economic aspects are developed, including rights of way, highway financing and the role of federal aid in it, and traffic engineering. Other chapters are devoted to surveys and plans, drainage, roadside development, and subgrade structure.

Some consideration must, of course, be given to practical roadbuilding, and such matters as gravel and crushed rock roads, base courses, macadam surfaces, bituminous pavements and Portland-cement-concrete pavements are covered. Design techniques and the results of recent research findings are stressed in these sections.

**La machine-outil, v. 3 Usinage par outils en rotation. v. 6 Usinage par abrasion.** A. R. Métral, ed. Paris, Dunod, Montreal, Fomac, 1954. v. 3. 432 pp., illus., $23.60; v. 6. 168 pp., illus., $11.25.

Two previous volumes of this work dealing with machine tools in general and machines in the field of planing, shaping and slotting are already in the library. Volume 3, which has now appeared, is devoted to the use of rotation tools and consists of six separate papers. These discuss the principles of boring, drilling and milling machines and the best uses which can be made of them. A short section is included on tool holders.

Volume 6 has for its subject abrasive tools and the first chapter describes these in a general way. In the next papers machines used for grinding and polishing are discussed in detail and the last chapter covers sharpening tools.

Again in these volumes the illustrations are an outstanding feature.

**Manual of British water supply practice,** 2nd ed. A. T. Hobbs, ed. London, Institution of water engineers, 1954. 963 pp., illus., 55/-.

While the changes in this edition consist mainly of some re-arrangement of chapters, a new section on the economics of water engineering, and up-to-date references, it will be welcomed by those unable to obtain the out-of-print first edition.

This survey of waterworks practice is the work of many authoritative writers and there is a clear fundamental outline of the subjects dealt with. These include hydrology, hydrogeology, hydraulics, reservoirs, intakes, aqueducts, wells, purification and softening of water, hygiene, chemical, physical, bacteriological and biological examination of water, prevention of pollution, and organization and management of water policies.

**Materials of construction,** 9th ed M. O. Withey and G. W. Washa. New York, Wiley, 1954., irreg. paging, illus., $9.00.

The first edition of this book was published in 1899, but through the years each succeeding edition has been revised to keep abreast of new developments in the field of construction materials and their manufacture. New data and new sections have been added to the present work which presents the mechanical and physical properties of materials, and the influence of various factors on these properties. New testing machines and strain-measuring devices, and non-destructive tests, are discussed, as well as the latest information on chemical seasoning, wood products, and timber connectors.

In the field of concrete and cement new types of testing methods are given and a section is devoted to concrete aggregates and to mix design methods.

Other materials considered are wrought iron, alloy steels, and non-ferrous metals.

**Microscopical techniques in metallurgy.** Henry Thompson. Toronto, Pitman, 1954. 146 pp., illus., $3.50.

Intended as a reference work for students, inspectors, examiners and others in the metal industries, this book presents the methods used in the microscopical examination of metals. Particular attention is paid to the sampling and preparation of specimens, and there are detailed descriptions of the various types of metallurgical microscopes in use, including the electron microscope.

Other subjects covered are photomicrography, both black and white and coloured and various special methods, such as flake and grain size determination.

**Pratique de l'organisation industrielle.** Ernest Hijmans and Eva Hijmans. Paris, Dunod, Montreal, Fomac, 1954. 196 pp., illus., $13.00.

This is a practical book on industrial organization presenting only those theories developed by the authors from personal experience. While this may be a limited approach, it is usually possible to draw parallels between the conditions and methods described and those familiar to the reader.

The authors use graphs and diagrams to illustrate their viewpoint on such subjects as material handling, filling orders, salary scales, quality control, job analysis and work measurement, and the training of workers.

The book is translated from the English edition, and, unfortunately, does not include an index.

**Principles of engineering thermodynamics,** 2nd ed. P. J. Kiefer, G. F. Kinney and M. C. Stuart. New York, Wiley, 1954. 539 pp., figs., $7.75.

A large number of new features and subjects are introduced in this edition to bring it up-to-date with the advances in thermodynamic thought since the first edition was published in 1934. It covers the thermodynamic basis of fluid mechanics and aerodynamics and unifies the mechanical, chemical and aerodynamic applications.

The contents are divided into four parts: the classification and accounting of energy, covering energy in transition, stored energy and energy equations; the availability of energy, with the subheadings Reversible processes and cycles, Carnot principle, Absolute temperature scale, and Entropy; properties of fluids, including ideal and non-ideal gases, and the thermodynamics of combustion; engineering applications, relating to power-generation cycles, heat-pump and refrigeration cycles and dynamic forces. In these chapters new formulae, charts, methods of analysis, etc., are used.

**Pulp and paper manual of Canada,** 22nd ed., 1954. Gardenvale, National Business, 1954. 446 pp., illus., flow sheets, $7.50.

This twenty-second edition of the Manual contains all the valuable sections found in previous editions; woodlands equipment and operation, flow sheets of pulp and paper mills, engineering data, lists of machinery, supply and service companies, arranged alphabetically both by company and by product, a list of trade names, and another of foreign companies represented in Canada.

Two of the five technical papers included were previously presented at branch meetings of The Engineering Institute of Canada; one, by E. C. Cooley on the Elk Falls paper mill, and the other, by J. F. Hayward, on deaeration and dealkalization of boiler feedwater.

This Manual will prove of value and interest to all those connected in any way with the pulp and paper industry.

**Rocket propulsion,** 2nd ed. rev. Eric Burgess. Toronto, British Book Service, 1954. 235 pp., illus., $3.60.

Although the author makes a claim in his preface that additional material will be found in nearly all chapters of this new edition there seems to be very little actual change from the first edition which appeared in 1952. The chapter headings and the illustrations are almost identical and the material on corresponding pages is very similar.

Nevertheless, this book will have a wide appeal to both the layman and the scientist for it includes the basic theories, the possibilities and the difficulties surrounding rockets, long-range projectiles, the artificial moon and interplanetary travel. The appendix, among other material, contains the laws of rocket motion and efficiencies, and a brief history of the rocket and interplanetary movement in Great Britain.

***Simplified site engineering for architects and builders.** Harry Parker and J. W. MacGuire. New York, Wiley, 1954. 250 pp., illus., tables, $5.00.

Explains in detail the solution of problems that arise in the analysis of building sites and in preparation of the site plan, including interpretation of deed descriptions, dimensioning when angles are other than right angles, computation of areas of irregular plots, dimensioning and laying out of circular curves for driveways, computation of volume of cut and fill, etc. Problems requiring computations are accompanied with logarithmic computations shown in detail.

**Successful commercial chemical development.** H. M. Corley, ed. New York, Wiley, 1954. 374 pp., $7.75.

Authorized and sponsored by the Commercial Chemical Development Association, this is an interesting, new type of book in the field of industrial chemistry. It will be of value to research engineers, managers and design and sales engineers for it follows the chemical product from the embryo stage to full development.

The history of the chemical industry in North America is briefly discussed and the value of research group activity is noted. In describing the introduction of a new product every problem is covered from project selection, objectives, management, handling, sampling, and trade names to advertising, pricing, and marketing. Several case histories of new product developments bring the foregoing stages of the whole process into focus. The last chapter deals with some of the important qualifications for commercial chemical development work.

***Television: the electronics of image transmission in color and monochrome,** 2nd ed. V. K. Zworykin and G. A. Morton. New York, Wiley, 1954. 1,037 pp., illus., $17.50.

In the present edition of this detailed survey of the field the greatest emphasis is on the camera and viewing tubes, along with their physics background and the associated television fundamentals. In addition, specific aspects of circuitry, such as the video amplifier, are treated in detail. Most chapters have been rewritten and there are new chapters on colour and industrial television.

**Textbook of servomechanisms.** J. C. West. London, English Universities, Toronto, Musson, 1953. 238 pp., diagrs., 25/–.

Intended primarily for undergraduate students, this book assumes an elementary knowledge of electronics on the part of the reader, and describes the scope and principles of automatic control and design techniques used in control systems.

The author develops the subject from simple examples, and each new topic is introduced with a specific example before general principles are discussed.

There is a bibliography covering control systems and non-linear mechanics, and students and others interested in the subject should find this a useful book.

**Twinning and diffusionless transformations in metals.** E. O. Hall. Toronto, Butterworth, 1954. 181 pp., illus., $5.00.

The author has taken for his subject one mode of metal deformation and has dealt with the metallurgy, crystallography, and physical principles underlying twin formation. He has also included a chapter on an allied phenomenon, that of the diffusionless types of phase change.

The first two chapters cover elementary crystallography, the stereographic projection, and the growing of single crystals for the benefit of students. Other chapters discuss the formation of twins under stress and by heat treatment, and the theories of twin formation. The appendices contain information on the crystal structure of the metallic elements and crystallographic formulae and data.

***Water supply and waste-water disposal.** G. M. Fair and J. C. Geyer, New York, Wiley, 1954. 973 pp., diagrs., $15.00.

Treatment of the two subjects is integrated, with the first half of the book devoted to the collection and removal of water and waste-water, and the second half to their treatment and to the natural purification of water. Emphasis is on principles rather than practice in dealing with sanitation; supply and disposal systems; ground water collection, transmission, and distribution; the biology of water and waste-water; methods of treatment and purification; and related topics. The book is intended for students and practicing engineers.

***What every engineer should know about rubber.** W. J. S. Naunton. Washington, Natural Rubber Bureau, 1954. 128 pp., illus., $0.50 (U.S.).

Discusses briefly the sources, manufacture, properties, and testing of natural rubber and, at greater length, its engineering applications. Among the latter are anti-vibration systems, sound insulation, flexible couplings, belts, seals, and other uses.

***Yearbook of the heating and ventilating industry, 1954.** Compiled in collaboration with the Association of heating, ventilating and domestic engineering employers. London, Technitrade journals, 1954. 329 pp., 8/4

The eighth annual issue contains a bibliography of heating and ventilating literature, lists of pertinent British standards and codes, a directory of the industry, and several articles on technical or trade topics, for example, on smog and on panel heating.

# BOOKS RECEIVED

**Automatic selling.** G. R. Schreiber. New York, Wiley, 1954. 195 pp., $5.00.

**Blast cleaning manual.** Society of automotive engineers. New York, The Society, 1954. 54 pp., figs., pa. , $4.00 (U.S.).

**Centralization and decentralization in industrial relations.** Helen Baker and R. R. France. Princeton, University. Industrial relations section, 1954. 218 pp., $4.00 (U.S.).

**Crystal rectifiers and transistors.** M. G. Say, ed. Toronto, British Book Service, 1954. 170 pp., figs., $3.60.

**Electrical engineer's reference book,** 7th ed. E. Molloy, M. G. Say and R. C. Walker, eds. Toronto, British Book Service. 1954. Irreg. paging, diagrs., $12.00.

**The fundamentals of electric log interpretation.** M. R. J. Wyllie. New York, Academic press, 1954. 126 pp., figs., $3.60 (U.S.).

**Horizon mining.** C. H. Fritzsche and E. L. J. Potts. Toronto, Nelson, 1954. 614 pp., illus., $15.00.

**How to use test probes.** A. A. Ghirardi and R. G. Middleton. New York, Rider, 1954. 172 pp., illus., pa., $2.90 (U.S.).

**Jet: The story of a pioneer.** Sir Frank Whittle. Toronto, Saunders, 1953. 320 pp., illus., $3.50.

**Newnes engineer's reference book,** 6th ed. F. J. Camm, ed. Toronto, British Book Service, 1954. 1970 pp., diagrs., $12.00.

**Norwegian-English technical dictionary.** John Ansteinsson. Trondheim, Bruns Bokhandels, New York, Kraus Periodicals, 1954. 327 pp., $7.75 (U.S.).

**Obtaining and interpreting test scope traces.** J. F. Rider. New York, Rider, 1954. 186 pp., illus., pa., $2.40 (U.S.).

**Picture book of TV troubles, v. 1, Horizontal AFC-oscillator circuits.** John F. Rider laboratories staff. New York, Rider, 1954. 80 pp., illus., pa., $1.35 (U.S.).

**Power system transients.** E. O. Taylor, ed. Toronto, British Book Service, 1954. 176 pp., figs., $3.60.

**Production engineering, jig and tool design.** E. J. H. Jones. Toronto, British Book Service, 1954. 324 pp., illus., $3.00.

**The repair of the small electric motor.** Karl Wilkinson. Toronto, British Book Service, 1954. 180 pp., diagrs., $3.50.

**The scientific basis of road design.** F. L. D. Wooltorton. Toronto, Macmillan, 1954. 364 pp., figs., $11.75.

**Steam, air and gas power,** 5th ed. W. H. Severns, H. E. Degler and J. C. Miles. New York, Wiley, 1954. 502 pp., illus., $6.50.

**Strength and resistance of metals.** J. M. Lessells. New York, Wiley, 1954. 450 pp., illus., $10.00.

**A treatise on applied hydraulics.** Herbert Addison. Toronto, British Book Service, 1954. 724 pp., illus., $9.65.

**Television and special tubes vademecum,** 11th ed., 1954. J. A. Gijsen, ed. Antwerp, Brans, 1954. 244 pp., pa.

# TECHNICAL BULLETINS AND PAMPHLETS RECEIVED

**British electrical and allied industries research association. Technical reports:**

C/T111—The economic value of hydrogen produced by wind power, by A. H. Stodhart. C/T112—The use of wind power in Denmark, by E. W. Golding and A. H. Stodhart. G/T275—Gas-blast circuit-breakers. Effect of arcing on the mass-flow of air through the nozzle and on nozzle pressure (third progress report), by A. A. Hudson. G/T283—Factors affecting the temperature-rise of fuse terminals. Fuses in free air without cases, by H. W. Baxter and M. T. Cree. L/T306—The hollow cathode effect and the theory of glow discharges, by P. F. Little and A. Von Engel.

**Canada. National research council. Government specifications board. Specifications:**

3-GP-2B—Oil; fuel. 3-GP-336—Lubricant; gear, universal (sub-zero). 3-GP-340A—Lubricant; gear, universal (grade 75). 3-GP-360A—Lubricant; gear universal (grade 80). 3-GP-390A—Lubricant; gear, universal (grade 90). 3-GP-685A—Grease; auto motive and artillery. 4-GP-5 0A—Duck; cotton light water resistant treatment. 4-GP-51A—Duck: cotton light rot resistant treatment. 4-GP-52A—Duck; cotton rot resistant and light water resistant treatment. 4-GP-53A—Duck; cotton heavy rot and water resistant treatment. 4-GP-54A—Duck; cotton heavy rot, water and flame resistant treatment. 5-GP-23—Leather; cattlehide, vegetable tanned, case. 39-GP-15—Pullers; nail. 43-GP-9—Barrier materials, grease resistant; flexible, non-corrosive, self-adhering coating. 45-GP-5—Wrenches; impact, pneumatic, portable. 45-GP-8—Shears; pneumatic, portable.

**Provisional specifications:**

1-GP-120P—Coating, strippable, protective.

**Canadian standards association. Approvals laboratories:**

List of approved equipment, 4th ed., supplement "E", May, 1954.

**Edison electric institute. Specification:**

MS-9-1954—Test switches for transformer rated meters.

**International bank for reconstruction and development:**

Ninth annual report, 1953-1954.

**Montreal. Civil service commission:**

Ninth annual report for the fiscal year ending April 30th, 1954.

**United Kingdom information office:**

Chemistry research, 1953. 65 cents. Industrial Britain.

**United States. Highway research board. Bulletin:**

No. 89—Night visibility.

**Windsor, Ont.**

First annual year book, 1954.

# STANDARDS REVIEWED

**Canadian standards, Canadian standards association, National research building, Ottawa, Canada.**

**C.S.A. C22.2 No. 36: 1954 — Construction and test of hair dressing equipment,** 2nd. ed. $1.00.

This standard applies to appliances for potentials of not more than 250 volts between conductors and to so-called pedestal and pre-heat "permanent-wave machines," hair dryers, steamers and curling irons, and is for general domestic and commercial use.

**C.S.A. C22.4 No. 111: 1954 — Antenna towers and antenna supporting structures,** .75c.

The towers and structures covered in this specification are over 80 feet in height above the ground or over 50 feet in height above their base when mounted on a building or other structure. The standards do not apply to ship or mobile equipment or antenna installations connected with carrier current equipment. Included under tower construction are specifications for steel and timber construction.

**C.S.A. C22.4 No. 112: 1954 — Amateur and domestic antenna supporting structures,** .75c.

This standard was compiled for use by municipalities contemplating legislation controlling the erection of domestic antenna structures. It applies to structures between 15 and 80 feet in height from the ground level or under 50 feet in height if the base is mounted on a building. It has the same reservations in scope as does the preceding standard, with the addition of the design of the antenna array itself, and it covers steel, aluminum, timber and magnesium tower construction.

**British standards. British standards institution, 2 Park Street, London, W.I. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.**

**B.S. 2490: 1954 — Waterproof drawing inks.** 3/–.

The scope of the specification is limited to water soluble dyes and it considers eleven colours which are defined, with suitable tolerances, in terms of the X, Y and Z stimuli of the International Commission on Illumination. Tests are also specified for good drawing ink covering draughting, keeping and erasing qualities required, and resistance to light and solvents. These tests of quality include waterproof black carbon inks as well. Standard sizes of containers and methods of sealing are recommended.

**B.S. 2491: Part 1: 1954 — Domestic cooking appliances for use with Butane Propane gases. Part 1: Appliances for use with butane gases.** 6/–.

The appliances to which the standard relates are those for use in the home and in caravans, houseboats, etc., and it specifies the construction, operation and safety requirements and tests for cookers, ovens, hot plates, boiling burners and grillers used with butane gas at 11 in. w.g. pressure.

# Business & Industrial Briefs

## A Digest of Information received by The Editor

## Appointments and Transfers

**Shawinigan Water and Power.**—Appointment of three men to senior positions in The Shawinigan Water and Power Company was announced by J. A. Fuller, president, effective November 30.

Leo E. Boissonault becomes assistant vice-president, finance; A. C. Joncas is appointed assistant treasurer; and Alex Timon is named comptroller of the company. The first two positions are new ones, and that of comptroller has been filled since 1946 by C. W. Hemming, who is retiring after 34 years with the company.

●

**Robertshaw-Fulton Elects Officers.**—The board of directors of Robertshaw-Fulton Controls (Canada) Limited, recently-formed subsidiary of Robertshaw-Fulton Controls Company, has elected John A. Robertshaw, president, George A. Elliott, vice president and general manager, Walter H. Steffler, secretary and treasurer, B. D. Taylor, comptroller, and H. William Biggar, assistant secretary and assistant treasurer. Messrs. Robertshaw, Steflller and Taylor hold similar positions with the parent firm, Robertshaw-Fulton Controls Company, whose headquarters are at Greensburg, Pa.

W. R. Anderson

●

**Allis-Chalmers Sales.** — Norman H. Hollefriend, manager of the industrial division, Canadian Allis-Chalmers, for the past seven years, has been appointed director of sales for the entire company's operations. He joined the firm in 1926.

●

**Trans-Canada Pipe Lines.**—Four appointments to the staff of Trans-Canada Pipe Lines Limited have been announced by N. E. Tanner, president of the company which will export Alberta natural gas to eastern Canada and the mid-western United States.

The appointments are: D. R. Pflug, chief engineer; R. J. "Don" Wallace, manager of gas supply; Douglas G. Simpson, controller and assistant treasurer; and D. W. Brown, information officer.

●

**Du Pont of Canada.**—Appointment of Walter R. Anderson as supervisor of the Du Pont of Canada plant being built at Maitland, Ontario, to manufacture "Freon" fluorinated hydrocarbons, was recently announced by the company's chemicals department.

Born in Hamilton, Ontario, Mr. Anderson is a graduate of Queen's University. He joined the company in 1946 as a chemical engineer, and four years later was made process engineer in the textile fibres division. He moved to Maitland in 1952 in connection with the construction of the nylon intermediates plant there, and returned to Montreal this year as a member of the chemicals department.

**P. H. Desrosiers Honoured.** — P. H. Desrosiers of Montreal has been honoured as a member of the Quarter Century Club of the Canadian Good Roads Association at its annual meeting in Toronto on November 8, 9, 10. Mr. Desrosiers is a member of the Executive Committee of the C.G.R.A. In Montreal he is president of Ciment Fondu Lafarge (Canada) Limited, executive vice-president of Joliette Steel Division of Dominion Brake Shoe Company, Ltd. as well as president of several building materials companies.

●

**British Insulated Callender's Board Changes.**—G. A. Rendle has been appointed to the Board of British Insulated Callender's Construction Co., Ltd. He becomes manager, cable contracts, in succession to C. H. Frankland, who, while remaining a director of B.I.C. Construction Co., Ltd., has undertaken special duties at the Trafford Park Works of British Insulated Callender's (Submarine Cables) Ltd.

P. H. Desrosiers


RAPID DELIVERY...
WAREHOUSE STEEL SERVICE
coast-to-coast!
Because Dominion Bridge maintains complete stocks of warehouse steel at nine strategic locations across Canada you are never far from the source of supply. This assures prompt delivery right to your plant, thereby eliminating the need for costly storage and handling facilities under your own roof.
Every Dominion Bridge warehouse has modern cutting, storage, handling and shipping facilities to take care of your urgent requirements — LARGE or Small.
FROM A BAR TO A TRUCKLOAD
WAREHOUSE DIVISION*
DOMINION BRIDGE
COMPANY LIMITED
Warehouses at: Montreal • Ottawa • Toronto
Winnipeg • Calgary • Vancouver
Associate Warehouses at:
Amherst • Sault Ste. Marie • Edmonton
*Other Divisions: Structural • Platework • Mechanical • Boiler

C. Kibblewhite has also been appointed to the Board of B.I.C. Construction Co., Ltd. as an executive director.

**English Electric.**—J. G. Warnock has been appointed hydraulic engineer in charge of the new hydraulic department of the English Electric Company of Canada Limited, which is located at the headquarters of the general engineering division of the John Inglis Co. Limited in Toronto, where the manufacture of heavy hydro-electric plant will be centred.

Mr. Warnock is a graduate of the University of Glasgow. He was engaged on hydro-electric work in the United Kingdom with 'English Electric' since 1945, and has been with the English Electric Company of Canada Limited since 1952.

**Integrated Operation.** — Maynard H. Patterson has been named vice-president and general manager of integrated operations of Minnesota Mining and Manufacturing of Canada Ltd., London, Ontario, and Irvington Varnish and Insulator Co. of Canada Ltd., Hamilton. The Hamilton plant becomes a varnish and insulator unit in the 3M company, effective Nov. 1, with the head office in London.

# New Equipment and Developments

**Portable Oxy-Acetylene Outfit.** — A lightweight, fully portable oxy-acetylene outfit in the low price range has been introduced by Dominion Oxygen Company, division of Union Carbide Canada Limited. The new unit, for light-to-medium welding and cutting work in auto repair shops, welding and sheet metal shops, and industrial plants, is called the Prest-O-Lite Welding and Cutting Outfit, and features an exclusive "all-in-one" blowpipe with interchangeable welding and cutting tips. The same blowpipe heats, bends, solders, brazes, welds, and cuts. No special attachments are needed. As furnished, the outfit welds up to 3/16 in., and cuts through ⅜ in. of solid steel. Additional tips are available for welding up to ⅜ in. and cutting up to 2 inches.

**Textile Mill Re-opened.**—Textile Sales Limited, Montreal, recently announced the signing of an agreement with Milltown Textile Co-operative Limited which will re-open the company's St. Croix Mill at Milltown, New Brunswick.

The arrangement is the result of discussions between executives of Textile Sales Limited and representatives of the employees. The company had announced, late in August, that this mill would be closed due to the depressed conditions common to the Canadian textile industry as a whole.

The management of the mill will now be under Milltown Textile Co-operative Limited, an organization composed exclusively of mill employees. The new management has announced the appointment of Phillip Boel as plant manager. The production will cover the same full range of synthetic fabrics including linings, dressgoods, plaids, and suitings, as was formerly manufactured there. As in the past, the merchandising of these products will be carried out by Textile Sales Limited through their sales organization in Montreal, Toronto, Winnipeg and Vancouver. The arrangement has been entered into for an indefinite period.

The mill resumed operations November 1st with about 150 employees and it is expected to employ about 300 by the year end. Approximately 400 were employed when the mill closed down.

**New Kraft Pulp Mill.**—Crown Zellerbach Canada officials announced recently that plans for a new kraft pulp mill at Duncan Bay, on Vancouver Island, are in final engineering stages, with the mill scheduled to begin producing in mid-summer, 1956.

Excavations for the new mill buildings are already under way and actual construction is scheduled to begin as soon as spring weather permits.

Cost of the Duncan Bay kraft mill has been estimated at $15,000,000.

The kraft mill represents the second stage of a planned development which began in 1952 with construction of a newsprint mill by the Elk Falls Company Limited, which is jointly owned by Crown Zellerbach Canada Limited and Canadian Western Lumber Company, Limited.

**Silicone Rubber Gum.**—A new, low-shrinkage, general-purpose silicone rubber gum is available from Canadian General Electric Company's chemical department.

Designated as SE-30, the new gum is being used in compounds from which parts requiring close tolerances may be produced. Because the shrinkage of such material is extremely low, molds and dies designed for organic rubber may often be used with compounds made from SE-30 silicone rubber gum.

Compounds for conventional type molding, extrusion, calendering, knife coating or dip coating are readily formulated with the new gum. They offer high tensile strength, excellent low compression set and good resistance to elevated temperatures.

Good electrical properties, flexibility down to minus 65° F., and excellent hot tear strength from the mold are other features offered by compounds incorporating SE-30 silicone rubber gum.

Further information may be obtained from Chemical Materials Sales, Canadian General Electric Co. Ltd., 940 Lansdowne Ave., Toronto.

**New Siporex Plant.**—Dominion Tar & Chemical Company, Limited announce the construction of a $1,250,000 plant at Delson, near Montreal, for the production of a light weight cellular building material by its "siporex" division.

The latest development in the Canadian construction field, "siporex" is an autoclaved precast light cellular concrete that is built in slabs for walls, roofs and floors. It was developed in Sweden over 20 years ago and introduced to the Canadian market after extensive investigation by Dominion Tar & Chemical officials in North America and Europe.

In Sweden the use of "siporex" was found to reduce building costs from 10 to 15 per cent as its use permitted rapid construction as well as affording high insulation and being fire and vermin proof. "Siporex" is manufactured by a patented process from finely ground sand, Portland cement and chemical additives.

The new factory at Delson, 16 miles south of Montreal, is being constructed of "siporex" which has been imported from Sweden. The plant which covers 40,000 square feet, will be completed at the end of the year with production scheduled for next March. A staff of 55 will be employed in this new addition to the industrial life of the Province of Quebec.

# Publications

**For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.**

**Please mention *The Engineering Journal* when writing.**

**Folder Illustrates Tournatractor.** — A 28-page folder in color, describing and illustrating features of the 208 hp. rubber-tired tractor built by LeTourneau-Westinghouse Company, Peoria, Illinois, has been issued by the company.

By extensive use of photos, diagrams and charts, the folder shows how the unit's range of speeds cuts minutes from the work cycle, and reasons why the machine requires low maintenance and few repairs. Colorful blow-ups illustrate how anti-friction bearings put more horsepower to work, how the machine's heavy, all-welded steel case provides a big, rugged mounting for every operating assembly, and how electric motors at point of action give fast, positive, accurate control.

This folder may be obtained by requesting Tournatractor Features Folder, Form 54-005-T, from Advertising Department, LeTourneau - Westinghouse Company, Peoria, Illinois.

**Die-Casting Film.**—A story of the die-casting process, its achievements, and its promise for the future is the subject of a 30 minute 16 mm. colour and sound motion picture which has just been released entitled "How Else Would You Make It?" This film was produced by the American Zinc Institute in co-operation with the American Die Casting Institute and covers the die-casting of zinc, aluminum, magnesium and copper alloys.

The film gives an interesting, highly educational pictorial description of the scope of the die-casting process. It vividly illustrates and describes the vast range of sizes and widespread application of die-castings. A comprehensive discussion and evaluation of die-casting alloys is included. Modern die-casting practice is portrayed by an examination of the types of machines, dies and principal operations. The economy of die-casting is outlined by showing how production costs are reduced to a minimum by the nature of the process.

Sample castings demonstrate how the design engineer utilizes this process to achieve by die-casting, improved appearance, optimum functional properties, strength and compactness at lowest cost.

Case histories of various outstanding die casting applications show numerous examples of castings that respond to the demands of practically every aspect of life. Automobiles contain a large number of die castings including such items as the radiator grille, hood ornament, horn ring, carburetor, door handles and automatic transmission housings. A high percentage of the chrome trim on refrigerators, stoves, washing machines, etc., is composed of chromium plated zinc alloy die castings, while the lightness of vacuum cleaners is due in part to the use of aluminum die-cast components.

The film is available for distribution for showing before industrial, technical and educational groups. Canada's largest producer of zinc for die-casting, the Consolidated Mining and Smelting Company of Canada Limited is handling the Canadian distribution of this film.

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**Bristol's General Bulletin.** — A new general bulletin, listing and illustrating the complete line of recording automatic controlling, and telemetering instruments manufactured by The Bristol Company of Canada Limited, 71-79 Duchess Street, Toronto, has just been published.

The bulletin illustrates and describes briefly the full line of recorders and controllers for temperature, flow, liquid level, mechanical motion, running time, count, and operation, and speed. Also included are Bristol's electric and electronic instruments for measuring current, voltage, power, and other variables which can be translated into electrical quantities, such as strain, capacitance, resistance, and smoke density.

Copies of the bulletin, DMO35, are available from The Bristol Company of Canada Limited, 71-79 Duchess Street, Toronto, Ontario.

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**Film Directory.** — Many thousands of Canadian organizations now regularly use 16 mm. sponsored films in their programs. Several hundred sponsors have free films available.

With the aim of bringing together these two groups—users and sponsors—two years ago the staff of Crawley Films compiled and published Canada's first Directory of Sources of Free 16 mm. Sponsored Films. The first printing was quickly over-subscribed. Second and third printings were required to answer requests totalling more than 15,000 copies Certainly the demand dramatized the wide use of sponsored films in this country.

This new enlarged edition lists 256 sources, giving access to more than 8,000 free films. For your copy write to Crawley Films Limited, 19 Fairmont Avenue, Ottawa 3, Canada.

# Publications of Other Engineering Societies

Exchange arrangements exist between The Engineering Institute of Canada and engineering societies in the British Empire and the United States whereby members of the Institute may secure the publications of these societies at special rates which, in most instances, are the same as charged to their own members. A list of these publications with the amounts charged is given below. Subscriptions should be placed at E.I.C. Library, 2050 Mansfield St., Montreal 2, Que., but **no remittance** should be made until an invoice has been received. **These prices are subject to change without notice.**

| | *Rate to E.I.C. Members* | *Rate to Non-Members* |
|---|---|---|
| **AMERICAN INSTITUTE OF CHEMICAL ENGINEERS** | | |
| Chemical Engineering Progress (including postage to Canada) | $5.75 | |
| **AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS** | | |
| Electrical Engineering—Per year (including postage to Canada) | $7.50 | $16.00 |
| Transactions — annual, bound (including postage to Canada) | 8.00 | 16.00 |
| Combined subscription (including postage to Canada) | 10.00 | 20.00 |
| **AMERICAN SOCIETY OF CIVIL ENGINEERS** | | |
| Separates of papers published during year, per year (including postage to Canada) | $13.50 | $20.00 |
| Civil Engineering — Per year (including postage to Canada) | 5.50 | 7.00 |
| Transactions — annual per year | 10.00* | 15.00† |
| (Other publications 50% reduction on Canadian price to E.I.C. members) | | |

* *If subscription received before Jan. 1st, otherwise $15.00.*

† *If subscription received before Jan. 1st, otherwise $20.00.*

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| **AMERICAN SOCIETY OF MECHANICAL ENGINEERS** | | |
| Mechanical engineering — Per year (including postage to Canada) | $ 5.00 | $10.00 |
| Transactions & Journal of Applied Mechanics (available only in combination subscription; including four issues of the Journal of Applied Mechanics, and eight issues of Transactions) | 12.00 | |
| Transactions & Journal of Applied Mechanics (available in bound form in April) | 17.00 | |
| Applied Mechanics Reviews—Per year (including postage to Canada) | 11.00 | |
| Journal of Applied Mechanics | 5.00 | |
| **INSTITUTION OF CIVIL ENGINEERS** | | |
| Proceedings — three parts per year | | |
| Part I (General) | $4.00 | |
| Part II (Airport, Maritime, Railway and Road Engineering) | 2.00 | |
| Part III (Public health, Structural, Works construction, Hydraulics engineering) | 2.00 | |
| All three parts together | 6.00 | |
| **INSTITUTION OF ELECTRICAL ENGINEERS** | | |
| Journal (General Papers) | $2.25 | |
| Part A (Power Engineering) | 3.00 | |
| Part B (Radio and Electronic Engineering) | 3.00 | |
| Part C (Collected Monographs) | 1.25 | |
| Journal and three parts together | 8.50 | |
| **INSTITUTION OF MECHANICAL ENGINEERS** | | |
| The "Chartered Mechanical Engineer" and 'separates' of Proceedings | | $15.00 |
| The C.M.E. and 'separates', bound volumes of Proc. and Automobile Div. Proc. | | 21.00 |
| The C.M.E., bound volumes of Proc. and Automobile Div. Proc. | | 19.50 |
| Automobile Div. Proc. | | 3.00 |
| C.M.E. only | | 4.00 |
| **INSTITUTION OF ENGINEERS, AUSTRALIA** | | |
| Journal — monthly, per year | $8.00 | $16.00 |
| **INSTITUTION OF ENGINEERS (INDIA)** | | |
| Journal — quarterly, per year | $3.00 | $4.50 |
| **NEW ZEALAND INSTITUTION OF ENGINEERS** | | |
| New Zealand Engineering | $4.00 | |
| **SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS** | | |
| Transactions — monthly, single copies | $ .75 | $1.00 |

*Members wishing their subscriptions to commence with the January issue should place orders with the E.I.C. Library immediately. Every effort will be made to comply with requests. However, receipt of the January issue cannot be guaranteed.*

# Professional Cards

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